~~~~~CASE 1 Acute Follicular Conjunctivitis~~~~~

*1 Acute Follicular Conjunctivitis*

*Usha Rajapuram Kumar and Weldon W. Haw*

*Abstract*

*Acute conjunctivitis is a common ophthalmologic disease. Acute*

*conjunctivitis may be caused by viruses, bacterial, chlamydia,*

*toxins/medications, and allergic reactions. Clinical features such*

*as history and examination can be useful in determining the etiology.*

*In atypical cases, diagnostic examination with cultures,*

*scrapings, direct immunofluorescence, enzyme-linked immunosorbent*

*assays, or polymerase chain reactions may be useful in*

*identifying the causative pathogen. In most cases of viral conjunctivitis,*

*observation and symptomatic treatment is all that is*

*necessary. Precaution is an important step to avoid further*

*spread of the contagious disease. Specific therapy with antiinfective*

*agents may be required for unusual infectious causes of*

*conjunctivitis (i.e., bacterial, chlamydial, etc.).*

*Keywords: conjunctivitis, acute follicular conjunctivitis, acute*

*conjunctivitis, viral conjunctivitis, adenoviral conjunctivitis*

*1.1 History*

*A 37-year-old female office worker has a 2-week history of photophobia,*

*discomfort, and headache centered around her right*

*eye. A week previously, she developed sudden onset of redness*

*and watering of the right eye the first day back at work, having*

*returned several days earlier from a vacation in Hawaii. She also*

*noted swelling in front of her right ear. She saw her eye-care*

*practitioner, who found unilateral follicular conjunctivitis with*

*a mildly tender preauricular node. He treated her with a 2-*

*week course of topical tobramycin–dexamethasone ophthalmic*

*suspension drops; her node became slightly smaller, but 2 days*

*after cessation of the topical tobramycin–dexamethasone, she*

*had epithelial infiltrates in the cornea and persisting follicles.*

*Visual acuity is 20/25 and 20/20 in her right and left eyes,*

*respectively. There is a right-sided nontender preauricular*

*node. At penlight examination, the right eye shows a 1- to 2-*

*mm ptosis of the upper lid and mild injection of the bulbar conjunctiva;*

*the left eye appears quiet. Biomicroscopy reveals a*

*moderate number of medium-sized pretarsal follicles and*

*papillae in the right eye (▶Fig. 1.1); the left eye demonstrates*

*substantially fewer follicles in the inferior fornix. The right cornea*

*shows diffuse midperipheral and a few central epithelial*

*infiltrates, with no stromal involvement or other anterior segment*

*findings. The left cornea and anterior segment are normal.*

*Differential Diagnosis—Key Points*

*1. Acute follicular conjunctivitis is commonly encountered in*

*the general ophthalmologic setting. The patient’s history is*

*particularly remarkable in that she was recently on vacation,*

*possibly increasing the risk of encountering infectious agents*

*either from acquaintances or from fomites she may have*

*contacted. She specifically denies any sexual contact, but*

*stayed in hotel rooms and used swimming pool facilities.*

*The differential diagnosis in this case can be narrowed to*

*include adenoviral keratoconjunctivitis, chlamydial disease*

*(adult inclusion conjunctivitis), primary herpes simplex or*

*Epstein–Barr (EB) keratoconjunctivitis, and molluscum*

*contagiosum. Influenza virus, paramyxovirus, and human*

*immunodeficiency virus (HIV) can, although rarely, cause*

*conjunctivitis during systemic infection.4 Toxic and allergic*

*reactions should also be considered in previously treated or*

*self-medicating patients, although lymphadenopathy is not a*

*common feature.*

*2. Adenovirus is a leading cause of follicular conjunctivitis and*

*can present in milder forms, such as seen in the present*

*case, to more fulminant forms with substantial ocular*

*morbidity. It is generally acquired by fomite—hand–eye*

*contact or from swimming pools. These can be visually*

*significant. Clinical symptoms and signs generally occur*

*about 7 to 10 days after exposure to the virus.6 Its more*

*severe forms include epidemic keratoconjunctivitis (EKC)*

*caused by several adenoviral serotypes including 8, 19, or*

*37. EKC routinely demonstrates subconjunctival or petechial*

*hemorrhages and pseudomembranes, which may be*

*accompanied by prominent lid edema and erythema and*

*even preseptal cellulitis. Systemic symptoms may include*

*fever and malaise. Pharyngoconjunctival fever (PCF) is*

*generally a milder condition and includes an antecedent or*

*simultaneous pharyngitis, fever, and upper respiratory*

*symptoms, and demonstrates relatively mild or absent*

*corneal infiltrates. PCF is most commonly caused by*

*adenoviral serotypes 3, 5, 7, or 11.4 In both conditions, the*

*acute onset is in one eye, followed by the second eye a few*

*days later; the latter eye is generally less involved with*

*symptoms and signs.*

*This patient has no antecedent or concurrent systemic*

*symptoms. She developed epithelial infiltrates only after*

*cessation of topical tobramycin–dexamethasone; topical*

*corticosteroid usage early in the course of acute conjunctivitis*

*can mask this helpful diagnostic corneal finding. Typically,*

*within a week of onset of EKC, fine diffuse punctate epithelial*

*infiltrates develop; these coalesce into larger, coarse epithelial*

*Fig. 1.1 Superior pretarsal mixed follicular and papillary conjunctivitis. infiltrates about a week later. These are replaced by focal*

*subepithelial infiltrates, which become more intense by a*

*month after onset and typically reside in the central and*

*paracentral cornea. These subepithelial infiltrates are thought*

*to be a result of an immune response to viral antigens*

*deposited in the superficial corneal stroma.4*

*Adult chlamydia inclusion conjunctivitis is caused by*

*Chlamydia trachomatis serotypes D–K; it is an oculogenital*

*disease generally found in younger, sexually active adults, but it*

*can also be contracted from fomites including toilet seats and*

*inadequately chlorinated swimming pools or hot tubs. Onset of*

*first symptoms may be more difficult to pinpoint, but is likely*

*within 1 to 2 weeks of exposure. It is commonly unilateral, and*

*involves mild lid swelling and a minimal mucopurulent*

*discharge. Follicles are usually predominantly located in the*

*inferior fornices. A minimally tender preauricular node may*

*develop as well as pseudoptosis, both features presenting with*

*this patient. Small epithelial infiltrates as seen in this patient can*

*develop 2 to 3 weeks after onset of the conjunctivitis. A*

*superior micropannus may develop. Corticosteroid use again*

*may have altered the clinical presentation of this patient. The*

*patient denies any systemic or genital symptoms, but the*

*clinician must remain circumspect in this regard.*

*Chlamydia psittaci, an infection of birds, is rarely transmitted*

*to humans. The infection can inhabit cats, but this patient had*

*not knowingly been exposed to birds or cats. Clinical findings*

*are similar to inclusion conjunctivitis except that no pannus is*

*seen; the disease is often accompanied by a mild influenzalike*

*illness or frank pneumonia. Presentation of a Parinaud’s*

*oculoglandular syndrome, although most commonly*

*attributed to cat-scratch disease, would also invoke another*

*possible chlamydial condition—lymphogranuloma venereum.*

*This is a venereal disease accompanied by lymphadenitis and*

*occasionally systemic symptoms. The conjunctiva would*

*classically demonstrate follicles and one or more granulomas.*

*Newcastle disease infection (a paramyxovirus) of poultry*

*workers may present similarly as in this patient, but the*

*follicles are generally prominent only in the lower lid, and any*

*epithelial infiltrates are more scant.*

*3. Primary herpes simplex virus (HSV) and EB virus may present*

*as an acute follicular conjunctivitis, with possible mild*

*conjunctival hemorrhages or even membranes. Primary*

*herpes simplex infection in adults is often accompanied by*

*vesicular lid lesions, with watery discharge and a preauricular*

*node. The cornea may develop a fine punctate epitheliopathy*

*or small fine dendritic figures. EB virus keratoconjunctivitis*

*may manifest subepithelial infiltrates similar to adenovirus,*

*and patients may present with no systemic manifestations or*

*with the more classic spectrum of fever, sore throat, and*

*lymphadenopathy of mononucleosis.*

*4. Molluscum contagiosum is now the most commonly*

*encountered poxvirus and can cause a unilateral follicular*

*conjunctivitis. The lid must be carefully examined for*

*molluscum lesions. Punctate epithelial erosions and, rarely, a*

*corneal pannus may develop. Corneal infiltrates are not seen.*

*Preauricular lymphadenopathy is also not a characteristic*

*feature, unlike the vaccinia poxvirus, which may be*

*encountered when administered as a smallpox vaccination.*

*1.2 Test Interpretation*

*Clinical suspicion is useful in determining whether further*

*diagnostic tests are required to confirm specific etiologies of*

*acute follicular conjunctivitis. In most instances of typical acute*

*conjunctivitis, simple observation for 1 or 2 weeks is reasonable*

*if adenovirus is suspected. Her social history was unremarkable*

*for risk behaviors for chlamydia, other than possibly through*

*fomite exposure. Her subepithelial infiltrates were potentially*

*consistent with chlamydia or adenovirus, although the clinical*

*picture was possibly altered by use of prior topical corticosteroids*

*before referral. Cultures and other tests were performed*

*to rule out viral and chlamydial disease. Cultures may not be*

*helpful in certain health systems or hospitals if performed*

*infrequently.*

*Adenovirus can be identified by several diagnostic methods*

*including viral cell culture, direct immunofluorescence, polymerase*

*chain reaction (PCR), and enzyme-linked immunosorbent*

*assay (ELISA). However, in most instances, these tests are*

*not generally employed for various reasons, including time*

*delay of receiving results, expense, or necessity for elaborate*

*equipment. Recently, a rapid immunodetection assay (RPS*

*Adeno Detector; Rapid Pathogen Screening Inc., Sarasota, FL)*

*has been developed, which is capable of detecting 53 of the*

*adenoviral serotypes. The assay samples regions along the palpebral*

*conjunctiva targeting the adenovirus hexon antigen. This*

*point-of-care testing method can be performed in the office,*

*yields rapid results, and has a higher sensitivity and specificity*

*compared to viral culture and PCR testing.4,5*

*HSV detection is possible through viral culture or antigen- or*

*DNA-detection methodologies; however, these methodologies*

*are only indicated in complex cases when the clinical diagnosis*

*is uncertain. All cases of suspected neonatal herpes infection*

*require laboratory testing. Scrapings from the vesicle base or*

*conjunctiva can also be tested for HSV. For chlamydia, conjunctival*

*scrapings for direct fluorescent antibody (DFA) testing and*

*McCoy cell culture were performed. These tests are fairly sensitive*

*and highly specific. These scrapings are effectively obtained*

*with small-wire Dacron swabs.*

*Kits for DFA testing have an indefinite shelf life and are provided*

*by a properly equipped laboratory with personnel properly*

*trained to do the analysis. The conjunctiva is anesthetized*

*with proparacaine, and the Dacron swab is rubbed across the*

*fornix or pretarsal conjunctiva with firm strokes sufficient to*

*harvest epithelial cells. The swab is rolled over the glass slide*

*provided in the kit, and a smudge of material should be apparent*

*by the naked eye when the slide is observed in reflected*

*light. The slide is preserved with a fixative and transported to*

*the laboratory. The same swab used for the glass slide can then*

*be inoculated into suitable tissue culture transport medium by*

*cutting or breaking off the top portion of the handle to allow*

*the Dacron portion to be fully immersed in the medium. Alternatively,*

*PCR, or nucleic acid amplification testing, is available*

*for testing of chlamydia. Giemsa orWright-Giemsa staining was*

*not ordered because this test is infrequently performed now*

*that more sensitive and specific testing is available. For this case*

*study, test results were negative for adenovirus and herpes*

*simplex as well as for chlamydia.*

*1.3 Diagnosis*

*Acute follicular conjunctivitis, likely adenoviral.*

*1.4 Medical Management*

*Observation and symptomatic treatment with cool compresses*

*and unpreserved lubricants were initiated. The patient was*

*counseled regarding the potential infectious nature of the condition:*

*the contagious nature of the conjunctivitis and the*

*potential for possible infectivity to others for another week or*

*two (or longer). Strict personal hygiene including frequent hand*

*washing, keeping personal soiled tissues, washcloths, and pillowcases*

*isolated from others is recommended. If the patient*

*develops conjunctival membranes or pseudomembranes,*

*removal with a forceps or cotton swab or a self-retained amniotic*

*membrane may provide symptomatic relief, prevent symblepharon*

*formation, and speed resolution.*

*Currently, there are no FDA-approved treatments for adenoviral*

*keratoconjunctivitis. Although controversial, a mild topical*

*corticosteroid such as loteprednol may be considered if visually*

*significant subepithelial infiltrates are present; the goal is to*

*minimize visual loss related to persistent corneal scarring and*

*maximize vision potential. It is important to note that goal of*

*steroids is not to completely eradicate all subepithelial infiltrates.*

*However, use of topical steroids may potentiate viral*

*shedding.*

*New potential therapeutic options being evaluated include*

*povidone iodine or a combination 0.6% povidone iodine/0.1%*

*dexamethasone ophthalmic suspension (also known as FST-*

*100; Shire, Lexington, MA). Antiviral agents such as trifluridine,*

*vidarabine, and ganciclovir demonstrate only mild effectivity*

*against adenovirus. Ganciclovir ophthalmic gel has been shown*

*to decrease adenoviral loads experimentally; however, it has*

*not been effective in the treatment of conjunctivitis in clinical*

*trials. Topical cidofovir has shown benefit by reducing adenoviral*

*titers and the formation of subepithelial infiltrates; however,*

*in a recent clinical study, it did not demonstrate decreased*

*duration of clinical symptoms compared to those without treatment.*

*Several other agents which have demonstrated potential*

*benefit, but require further investigation include 2′3′-dideoxycytidine,*

*interferon β, interferon γ, immunoglobulin, and Nchlorotaurine.*

*4*

*Signs of herpes epithelial keratoconjunctivitis or a positive*

*herpes testing result would warrant initiation of topical trifluridine*

*therapy and consideration for systemic acyclovir 400mg*

*five times a day for 1 to 2 weeks. Oral antivirals such as*

*acyclovir or valacyclovir offer the advantage of reducing epithelial*

*toxicity in an irritated eye.*

*Although adult chlamydial conjunctivitis often resolves spontaneously,*

*6 systemic therapy is recommended because of the*

*relatively high incidence of genital and other nonocular involvement.*

*Treatment of sexual partners is mandatory and, along*

*with the patient, should also be evaluated for coinfection with*

*other sexually transmitted diseases such as syphilis and gonorrhea.*

*6 The traditional therapy includes tetracycline 250mg*

*orally four times daily for 1 week, avoiding milk products and*

*antacids, which reduce absorption. Alternatively, doxycycline,*

*100mg twice a day for 7 days, can be taken with food and*

*is usually better tolerated. Pregnant or breastfeeding women*

*may take erythromycin, 500mg four times daily for 1 week,6 or*

*sulfisoxazole, 0.5 to 1 g four times daily for 3 weeks. Azithromycin*

*1 g as a single dose is also effective for adult inclusion*

*conjunctivitis.*

*1.5 Rehabilitation and Follow-up*

*The patient should be examined in 4 to 6 weeks to ensure that*

*symptoms have improved, follicles have nearly regressed, and*

*corneal opacities have continued to fade. If visually threatening*

*corneal opacities or conjunctival membranes/pseudomembranes*

*are present, then more frequent visits may be indicated.*

*A careful history should be obtained to make certain that the*

*prescribed medications have been taken properly. In patients*

*with unresolved and persistent corneal opacities with residual*

*visually significant scarring (i.e., reduced visual acuity, contrast*

*sensitivity, or photophobia), excimer laser phototherapeutic*

*keratectomy with low-dose mitomycin C may be considered.4*

~~~~~CASE 2 Chronic Follicular Conjunctivitis~~~~~

*2 Chronic Follicular Conjunctivitis*

*Brian Jem Jin Chang and Weldon W. Haw*

*Abstract*

*Most conjunctivitis symptoms will resolve within 1 to 2 weeks*

*of onset. In some instances, conjunctivitis can be classified as*

*chronic, or persisting beyond 16 days. Although viral conjunctivitis*

*is the most common cause of chronic follicular conjunctivitis,*

*the possibility of unusual infectious causes such as*

*chlamydia must be entertained. Other causes of persisting conjunctivitis*

*may be related to exposure to preservatives based in*

*topical medication use (toxic) or malignancies (masquerade*

*syndrome). Clinical examination, cultures, and suspicion for*

*medication-induced causes may be important in identifying the*

*cause. Treatment of the underlying cause will resolve the conjunctivitis.*

*Removal of the offending topical agent or changing*

*to a preservative-free alternative will resolve the toxic conjunctivitis.*

*Failure to address toxic follicular conjunctivitis may result*

*in significant sequelae ocular surface sequelae such as corneal/*

*conjunctival scarring, symblepharon, and punctal stenosis.*

*Keywords: conjunctivitis, bacterial conjunctivitis, follicular conjunctivitis,*

*chronic conjunctivitis, toxic conjunctivitis, medicamentosa*

*2.1 History*

*A 38-year-old female patient presents for a routine follow-up*

*visit 15 months after penetrating keratoplasty and anterior segment*

*reconstruction for trauma to the right eye. Her eyes are*

*comfortable, but she complains of mild right-sided preauricular*

*discomfort and swelling. She recalls that 6 weeks previously*

*she developed a fever and swollen glands, particularly on the*

*right side of her face, and her internist suspected “strep throat”*

*or “mononucleosis.” She had no ocular symptoms at that time.*

*Throat culture and Epstein–Barr virus serology were taken and*

*were negative. She was treated with oral penicillin for 14 days,*

*and she recovered symptomatically except for the persisting*

*preauricular lymphadenopathy.*

*The patient is otherwise healthy with a negative review of*

*systems. Her past ocular history is also significant for medically*

*treated traumatic angle recession glaucoma of her right eye.*

*Her left eye is normal with no ocular history. Her ocular medications*

*for the right eye were loteprednol etabonate 0.5% twice*

*daily, brimonidine 0.2% twice daily, timolol gel-forming solution*

*0.5% twice daily, and methylcellulose at bedtime. She had*

*last been seen 3 months previously, and no ocular inflammation*

*was seen. Her current examination reveals a visual acuity*

*of 20/60 + with pinhole to 20/40 in the right eye. Intraocular*

*pressures were 28mm Hg in the right eye and 14mm Hg in the*

*left eye. She has a slightly tender right preauricular lymph node.*

*External exam reveals slight puffiness of the lids, right worse*

*than left. Biomicroscopy of the right eye shows mild lid scurf*

*and no other lesions. The conjunctiva reveals prominent follicles*

*and papillae in the inferior fornix and superior pretarsal*

*area (▶Fig. 2.1). No granulomas are present. The keratoplasty*

*has mild diffuse epitheliopathy. The anterior segment exam is*

*otherwise noncontributory. The left eye shows mild pretarsal*

*papillae, without follicles, and an otherwise normal exam.*

*Differential Diagnosis—Key Points*

*1. The patient has unilateral follicular conjunctivitis, presumed*

*to be chronic given the associated 6-week history of*

*preauricular lymphadenopathy with febrile illness. Chronic*

*follicular conjunctivitis is defined as lasting more than 16*

*days, and is characterized by the presence of follicles in the*

*superior and inferior tarsal conjunctiva, and less commonly*

*the bulbar conjunctiva. It can manifest either with an acute*

*onset of symptoms, as in this case, or with insidious onset.*

*2. A detailed history is necessary to elucidate the etiology of*

*chronic follicular conjunctivitis. This should include the*

*onset and duration of symptoms, and the presence of*

*ocular redness, discharge, discomfort, or photophobia. The*

*use of prescribed or over-the-counter ocular medications,*

*lubricants, or herbal preparations must be ascertained.*

*Fig. 2.1 Medium-sized “buried” pretarsal follicles in midst of papillary response. (a) Inferior tarsal. (b) Superior tarsal.*

*Patients frequently will not recall, or admit to, over-thecounter,*

*herbal, or home remedies, or naturopathic or*

*homeopathic preparations, unless directly and specifically*

*questioned. This patient denied using any eye drops other*

*than the prescription medications already listed. She denied*

*close contact with animals, including cats and birds. She*

*had not traveled to potentially endemic areas for other*

*infectious etiologies.*

*3. Viral infections are common causes of chronic follicular*

*conjunctivitis. In this case, they were high on the differential*

*diagnosis because of the febrile prodrome and preauricular*

*lymphadenopathy. The differential diagnosis for viral*

*etiologies includes Epstein–Barr virus, herpes simplex virus,*

*and adenovirus. Mitigating against these diagnoses were*

*unilaterality and lack of corneal signs (though the latter*

*could be masked by the use of the topical corticosteroid*

*loteprednol). Additionally, with Epstein–Barr virus and*

*adenovirus, at least some degree of follicular involvement is*

*generally noted in the other eye. Another cause of chronic*

*follicular conjunctivitis is molluscum contagiosum virus (a*

*poxvirus). This patient had no eyelid lesions or chronic*

*blepharitis to suggest molluscum.*

*4. While viral infection seemed more likely in this specific*

*patient, it is important to consider the potential of bacterial*

*infection. In particular, Chlamydia trachomatis is one of the*

*most common causes of chronic follicular conjunctivitis. C.*

*trachomatis is a sexually transmitted obligate intracellular*

*bacterium that is responsible for two clinical forms:*

*trachoma and adult (or neonatal) inclusion conjunctivitis.*

*Giemsa staining with basophilic intracytoplasmic inclusions,*

*direct immunofluorescent (DFA), and enzyme-linked*

*immunosorbent assay (ELISA) have been developed for*

*detection of chlamydia inclusion conjunctivitis. If indicated,*

*treatment of the patient and partner with azithromycin*

*1,000mg orally once a day, doxycycline 100mg orally twice*

*a day for 7 to 10 days, or erythromycin 500mg orally four*

*times a day for 7 to 10 days may be effective. This patient*

*was monogamous, and she denied any gynecologic*

*complaints, but the presence of unilateral chronic follicular*

*disease in a sexually active adult should always raise*

*suspicion of adult inclusion conjunctivitis. Other bacterial*

*etiologies of chronic follicular conjunctivitis include*

*Moraxella species, Lyme disease, and Bartonella henselae,*

*which causes Parinaud’s oculoglandular syndrome.*

*However, the patient’s presentation was not consistent with*

*any of these.*

*5. Toxic follicular conjunctivitis must be considered,*

*particularly with the patient’s history of chronic topical*

*medication usage. Also, she had hurricane epitheliopathy, a*

*punctate keratitis with a swirling configuration inside the*

*keratoplasty wound margin, which has been associated with*

*toxic effect from preserved medication usage. The*

*preservatives utilized included benzalkonium chloride and*

*benzododecinium bromide, and may contribute to punctate*

*keratitis and follicle formation. Timolol is rarely associated*

*with toxic conjunctival effects but can contribute to*

*epithelial keratitis. Brimonidine tartrate (Alphagan), a*

*selective alpha-2-adrenergic agonist, has been reported to*

*cause vernal-like keratoconjunctivitis with papillae and*

*follicles. Its related product, apraclonidine hydrochloride*

*(Iopidine), which is also an alpha-2-adrenergic agonist, is*

*also known to cause a follicular conjunctivitis in some cases.*

*6. Masquerade syndromes can also present as chronic follicular*

*conjunctivitis. Subconjunctival malignancies such as mantle*

*cell lymphoma, B-cell non-Hodgkin lymphoma, and*

*mucosa-associated lymphoid tissue (MALT) lymphoma*

*should be considered for chronic, atypical follicular*

*conjunctivitis. A noninflammatory, salmon-colored*

*appearance and encroaching onto the globe may be typical*

*of a lymphoma. Examination in sunlight may help*

*accentuate and delineate the involved area of conjunctiva.*

*There have also been case reports of ocular rhinosporidiosis*

*and relapsing polychondritis causing chronic follicular*

*conjunctivitis.*

*2.2 Test Interpretation*

*Pathologic examination of conjunctival scrapings reveals polymorphonuclear*

*leukocytes and lymphocytes, with no eosinophils,*

*suggesting a chronic inflammatory response. Viral*

*cultures were negative for herpes simplex virus (determined by*

*2 days’ incubation on human fibroblast cells) and adenovirus*

*(determined by 2 weeks’ incubation). Chlamydia culture on*

*McCoy cells and conjunctival smear for direct fluorescent antibody*

*(DFA) staining were negative. Other than Chlamydia, bacterial*

*cultures were not obtained in this case given the lack of*

*clinical suspicion of bacterial infection. Conjunctival biopsy can*

*be considered in cases of protracted or atypical follicular conjunctivitis*

*where masquerade syndrome is suspected.*

*2.3 Diagnosis*

*Unilateral toxic chronic follicular conjunctivitis.*

*2.4 Medical Management*

*If any cultures or stains are positive, treatment should be*

*directed toward the specific pathogen. While cultures are pending,*

*observation is a reasonable approach to determine the natural*

*history of follicle development or improvement. In this*

*case, the follicles persisted and the eye actually became more*

*symptomatic initially, with erythema and irritation developing*

*while culture results were pending. With negative diagnostic*

*tests, toxic follicular conjunctivitis became the primary diagnostic*

*possibility. Brimonidine was discontinued since it was*

*the most likely offending agent.*

*In many cases, discontinuation of the offending medication is*

*all that is required. If the specific medication is required, a preservative-*

*free preparation should be used. Cold compresses and*

*preservative-free artificial tears or ointments can help with irritation.*

*Several studies have demonstrated the efficacy of topical*

*corticosteroids, topical cyclosporine A 1%, and topical tacrolimus*

*ointment in the treatment of chronic follicular conjunctivitis.*

*However, it is unlikely that any of these agents would have*

*an adequate or durable effect on the conjunctival response*

*when the toxic agent is still being utilized.*

*Failure to recognize toxic follicular conjunctivitis can result in*

*progressive punctal stenosis and subconjunctival scarring (i.e.,*

*pseudopemphigoid). This can be a self-limiting or progressive*

*disorder. In cases of progression, conjunctival scarring, obliteration*

*of the conjunctival fornices, symblepharon, and loss of conjunctival*

*goblet cells will result in severe ocular surface disease.*

*If untreated, toxic follicular conjunctivitis can result in superficial*

*punctate keratopathy, and in severe cases, large epithelial*

*erosions and corneal ulceration/melting.*

*2.5 Rehabilitation and Follow-up*

*Removal of the offending agent is the imperative first step.*

*Preservative-free lubrication may be useful in comfort or symptom*

*relief. Close observation is recommended initially for early*

*detection of any occult infectious processes. The patient should*

*be followed up every 2 to 3 weeks until improvement is noted.*

*In this case, the patient’s symptoms rapidly improved upon*

*removal of brimonidine, and by 3 weeks, her follicles were*

*improving. The follicles completely resolved by 2 months after*

*stopping brimonidine, as did the hurricane epitheliopathy.*

*Toxic follicular conjunctivitis is most commonly caused by*

*topical anesthetics, antiviral agents such as trifluridine and*

*idoxuridine, aminoglycoside antibiotics such as gentamicin and*

*tobramycin, and glaucoma medications such as pilocarpine, brimonidine,*

*timolol, apraclonidine, epinephrine, and dipivefrin.*

*Brimonidine has rarely been reported to cause follicles, and in*

*this case, the viral prodrome may have predisposed the patient*

*to developing this response through a subclinical irritated conjunctiva.*

~~~~~CASE 3 Acute Bacterial Conjunctivitis~~~~~

*3 Acute Bacterial Conjunctivitis*

*Abigail Huang and Weldon W. Haw*

*Abstract*

*Acute bacterial conjunctivitis may result in conjunctival injection*

*associated with chemosis, papillary reaction, and purulent discharge.*

*Gram stain and conjunctival cultures are not necessary in*

*all cases of uncomplicated suspected bacterial conjunctivitis.*

*Indications for Gram stain and culture include suspected bacterial*

*conjunctivitis in neonates, immunocompromised individuals,*

*and in cases of refractory, recurrent, or abundant purulent conjunctivitis.*

*Treatment with a broad-spectrum topical antibiotic*

*may shorten the symptom duration and reduce the transmissibility*

*and the risk of rare complications. In rare situations*

*(hyperacute conjunctivitis, gonococcal conjunctivitis, neonates),*

*systemic antibiotics may be required to prevent complications.*

*Keywords: bacterial conjunctivitis, follicular conjunctivitis, acute*

*conjunctivitis*

*3.1 History*

*A 60-year-old woman presents with complaints of decreased*

*vision, irritation, and discharge in her right eye over the past 3*

*days. She reports that her eye has been stuck shut for the past 2*

*days, requiring a warm, wet washcloth to open the eye. She*

*denies any trauma or surgery. She denies any contacts with ill*

*individuals and does not have any fevers, chills, malaise, or any*

*other ill symptoms. Her past medical history includes hypertension*

*and a hysterectomy 10 years ago. She reports no allergies*

*to medications and uses metoprolol for hypertension. She*

*denies any family history of eye disease.*

*The patient is healthy with a negative review of systems*

*other than her ocular complaints. She is wearing glasses. On*

*examination, her corrected visual acuity with glasses is 20/40*

*OD and 20/25 OS. Manifest refraction OD is –2.50 –1.00 Å~ 85*

*and corrects her to 20/30. Her manifest refraction OS is –2.00 –*

*0.75 Å~ 90, which corrects her vision to 20/20. There is no afferent*

*pupillary defect. Slit-lamp examination of the left eye is*

*normal. The right conjunctiva is injected and edematous. There*

*is mucopurulent discharge from the lower lid (▶Fig. 3.1). The*

*inferior fornix is covered with a fibrin–mucus pseudomembrane*

*(▶Fig. 3.2). The inferior and superior palpebral conjunctiva*

*show a 2 + papillary reaction. The corneas are clear and*

*with no evidence of scarring or inflammation. The anterior*

*chambers are quiet. The right lens demonstrates mild cataractous*

*changes. The left lens is clear. The posterior poles of the*

*right and left eyes are normal. The cup-to-disc ratio is 0.4 in*

*both eyes. Intraocular pressures are 18 and 15mm Hg, respectively.*

*Mucus from the right eye is submitted for Gram stain,*

*and cultures are plated on blood and chocolate agar.*

*Differential Diagnosis—Key Points*

*1. Conjunctival redness with irritation and discharge is a*

*typical feature of bacterial conjunctivitis. The presence of*

*purulent discharge that crusts and seals the eyelids, lack of*

*itching, and no history of conjunctivitis point to a bacterial*

*cause of conjunctivitis. Although the absence of ill contacts*

*and negative review of systems does not exclude the*

*possibility of a viral etiology, it does makes it less likely.*

*Onset of symptoms over less than 24 hours with copious*

*purulent discharge must alert one to the possibility of more*

*virulent genera such as Neisseria.*

*2. Rapidity of symptom onset can be useful for clinical*

*diagnosis and for suggesting a causative organism*

*(▶Table 3.1).*

*3. Uncomplicated bacterial conjunctivitis is generally selflimited*

*within 1 to 2 weeks of presentation. However,*

*empiric treatment with any broad spectrum topical*

*ophthalmic antibiotic can shorten symptom duration and*

*decrease transmissibility.*

*4. Gram stain and conjunctival cultures are not necessary in*

*cases of uncomplicated suspected bacterial conjunctivitis*

*but should be performed in neonates,*

*immunocompromised individuals, and in cases of*

*refractory, recurrent, and copiously purulent conjunctivitis.*

*Fig. 3.1 The right eye shows hyperemia and discharge from the lower*

*lid.*

*Fig. 3.2 The inferior fornix of the right eye demonstrating an*

*inflammatory pseudomembrane covering the tarsal conjunctiva.*

*3.2 Test Interpretation*

*The Gram stain showed numerous gram-positive cocci in pairs*

*and numerous polymorphonuclear lymphocytes. Cultures grew*

*Streptococcus pneumoniae that was sensitive to penicillin, ciprofloxacin,*

*vancomycin, and trimethoprim/sulfamethoxazole.*

*3.3 Diagnosis*

*Streptococcal pneumoniae bacterial conjunctivitis with the formation*

*of inflammatory pseudomembranes.*

*Acute bacterial conjunctivitis presents as a red eye with conjunctival*

*injection, chemosis, and purulent or mucopurulent*

*discharge. Patients experience ocular irritation and may report*

*that their eyelids are stuck together in the morning due to discharge.*

*These symptoms begin in one eye and infection can*

*spread to the other eye, often within 24 to 48 hours. Incidence*

*of bacterial conjunctivitis was estimated at 135 in 10,000 in one*

*study and is less common in adults than viral conjunctivitis.*

*However, it may be responsible for 50 to 70% of conjunctivitis in*

*children and is the eye disease most commonly seen by primary*

*care doctors, estimated at 1% of all consultations.*

*When diagnosing bacterial conjunctivitis, it is important to (1)*

*differentiate bacterial from other forms of conjunctivitis (e.g.,*

*viral, allergic) and (2) identify hyperacute bacterial conjunctivitis,*

*which requires more intensive and systemic treatment.*

*It can be difficult to discern the underlying cause of conjunctivitis*

*as symptoms are often nonspecific. Classically, a purulent/*

*mucopurulent discharge and the presence of conjunctival*

*papillae favor a bacterial cause, while watery discharge associated*

*with follicles suggests a viral origin. However, a large*

*meta-analysis found that these signs and symptoms did not correlate*

*with underlying cause of conjunctivitis. Instead, a recent*

*study found that the strongest predictors of bacterial conjunctivitis*

*are a combination of three signs—lack of itching, no history*

*of conjunctivitis, and one (and especially two) glued eyelids.*

*It is not necessary to perform Gram stain and conjunctival*

*cultures in cases of suspected uncomplicated bacterial conjunctivitis.*

*However, cultures should be performed in neonatal or*

*immunocompromised patients and in cases of refractory, recurrent,*

*or severe purulent conjunctivitis.*

*It is critical to identify hyperacute bacterial conjunctivitis*

*(e.g., gonococcal conjunctivitis). These patients present with*

*copious purulent discharge and decreased vision and often eyelid*

*swelling, tenderness to palpation of the eye, and preauricular*

*adenopathy. In such cases, there is a high risk of corneal*

*involvement and risk of corneal perforation.*

*3.4 Medical Management*

*This patient can be managed medically with topical antibiotic*

*drops. She was treated with trimethoprim sulfate–polymyxin B*

*drops four times a day for 7 days. After 2 days, her symptoms*

*had improved significantly.*

*Most cases of bacterial conjunctivitis are self-limiting within*

*1 to 2 weeks, and no differences in outcome have been*

*observed in antibiotic treatment versus placebo groups. Thus,*

*no treatment and immediate treatment are both reasonable*

*approaches. However, antibiotic therapy leads to quicker recovery*

*and return to work/school and decreases risk of transmission.*

*All broad-spectrum antibiotic eye drops are generally*

*effective for treating empiric bacterial conjunctivitis. Polymyxin*

*combination drops, aminoglycosides, fluoroquinolones,*

*and bacitracin used four times daily for a week are*

*options for treatment. Warm compresses and artificial tears*

*can be offered for comfort. Patients should be cautioned to*

*avoid touching their eyes or sharing towels or washcloths*

*while symptomatic.*

*Hyperacute conjunctivitis, on the other hand, mandates quick*

*diagnosis and more aggressive therapy as serious complications*

*such as corneal perforation can occur. A Gram stain that shows*

*gram-negative diplococcus is highly suggestive of gonococcal*

*conjunctivitis. Treatment consists of a one-time intramuscular*

*dose of ceftriaxone if the cornea is not involved. If the cornea is*

*affected, inpatient ceftriaxone intravenous therapy in combination*

*with topical bacitracin, gentamicin, ciprofloxacin, or besifloxacin*

*is used. In addition, frequent (every 30–60 minutes)*

*saline irrigation of the conjunctiva is necessary. Possible chlamydial*

*coinfection should be treated as well since up to onethird*

*of patients with gonococcal conjunctivitis have concurrent*

*chlamydia venereal disease.*

*3.5 Surgical Management*

*There is almost no role for surgery in acute bacterial conjunctivitis.*

*Inflammatory membranes or pseudomembranes can be*

*seen in several types of conjunctivitis, such as Clostridium diphtheriae,*

*Neisseria gonorrhoeae, or beta-hemolytic Streptococci,*

*viral conjunctivitis, or ligneous conjunctivitis. Pseudomembranes*

*consisting of fibrin-rich exudate may be easily peeled*

*from the conjunctiva, while the true membranes seen in more*

*severe cases cause bleeding when removed. There is insufficient*

*evidence to recommend for or against (pseudo)membrane*

*debridement.*

*Table 3.1 Bacterial conjunctivitis*

*Onset*

*Hyperacute (< 24 h) Acute (hours to days) Slow (days to weeks)*

*Organisms Neisseria gonorrhoeae Haemophilus influenzae Enterobacteriaceae*

*Neisseria meningitidis Staphylococcus aureus Moraxella lacunata*

*Streptococcus pneumoniae Pseudomonas*

*Staphylococcus aureus*

*Proteus spp*

~~~~~CASE 4 Pterygium~~~~~

*4 Pterygium*

*Weldon W. Haw and Edward E. Manche*

*Abstract*

*A pterygium is a nonmalignant, fibrovascular overgrowth of the*

*bulbar conjunctiva typically in the nasal interpalpebral fissure.*

*It is often related to exposure to ultraviolet light and/or chronic*

*dry eye disease. It is important to distinguish a pterygium from*

*malignant conditions such as conjunctival intraepithelial neoplasia.*

*An atypical vascular pattern, appearance, or location*

*may increase the suspicion of a malignant lesion. In most*

*instances, a pterygium that is not symptomatic or impacting*

*vision can be treated conservatively with artificial tear supplementation*

*and protection from ultraviolet light. However, surgical*

*removal of the pterygium may be indicated in situations*

*with progressive growth impacting vision or recalcitrant symptoms.*

*Potential for recurrence should be discussed with the*

*patient prior to surgical removal.*

*Keywords: pterygium, conjunctival intraepithelial neoplasia,*

*pseudopterygium*

*4.1 History*

*A 32-year-old lifeguard presents with intermittent symptoms*

*of bilateral red eye, dryness, irritation, and foreign body sensation.*

*Visual acuity is 20/20 in both eyes. Examination reveals a*

*fibrovascular overgrowth of the bulbar conjunctiva extending*

*onto the cornea of both eyes (▶Fig. 4.1).*

*4.2 Test Interpretation*

*Diagnosis is based on typical clinical presentation. Corneal*

*topography may be useful in documenting topographic changes*

*and identifying induced astigmatism resulting from the pterygium.*

*Histologic examination reveals subepithelial fibrovascular*

*tissue with disruption of Bowman’s layer, increased*

*fibroblasts, and elastoid degeneration of the underlying*

*collagen.*

*4.3 Diagnosis*

*Pterygium, bilateral.*

*4.4 Medical Management*

*A small, nonactive, symptom-free pterygium may simply be*

*observed. Using the slit-lamp beam to measure the horizontal*

*and vertical dimensions of the pterygium may be useful in documenting*

*progression on serial examinations. A small, minimally*

*inflamed pterygium with mild symptoms may often be*

*managed with frequent use of preservative-free artificial tears*

*or topical nonsteroidal anti-inflammatory medications. For*

*active exacerbation of symptoms or inflammation, a short*

*course of a mild topical steroid may be useful in controlling the*

*symptoms. The topical steroid may be dosed four times daily*

*and tapered over 2 to 3 weeks. Expected response is complete*

*resolution of the inflammation with days of beginning the steroid.*

*However, overly aggressive tapering of the steroids may*

*result in recurrent inflammation. Some physicians have advocated*

*the use of ultraviolet-blocking sunglasses and continued*

*lubrication to limit progressive pterygium growth.*

*Differential Diagnosis—Key Points*

*1. A pterygium is a fibrovascular overgrowth of the bulbar*

*conjunctiva typically located in the nasal interpalpebral*

*fissure. It is a common finding among individuals 20 to 40*

*years of age with exposure to ultraviolet radiation and wind.*

*The incidence is higher in patients living closer to the*

*equator. It occurs more commonly in males than females.*

*2. A pterygium in its earliest stages is indistinguishable from a*

*pinguecula. A pinguecula is a benign, elevated, yellowish,*

*perilimbal lesion of the interpalpebral fissure. It may arise*

*from degenerative factors similar to pterygia. By definition,*

*however, pingueculae do not involve the cornea.*

*Pingueculae are believed to be precursors of pterygia.*

*3. A pterygium should be differentiated from a*

*pseudopterygium. Pseudopterygia result from nonspecific*

*inflammation from chemical injuries, trauma, burns, and*

*infections. The resulting injury leads to a fibrovascular,*

*bulbar conjunctival scar that extends over the cornea. A*

*probe may be placed between the body of a*

*pseudopterygium and the globe, whereas it may not be*

*placed between a true pterygium and the globe. In*

*addition, pseudopterygia differ from true pterygia as they*

*may occur outside the interpalpebral fissure or be*

*associated with symblepharon.*

*4. It is also important to distinguish a pterygium from a*

*malignant lesion. Conjunctival intraepithelial neoplasia (CIN)*

*may be mistaken for an atypical pterygium. CIN usually*

*appears in the interpalpebral limbal area. It may appear as a*

*gelatinous elevated lesion with varying degrees of*

*keratinization, as a small elevated vascularized*

*papillomatous lesion, or as a white plaque (leukoplakia).*

*Although it is difficult to differentiate squamous cell*

*carcinoma from CIN, squamous cell carcinoma tends to*

*involve more of the limbal circumference, may be more*

*elevated, and may be immobile or fixed to the underlying*

*surface.*

*5. A pterygium may be associated with a pigmented iron line*

*at its leading edge, the “Stocker’s line,” i.e., a nonspecific*

*associated finding with no clinical value.*

*6. Most pterygia either grow very slowly or enter a quiescent*

*phase. Occasionally, pterygia may either become actively*

*inflamed or grow rapidly and progressively. Epithelial*

*irregularity, opacification of Bowman’s layer, and*

*prominent and inflamed vessels may be predictive of an*

*active phase.*

*4.5 Surgical Management*

*Indications for surgical pterygium excision include interference*

*with vision from progressive growth over the visual axis,*

*induced astigmatism, unacceptable cosmesis, and severe symptoms.*

*Restriction of extraocular motility has also been reported.*

*However, patients should be counseled on the published recurrence*

*rates, which may be as high as 35 to 40%. These recurrence*

*rates tend to be higher for fleshy, actively growing*

*lesions. Recurrent pterygia may also demonstrate more aggressive*

*growth as compared to the primary pterygia. Subsequent*

*removal of recurrent pterygia may also be challenging because*

*of fibrovascular scarring. Several techniques have been reported*

*to diminish the recurrence rates. These include the use of irradiation,*

*extensive removal of Tenon’s capsule, application of*

*antimetabolites such as mitomycin C, amniotic membrane*

*transplantation, and conjunctival autografts. These adjunctive*

*maneuvers may decrease recurrence rates to less than 5%. Complications*

*of mitomycin C (0.02%) include persistent epithelial*

*defects and scleral necrosis. Therefore, the concentration and*

*duration of mitomycin C must be titrated to the appearance and*

*aggressiveness of the pterygium, used in subconjunctival space*

*with caution to avoid bare sclera and limbal stem cells, and*

*used judiciously to prevent these complications.*

*A pterygium is usually excised under local subconjunctival*

*anesthesia. Anesthetic infiltration with lidocaine in the correct*

*plane will result in “tenting” up of the pterygium. This will*

*facilitate the dissection of the pterygium and will provide adequate*

*anesthesia for its removal. Multiple methods exist for*

*pterygium excision. One method involves a 69 Beaver blade and*

*Westcott scissors, which are sufficient for undermining the*

*body of the pterygium and anterior lamellar dissection of the*

*corneal component of the pterygium. Removal of Tenon’s*

*capsule with preservation of the overlying conjunctiva is an*

*important step in reducing recurrence rate and optimizing*

*postoperative results. Sending the pterygium to an appropriate*

*ocular pathology laboratory for histopathologic examination*

*will confirm the diagnosis. Primary conjunctival anastomosis,*

*rotational flaps, and various conjunctival autograft or amniotic*

*membrane transplantation techniques have been used to close*

*the conjunctival defect created by pterygium excision. Sutures*

*or fibrin glue can be used to secure the autologous conjunctival*

*graft or amniotic membrane graft. Following the surgery,*

*patients may be started on a topical antibiotic four times a day*

*until the surface has completely re-epithelialized. A topical corticosteroid*

*should be administered and tapered according to*

*the severity of the postoperative inflammatory response.*

*4.6 Rehabilitation and Follow-up*

*Follow-up for medically managed pterygia is dictated by the*

*severity of symptoms and the proximity to the visual axis. If*

*topical steroids are used for inflammatory pterygia or during*

*the postoperative period, earlier follow-up is indicated to assess*

*response and to evaluate the intraocular pressure.*

~~~~~CASE 5 Recurrent Erosion/Epithelial Basement Membrane Dystrophy~~~~~

*5 Recurrent Erosion/Epithelial Basement Membrane*

*Dystrophy*

*Weldon W. Haw*

*Abstract*

*Epithelial basement membrane dystrophy is the most common*

*corneal dystrophy. It can result in spontaneous episodes of*

*recurrent erosions. Diagnosis can be made by historical features*

*of a spontaneous recurrent erosion and evidence of the corneal*

*dystrophy on slit-lamp examination. It is useful to evaluate for*

*the dystrophy in both the involved and fellow eye. Treatment*

*can be successful with pharmaceuticals (antibiotic prophylaxis,*

*cycloplegia), bandage contact lens, or self-retained amniotic*

*membrane grafts. Occasionally, surgical alternatives may be*

*required. Epithelial debridement, scraping, anterior stromal*

*micropuncture, or excimer laser phototherapeutic keratectomy*

*can result in long-term symptom-free remissions. Hypertonic*

*solutions are useful in maintenance therapy.*

*Keywords: recurrent erosion syndrome, corneal dystrophy,*

*map-dot-fingerprint dystrophy, epithelial basement membrane*

*dystrophy, corneal abrasion, phototherapeutic keratectomy*

*5.1 History*

*A 35-year-old woman awoke from sleep with sudden onset of*

*unilateral pain, foreign body sensation, lacrimation, photophobia,*

*and blurred vision immediately upon opening her eyes. The*

*patient had a previous history of multiple similar episodes*

*occurring in either eye. The patient’s mother has also been*

*affected with similar episodes. She had no history of prior ocular*

*trauma.*

*Visual acuity is 20/400 in the involved eye and 20/20 in the*

*fellow eye. Slit-lamp examination of the involved eye revealed a*

*large, discrete area of epithelial sloughing (▶Fig. 5.1). The edges*

*of the epithelial defect were remarkable for a “heaped-up”*

*appearance. No infiltrate was apparent. Fluorescein dye*

*revealed pooling over the epithelial defect. Examination of the*

*fellow eye was remarkable for diffuse, superficial gray-white*

*opacities in a “map” and “dot” configuration (▶Fig. 5.2).*

*Differential Diagnosis—Key Points*

*1. Onset of symptoms was sudden and noted by the patient*

*upon opening her eyes while awakening. The prior day, the*

*patient had not noticed any premonitory symptoms. This is*

*the classic presentation of recurrent erosion syndrome. As*

*the patient opens his or her eyes, the corneal epithelium*

*that is loosely adherent to the underlying abnormal*

*basement membrane may be pulled off, causing a discrete*

*epithelial defect.*

*2. Notably, there was no acute, inciting event such as trauma.*

*The epithelium was shed spontaneously. Also, the patient*

*had a history of multiple spontaneous episodes. Thus, the*

*examiner should note that the diagnosis is not a simple*

*corneal abrasion.*

*3. On examination, discrete roughening of the corneal*

*epithelium is noted with a “sloughed-off” appearance. The*

*dislodged epithelium appears to be shed in a single large*

*“sheet.” This is also the typical appearance of a recurrent*

*erosion resulting from pathological adherence of the*

*epithelium to the underlying basement membrane.*

*Occasionally, symptoms may have improved by the time the*

*patient is examined as the epithelial changes may resolve*

*rapidly if the defect is small.*

*4. Recurrent epithelial erosion is usually noted among one of*

*two populations. The first population consists of patients*

*with a prior history of abrading trauma or surgery in the*

*affected eye. The second population consists of patients*

*with an underlying corneal dystrophy. Map-dot-fingerprint*

*dystrophy is the most common, accounting for an*

*estimated 50% of patients with recurrent epithelial erosion*

*syndrome. However, other basement membrane*

*dystrophies may also present with recurrent erosions. These*

*include Meesmann’s and Reis–Bücklers dystrophies.*

*Anterior stromal corneal dystrophies such as lattice,*

*macular, and granular dystrophies may also cause recurrent*

*epithelial erosion.*

*5. In order to differentiate between these causes, the*

*examiner should inquire about a past history of corneal*

*trauma or injury and whether recurrent episodes are*

*unilateral or bilateral. Our patient denied a history of*

*corneal injury (although the patient may often forget about*

*a minor ocular injury in the past, as recurrent erosion may*

*occur many years after the initial injury). Our patient also*

*noted that her recurrent episodes occurred in either eye.*

*These historical features suggest an underlying corneal*

*dystrophy rather than a past traumatic event as the*

*underlying etiology.*

*6. Family history may also be positive in a patient with*

*corneal dystrophies. Our patient had a mother who reports*

*similar episodes. Map-dot-fingerprint dystrophy may be*

*inherited in a dominant pattern, usually with incomplete*

*penetrance.*

*7. Examination of the contralateral, noninvolved eye is also*

*important as it may reveal evidence of dystrophic changes.*

*Examination of this patient’s fellow eye demonstrated a*

*typical pattern of map-dot-fingerprint changes. Fingerprint*

*lines are thin concentric lines arranged in a pattern that*

*resembles the prints on the end of a finger. Thicker*

*geographic lines surrounded by a faint haze are called map*

*lines. Dots are discrete, gray-white circular or oval lesions of*

*varying sizes. These corneal changes may be variable and*

*can change over time within the same individual. These*

*changes may be quite subtle and may require careful*

*examination. Map lines, dots, and fingerprint lines may be*

*identified at the slit lamp with a broad, tangential beam or*

*through a red reflex (▶Table 5.1; see also the following list).*

*5.1.1 Summary of Epithelial Basement*

*Membrane Dystrophy*

*● Most common corneal dystrophy.*

*● Estimated 2% of population may have dystrophy.*

*● May represent an estimated 50% of recurrent erosions.*

*● Autosomal dominant—female predominance.*

*● Map lines, fingerprint lines, and dots.*

*5.2 Test Interpretation*

*Diagnosis is made by careful slit-lamp examination of the*

*involved and fellow eyes. The ocular and family history may*

*also be useful. No ancillary tests are required for diagnosis.*

*5.3 Diagnosis*

*Recurrent epithelial erosion syndrome, basement membrane*

*dystrophy type.*

*5.4 Medical Management*

*Medical management during the acute stage is directed at*

*safely promoting epithelial healing while maximizing patient*

*comfort. The application of a prophylactic topical antibiotic*

*ointment in conjunction with a pressure patch for 24 to 48*

*hours may achieve both of these goals. Cycloplegia may also be*

*useful in relieving discomfort for those patients with a significant*

*associated anterior chamber reaction or ciliary spasm.*

*Some clinicians have advocated the use of a soft bandage contact*

*lens to facilitate epithelial healing. However, the use of a*

*contact lens may lead to complications of a “tight lens syndrome”*

*or secondary infectious keratitis. Self-retained amniotic*

*membrane grafts are available and can be placed in the clinic*

*setting. Both cryopreserved (Prokera) and dehydrated amniotic*

*membrane (AmbioDisk) grafts may promote healing of the*

*corneal epithelium.*

*5.5 Surgical Management*

*In more severe or recurrent cases, it may be necessary to pursue*

*more aggressive therapeutic interventions. These include the*

*use of total epithelial debridement, anterior stromal micropuncture,*

*or excimer laser phototherapeutic keratectomy (PTK).*

*Epithelial debridement is most appropriately performed during*

*the acute phase and is done by gently scraping the edge of*

*the epithelial defect with a moist Q-tip or cellulose sponge*

*under topical anesthesia. Performing this procedure during the*

*acute phase is appropriate as it may cause considerable ocular*

*discomfort. The remaining involved epithelium may then be*

*peeled off with a nontoothed forceps. The involved eye is then*

*managed as described earlier (antibiotic ointment, patch, bandage*

*contact lens, or self-retained amniotic membrane graft).*

*Since epithelial basement membrane dystrophy is a diffuse disease,*

*gentle epithelial debridement should be performed over*

*the entire surface of the cornea. Bowman’s membrane should*

*not be violated as this may result in subepithelial scarring. Following*

*this procedure, patients may remain symptom-free for 1*

*or 2 years. However, recurrences are possible.*

*Fig. 5.1 Recurrent erosion: red reflex examination demonstrates*

*diffuse sloughing of the epithelium as a large sheet.*

*Fig. 5.2 Epithelial basement membrane dystrophy: careful slit-lamp*

*examination reveals superficial gray-white opacities characteristic of*

*“map” and “dot” changes.*

*Table 5.1 Differentiation of etiology of recurrent erosion*

*Traumatic Map-dot-fingerprint*

*History of corneal trauma/injury in*

*affected eye*

*No history of trauma*

*Unilateral recurrent episodes May be bilateral recurrent*

*episodes*

*No family history May have positive family history*

*(autosomal dominant with*

*incomplete penetrance)*

*Contralateral eye—normal*

*examination*

*Contralateral eye—may have*

*evidence of map-dot-fingerprint*

*changes*

*Anterior stromal micropuncture involves making between 15*

*and 25 anterior stromal micropunctures with a bent 25-gauge*

*needle. This induces a cicatricial adhesion between the epithelium*

*and anterior stroma. This technique is most useful in*

*patients with posttraumatic recurrent erosions localized outside*

*the visual axis. Following anterior stromal micropuncture,*

*topical antibiotic ointment, cycloplegia, and a pressure patch*

*are applied.*

*The newest development in the management of recurrent*

*erosions involves the use of the excimer laser in a procedure*

*labeled PTK or phototherapeutic keratectomy. This procedure*

*involves removing the epithelium either manually or by laser*

*scrape and subsequent superficial photoablation of the cornea.*

*The entire cornea should be treated in patients with underlying*

*anterior corneal dystrophies. This wide superficial ablation is*

*particularly useful in the treatment of an underlying anterior*

*corneal dystrophy associated with significant visual impairment*

*due to scarring or recalcitrant, recurrent erosions. Complications*

*of excimer laser PTK include delayed corneal wound*

*healing and refractive changes.*

*5.6 Rehabilitation and Follow-up*

*Careful follow-up until resolution of the epithelial defect is recommended.*

*It is important to be vigilant for the development*

*of infectious keratitis. After the resolution of the epithelial*

*defect, it may be important for patients with recurrent epithelial*

*erosions to maintain adequate lubrication with nonpreserved*

*artificial tears four to eight times per day and with*

*artificial tear ointment prior to bedtime. The lubrication may*

*prevent the lid from applying traction to epithelium loosely*

*adherent to the underlying basement membrane. In addition,*

*hypertonic solutions such as 5% sodium chloride have the theoretical*

*advantage of osmotically drawing fluid from the epithelium*

*and promoting adherence to the underlying basement*

*membrane. Thus, 5% sodium chloride drops during the day and*

*5% sodium chloride ointment prior to bedtime may be useful as*

*an alternative to artificial tears for 3 or more months following*

*the acute episode. Vision may be impacted by irregular astigmatism*

*or corneal haze. A corneal topography may be useful in*

*identifying these circumstances.*

~~~~~CASE 6 Fuchs’ Corneal Dystrophy~~~~~

*6 Fuchs’ Corneal Dystrophy*

*Weldon W. Haw*

*Abstract*

*Fuchs’ endothelial dystrophy is a slowly progressive dystrophy*

*that results in cornea stromal edema associated with concurrent*

*loss of endothelial cell density. Stromal edema may be*

*most severe in the morning hours, and patients may notice a*

*diurnal vision fluctuation associated with worse vision in the*

*morning hours. Clinical features of Fuchs’ endothelial dystrophy*

*include the presence of corneal guttate with or without the*

*presence of corneal edema. The cornea thickness may be elevated*

*on pachymetry. Specular microscopy may be useful in*

*qualitatively and quantitatively examining the endothelial cell*

*layer. In mild instances, patients may be managed pharmacologically*

*with a hypertonic ophthalmic solution. In more*

*advanced situations, surgical management with endothelial*

*transplantation procedures (DSAEK, DMEK, etc.) or penetrating*

*keratoplasty (i.e., in advanced cases with corneal scarring) may*

*be entertained.*

*Keywords: Fuchs’ endothelial dystrophy, corneal dystrophy, endothelial*

*dystrophy, corneal edema, cornea transplant, endothelial*

*transplant, DSAEK, DMEK, penetrating keratoplasty*

*6.1 History*

*A 60-year-old woman presented with a history of slowly progressive*

*loss of vision in the left greater than the right eye. Initially,*

*her vision was worse upon awakening and gradually*

*cleared as the day went on; more recently, however, her vision*

*remained poor throughout the day.*

*Examination revealed corrected visual acuities of 20/200 in*

*the right eye and counting fingers at 4 feet in the left eye. Intraocular*

*pressure was 14mm Hg in each eye. Slit-lamp examination*

*of the cornea revealed central microcystic epithelial edema*

*and stromal edema with folds in Descemet’s membrane in the*

*left greater than the right eye (▶Fig. 6.1). Corneal guttatae and*

*endothelial pigmentation extended over the central portion of*

*the cornea in both eyes. The anterior chamber was deep and*

*quiet, and the iris was normal in both eyes. Moderate nuclear*

*sclerotic cataracts were present bilaterally, and dilated fundus*

*examination revealed normal posterior poles through a hazy*

*view. B-scan ultrasonography of the posterior poles was unremarkable.*

*Differential Diagnosis—Key Points*

*1. Corneal edema can be divided into congenital and acquired*

*causes. Congenital causes include dystrophies such as*

*posterior polymorphous dystrophy, congenital hereditary*

*endothelial dystrophy, congenital glaucoma, and forceps*

*injury. Acquired causes include pseudophakic/aphakic*

*bullous keratopathy, Fuchs’ corneal dystrophy, angle closure*

*glaucoma, herpes simplex stromal keratitis, varicella zoster*

*keratitis, iridocorneal endothelial (ICE) syndrome, posterior*

*polymorphous dystrophy, hypotony, corneal hydrops (as in*

*keratoconus), and trauma.*

*2. Endothelial dysfunction causes secondary stromal edema*

*that is worse in the morning. Eyelid closure while sleeping*

*decreases surface evaporation and maximizes corneal*

*edema upon awakening.*

*3. Corneal edema is a necessary component of Fuchs’ corneal*

*dystrophy. Patients with guttata but without corneal edema*

*are considered to have “endothelial dystrophy.”*

*4. In addition to complaints of decreased vision, patients with*

*advanced Fuchs’ dystrophy often complain of episodes of*

*sharp pain due to rupture of epithelial bullae. Clinical*

*examination readily distinguishes these patients from those*

*with recurrent erosion syndrome, who may have similar*

*complaints.*

*6.2 Test Interpretation*

*The diagnosis of Fuchs’ corneal dystrophy is usually made on*

*the basis of the classic slit-lamp findings of epithelial and stromal*

*edema, endothelial guttata, and endothelial pigmentation,*

*all of which are most prominent in the central cornea.*

*Ultrasonic pachymetry can sometimes be helpful in detecting*

*early subclinical corneal thickening in endothelial dystrophy*

*and in following progression of the endothelial dystrophy. This*

*information is useful in determining the likelihood of corneal*

*decompensation following cataract extraction. A general rule of*

*thumb is to proceed with cataract extraction alone if central*

*pachymetry is less than 600 μm, and to proceed with a combined*

*corneal endothelial transplant procedure such as Descemet’s*

*stripping automated endothelial keratoplasty (DSAEK) or*

*Descemet’s membrane endothelial keratoplasty (DMEK) in conjunction*

*with cataract extraction if central pachymetry is*

*greater than 600 μm. This rule of thumb is only loosely applicable,*

*however, as trauma to the endothelium during cataract*

*extraction varies greatly depending on the degree of skill of the*

*Fig. 6.1 Advanced Fuchs’ corneal dystrophy with severe stromal and*

*epithelial edema. (The image is provided courtesy of Peter R. Laibson,*

*MD, Philadelphia, PA.)*

*surgeon, as well as on the density of the nucleus. If cataract surgery*

*alone is planned, several endothelial protective measures*

*during cataract surgery can be incorporated in order to minimize*

*trauma to the endothelium. These include the use of a dispersive*

*or viscoadaptive viscoelastic for endothelial protection*

*during phacoemulsification, endocapsular and chop phacoemulsification*

*techniques, and BSS plus (balance salt saline solution)*

*irrigation fluid.*

*Specular microscopy can be useful in further elucidating the*

*status of the endothelium in early Fuchs’ corneal dystrophy.*

*Guttata are seen as dark spots within the mosaic of endothelial*

*cells. Increased variability in cell shape (pleomorphism) and*

*size (polymegathism) is typically present, and overall cell density*

*is diminished when compared to normal. As Fuchs’ corneal*

*dystrophy progresses, specular microscopy becomes more difficult*

*to perform because of increasing corneal edema.*

*6.3 Diagnosis*

*1. Fuchs’ corneal dystrophy OU.*

*2. Cataract OU.*

*6.4 Medical Management*

*In endothelial dystrophy, the patient is usually asymptomatic*

*and no treatment is necessary. In early Fuchs’ corneal dystrophy,*

*“morning blur” secondary to corneal edema can be*

*reduced through the use of hypertonic sodium chloride (e.g.,*

*NaCl 5%) drops. Initially, these may be required only upon*

*awakening, but as the disease progresses, they may be required*

*throughout the day. Hypertonic sodium chloride ointment at*

*bedtime may also reduce morning blur. Another approach to*

*reducing corneal edema involves using a hair dryer to dehydrate*

*the cornea. The hair dryer is placed on the lowest setting*

*and is directed toward the cornea at arm’s length for several*

*minutes. Eventually, progressive endothelial failure overwhelms*

*such measures and corneal transplantation is necessary to*

*rehabilitate vision.*

*6.5 Surgical Management*

*When corneal edema advances to the point where visual function*

*is significantly affected despite conservative management,*

*a corneal transplantation procedure is indicated. There are several*

*surgical approaches available to a patient with Fuchs’ endothelial*

*dystrophy, including DSAEK, DMEK, or penetrating*

*keratoplasty (PKP).*

*In most cases of Fuchs’ endothelial dystrophy, there is pure*

*endothelial dysfunction/corneal edema without corneal scarring.*

*In these instances, endothelial transplantation procedures*

*such as DSAEK or DMEK can be considered. These endothelial*

*transplant procedures are less invasive and have more rapid*

*visual recovery, less induced corneal astigmatism, and less graft*

*rejection than traditional penetrating corneal transplant procedures*

*(i.e., PKP). In DSAEK, the host endothelium is stripped and*

*removed and the donor’s endothelium and posterior corneal*

*stroma lenticel is transplanted to the posterior cornea. Often,*

*there is a hyperopic shift of approximately 1.0 to 1.5 D. Thus,*

*when performed in conjunction with cataract surgery, it is*

*important to place an intraocular lens (IOL) aiming slightly*

*more myopic than intended correction. In DMEK, following*

*stripping of the host Descemet’s membrane, a donor’s Descemet’s*

*membrane without stroma is transplanted onto the host*

*posterior cornea. Theoretical advantages of DMEK over DSAEK*

*include a more anatomic result with no optical interface, faster*

*visual recovery, lower rejection rates, less hyperopic shift, and*

*better refractive outcomes.*

*In instances of chronic endothelial dysfunction, bullous keratopathy*

*associated with visually significant cornea scarring can*

*occur. In these cases, the corneal scarring can limit the postoperative*

*visual outcome with an endothelial (DSAEK, DMEK)*

*transplant procedure, and this must be balanced with the risks*

*of a PKP. As visual rehabilitation after PKP can be as long as 6 to*

*12 months after surgery, the patient will, for a period of time,*

*be dependent on the less involved “better” eye for visual function*

*in the postoperative period. Therefore, when indicated,*

*PKP should be performed as soon as possible in the worse eye*

*while the patient still has functional vision in the better eye.*

*PKP is performed using standard techniques. Simultaneous*

*cataract extraction and IOL placement should be strongly considered*

*if any significant lenticular opacity is present, as cataracts*

*tend to worsen after PKP. Furthermore, cataract extraction*

*after PKP will traumatize the endothelium and shorten graft*

*survival. The determination of the appropriate IOL power is*

*problematic in these patients, as postoperative keratometry*

*cannot be predicted with great accuracy. Variations of surgical*

*technique, the amount of oversizing of the graft, wound healing,*

*the keratometric power of the recipient corneal rim, and donor*

*button all contribute to the final power of the grafted cornea.*

*Ultimately, each surgeon must develop his or her own algorithm*

*for determining IOL power based on experience.*

*Suturing techniques are determined by surgeon preference*

*and the degree of preoperative corneal edema. In cases where*

*diffuse limbus-to-limbus edema exists, a 16-bite interrupted*

*pattern allows for individual suture removal in the early postoperative*

*period if necessary for suture loosening or vascularization.*

*If the peripheral cornea is nonedematous, premature*

*suture loosening is less of a concern, and a running or combined*

*running–interrupted suture technique can be considered*

*(▶Fig. 6.2).*

*Fig. 6.2 Six weeks after penetrating keratoplasty.*

*6.6 Rehabilitation and Follow-up*

*Postoperatively, topical antibiotic and corticosteroid drops are*

*prescribed. Ointments and/or nonpreserved artificial tears can*

*be employed to rehabilitate the ocular surface as needed. The*

*antibiotics are discontinued after the surface has re-epithelialized.*

*Topical steroids are slowly tapered over 6 to 12 months.*

*The surgeon should minimize the number and frequency of*

*preserved topical eye drops to prevent surface toxicity. Following*

*DSAEK or DMEK procedure, the patient should remain in*

*the supine position until the air bubble is dissolved to allow the*

*graft to attach. In instances of PKP, the postoperative astigmatism*

*is managed initially by selective suture lysis and/or running*

*suture adjustment, guided by topography. Glasses or rigid*

*gas permeable contact lenses are prescribed when appropriate.*

*Occasionally, high degrees of astigmatism may require surgical*

*intervention such as astigmatic keratotomy, compression*

*sutures, wedge resection, or, rarely, repeat PKP. Laser in situ*

*keratomileusis (LASIK) may be useful in selected cases with*

*large refractive errors. LASIK should be performed only after all*

*sutures have been removed and in the presence of a secure*

*wound.*

~~~~~CASE 7 Keratoconus~~~~~

*7 Keratoconus*

*Aaron Wang and Weldon W. Haw*

*Abstract*

*Keratoconus is a noninflammatory ectasia of the central cornea.*

*Best corrected vision may be compromised from irregular corneal*

*astigmatism and corneal scarring. Slit-lamp findings may*

*be subtle. Corneal topography may be informative in assessing*

*the extent of the ectasia and the severity of the disease. Treatment*

*includes specialized rigid contact lenses, corneal crosslinking,*

*or deep anterior lamellar or penetrating keratoplasty.*

*We present here a case of a patient with keratoconus. The case*

*describes typical symptoms, exam findings, differential diagnosis,*

*testing and interpretation, and medical and surgical management*

*for keratoconus.*

*Keywords: keratoconus, corneal transplant, keratoplasty, INTACS,*

*hard contact lenses, pachymetry, astigmatism, corneal*

*thinning, cornea ectasia, corneal cross-linking*

*7.1 History*

*A 19-year-old man presents with complaints of gradual*

*decreased vision in his right eye over the past year. He has worn*

*glasses and contacts for 9 years, and despite a recent change in*

*his prescription and new contact lenses, he does not “see*

*clearly.” He denies any trauma, surgery, or recent eye infection.*

*He reports his vision in both eyes was clear as a child and young*

*adult and until last year was correctable to 20/20. His past medical*

*history is significant for seasonal allergies. He reports allergies*

*to penicillin and uses acetaminophen occasionally. He*

*denies any family history of eye disease.*

*The patient is healthy with a negative review of systems. He*

*is wearing contact lenses. On examination, his corrected visual*

*acuity with contacts is 20/50 OD and 20/25 OS. Manifest refraction*

*OD, –2.00 –7.50 Å~ 60, only corrects him to 20/100. His*

*manifest refraction OS is –2.25 –1.00 Å~ 28, which corrects his*

*vision to 20/40. There is no afferent pupillary defect. On slitlamp*

*examination, the lids and lashes are normal. He has an adequate*

*tear lake and tear breakup time. The corneas are clear*

*and with no evidence of scarring or inflammation. The anterior*

*chamber is quiet, the lens is clear, and the posterior pole viewed*

*after dilation is normal with a healthy foveal light reflex. The*

*cup-to-disc ratio is 0.3 bilaterally and the intraocular pressures*

*are 12 and 14, respectively.*

*On careful inspection of the cornea, mild thinning is evident*

*centrally, Vogt’s striae are visible on Descemet’s membrane*

*(▶Fig. 7.1), and a partial Fleischer’s ring is visible more prominently*

*with cobalt blue illumination. Ultrasound pachymetry*

*measures the corneal thickness at 450 μm in the right eye and*

*480 μm in the left. Computerized topography with the EyeSys*

*system showed steepening inferiorly in the right eye*

*(▶Fig. 7.2). A rigid gas permeable contact lens over-refraction*

*corrects the vision to 20/30 in the right eye.*

*Differential Diagnosis—Key Points*

*1. Individuals who present with unexplained visual*

*deterioration must be examined carefully with attention to*

*the cornea, anterior chamber, lens, nerve, and macula.*

*Unexplained visual loss or deterioration must be explained*

*by the examining ophthalmologist; otherwise, subtleties*

*such as mild cystoid macular edema and pars planitis, a*

*slightly swollen nerve and pseudotumor cerebri, or corneal*

*thinning and early keratoconus will be missed.*

*2. There are few conditions that cause decreased vision in a*

*young healthy patient secondary to astigmatism, ectasia,*

*and thin corneas.*

*a) Keratoconus is a disorder where the central or*

*paracentral cornea undergoes progressive thinning,*

*leading to irregular astigmatism and steepening where*

*the cornea bulges out in a conelike shape. The apex of*

*the cone is usually where the cornea is thinnest.*

*Keratoconus is normally bilateral but usually asymmetric.*

*Associations include atopy, Down’s syndrome, eye*

*rubbing, sleep apnea, and floppy eyelids. Hydrops,*

*irregular corneal astigmatism, and corneal scarring can*

*occur.*

*b) Pellucid marginal degeneration may cause peripheral*

*thinning in a quiet, uninflamed eye. It is a rare,*

*idiopathic, bilateral condition and results in thinning*

*inferiorly with clear overlying stroma. It can produce*

*large amounts of irregular astigmatism usually*

*correctable with spectacles or contacts. The apex of the*

*cornea is usually above the area of thinning, and*

*topography may show a crab-claw configuration.*

*c) Terrien’s marginal degeneration is the most common*

*cause of peripheral thinning. It is usually seen in patients*

*older than 40 years and causes gradual thinning and*

*ectasia beginning superiorly. This thinning is often*

*accompanied by lipid deposition and pannus formation.*

*Patients have a high against-the-rule astigmatism due to*

*flattening of the vertical meridian.*

*d) Keratoglobus is a rare bilateral condition consisting of*

*diffusely thinned corneas with ectasia and enlarged*

*corneal diameter. It may be seen in association with*

*connective tissue disorders. Patients with keratoglobus*

*are prone to hydrops and perforation. Because the most*

*pronounced thinning may be peripheral, surgical*

*management is challenging and may require limbus-tolimbus*

*keratoplasty.*

*e) Rheumatoid arthritis may cause peripheral ulcerative*

*keratitis in association with sclerotic processes. Central*

*thinning, however, seen in an otherwise quiet eye, is*

*thought to be secondary to keratoconjunctivitis sicca or*

*upregulation of collagenases.*

*Fig. 7.1 Slit-lamp photograph of the right eye showing fine striae of*

*Descemet’s membrane, Vogt’s striae, at the thinnest point in the right*

*cornea.*

*Fig. 7.2 (a) Computerized videokeratoscopy*

*using the EyeSys system demonstrates in the*

*right eye inferior steepening and superoinferior*

*dioptric asymmetry. (b) The left eye appears*

*relatively normal, but the cornea is thinner than*

*average.*

*7.2 Test Interpretation*

*The major diagnostic consideration in this patient stems from*

*unexplained visual loss in what at first appears to be a normal*

*exam. Careful examination reveals few striae in Descemet’s*

*membrane and central thinning. Refraction demonstrates*

*asymmetric high astigmatism with an oblique axis. Improvement*

*with a rigid gas permeable contact lens over-refraction is*

*suggestive of a corneal cause for the patient’s abnormal best*

*spectacle-corrected visual acuity.*

*The cornea is normally thickest nasally and inferiorly and*

*thins centrally to approximately 540 μm. Corneal thickness is*

*best measured with an ultrasound pachymeter. Using sound*

*waves calibrated to travel in the cornea, ultrasound pachymetry*

*gives reliable, reproducible measurements. This patient has thin*

*corneas, more so in the right eye.*

*Cobalt blue illumination highlights iron deposition in the epithelium,*

*which frequently occurs over irregular surfaces or a*

*change in curvature. In keratoconus, hemosiderin accumulates*

*in the epithelium around the base of a cone.*

*Computer-assisted videokeratoscopy or topography is one of*

*the most helpful tests when corneal abnormalities are detected*

*or suspected. Computerized topography most commonly*

*employs a Placido disc nose cone and a computer-based keratoscope*

*to capture the image and rapidly analyze the data. The*

*computer examines topographic data points across the Placido*

*rings and generates a color-coded map that corresponds to corneal*

*curvature. In this case, the asymmetry between the curvature*

*above and below the horizontal meridian is highly*

*suggestive of keratoconus. In addition to measuring the anterior*

*corneal curvature, optical topography units (i.e., Pentacam) can*

*also measure the corneal thickness and posterior corneal curvature,*

*which can also be useful in identifying corneal ectasia.*

*7.3 Diagnosis*

*Keratoconus in the right eye.*

*7.4 Medical Management*

*Keratoconus is a noninflammatory corneal ectasia of unknown*

*etiology. Its well-described findings include thinning, iron deposition*

*in the epithelium, and breaks in Bowman’s membrane.*

*The incidence of keratoconus is approximately 1 in 2,000 and is*

*almost always bilateral but usually asymmetric. Cases that*

*appear to be unilateral will often progress over time to include*

*the other eye. Most patients, as in the case here, can be managed*

*medically with glasses or contact lenses. If spectacle or*

*soft contact lens correction fails to yield good visual results,*

*then a rigid gas permeable lens or a toric lens may be used to*

*maximize visual acuity. In more advanced keratoconus where*

*the cornea is more protuberant, a larger hard contact lens such*

*as a scleral lens or specialty hybrid contact lens may be needed.*

*This patient presented with mild keratoconus and was not*

*correctable with glasses or soft contacts but was able to see 20/*

*30 with rigid gas permeable lenses. Were this patient not able*

*to see well with hard contacts and if the thinning were to progress,*

*surgical treatment might be necessary.*

*7.5 Surgical Management*

*Keratoconus can progress and the patient may no longer benefit*

*from contact lens wear. Ultraviolet light/riboflavin collagen*

*cross-linking of the cornea may stiffen the cornea and slow the*

*progression of keratoconus. Surgery would be the next step for*

*advanced patients who have difficulty achieving a proper contact*

*lens fit or have become intolerant of contact lens wearing,*

*or those who have significant central corneal scarring or poor*

*vision despite the rigid contact lens.*

*Surgical options include penetrating keratoplasty (PKP), deep*

*anterior lamellar keratoplasty (DALK), or intracorneal ring segments*

*(e.g., INTACS). INTACS can be used to flatten the cornea*

*and address a moderate degree of myopia. With the assistance*

*of many active eye banks, corneal transplantation has proved to*

*be very successful for patients with advanced keratoconus and/*

*or significant corneal scarring. Five-year success rates for PKP in*

*patients with keratoconus approach 95%. Nonetheless, after*

*PKP, patients are forever at risk for rejection and must be followed.*

*Patients are treated with topical corticosteroids, which*

*are tapered over time. Other complications include residual*

*astigmatism, myopia, glaucoma, cataract, and mydriasis.*

*An alternative to PKP, DALK has some advantages. With the*

*patient’s own Descemet’s membrane and the endothelium left*

*intact, the eye is structurally more secure both during and after*

*surgery, leading to fewer postoperative complications and more*

*rapid visual rehabilitation. Technically, however, lamellar keratoplasty*

*is a more challenging procedure. Recent studies found*

*evidence that rejection is less likely to occur with DALK as compared*

*to PKP. Best corrected visual acuity and refractive outcomes*

*have been similar between DALK and PKP.*

*7.6 Rehabilitation and Follow-up*

*This patient has done well in a rigid gas permeable contact lens*

*for the right eye. The left eye may eventually show changes consistent*

*with keratoconus.*

~~~~~CASE 8 Microbial Keratitis~~~~~

*8 Microbial Keratitis*

*Weldon W. Haw*

*Abstract*

*Microbial keratitis can be caused by several different bacteria.*

*Previous contact lens wear, history of trauma, and compromised*

*ocular surface are common contributing risk factors to*

*the development of microbial keratitis. Diagnostic stains, culture,*

*and sensitivities may assist in guiding directed antibiotic*

*therapy. Aggressive treatment with broad-spectrum empiric*

*antibiotics is warranted while waiting for identification of the*

*causative organism. Topical ophthalmic steroids must be used*

*with caution. Occasionally, glue or surgical alternatives may be*

*required to maintain the integrity of the globe in cases of corneal*

*perforation. If penetrating keratoplasty is required, it is*

*essential to remove the infection in its entirety. Long-term graft*

*survival may be compromised in performing a penetrating keratoplasty*

*in an actively infected/inflamed cornea.*

*Keywords: corneal ulcer, keratitis, corneal infection*

*8.1 History*

*A 39-year-old woman, with a history of contact lens wear,*

*presents with complaints of decreased vision, pain, photophobia,*

*redness, and discharge in her left eye for the previous 48*

*hours.*

*Visual acuity was 20/20 OD and CF 3′OS. Examination of the*

*right eye was unremarkable. Left eye external examination*

*showed mild lid and conjunctival edema, a papillary conjunctival*

*reaction, and a purulent discharge. The corneal stroma*

*showed a central, dense, gray-white, necrotic-appearing infiltrate*

*with loss of the overlying corneal epithelium (▶Fig. 8.1).*

*The edges of the infiltrate were indistinct and extended beyond*

*the stromal opacity. The anterior chamber showed 2 + cell and*

*flare and a 1-mm hypopyon. The iris, lens, and retinal examinations*

*were unremarkable.*

*Subsequent examination 4 days later showed vision of 20/20*

*OD and 20/400 OS. Left eye examination showed minimal lid*

*and conjunctival edema and scant purulent discharge. The cornea*

*showed a condensing gray-white opacity with defined borders.*

*The corneal epithelium was filling in the edges of the*

*opacity. Examination 11 days after initial presentation showed*

*vision of 20/20 OD and 20/400 OS. The gray-white stromal*

*opacity had condensed further with continued corneal re-epithelialization*

*(▶Fig. 8.2). Subsequent examination 1 month*

*later showed vision of 20/20 OD and 20/50 OS, and a central*

*corneal stromal opacity.*

*Differential Diagnosis—Key Points*

*1. The differential diagnosis of a corneal ulcer is extensive*

*including microbial, inflammatory, hypersensitive, or*

*immune-mediated processes. The history and clinical*

*examination in patients presenting with corneal ulcers is*

*imperative as differentiation among etiologies can be*

*challenging.*

*2. In a patient with a history of contact lens wear and the*

*above symptoms and clinical findings, the presumptive*

*diagnosis is microbial bacterial keratitis. It is important to*

*identify risk factors that predispose to bacterial corneal*

*ulcers. Contact lens wear was found to be a predisposing*

*factor in 56% of patients in the Olmstead County study. In*

*particular, patients should be inquired about history of any*

*overnight wear and methods of contact lens hygiene. Other*

*predisposing risk factors included ocular trauma (25%), lid*

*dysfunction, ocular surface disease, conjunctival*

*dysfunction, and lacrimal dysfunction.*

*3. The history of contact lens wear, lack of epithelium*

*overlying the infiltrate, central site of the ulceration, and the*

*presence of a suppurative reaction are all factors that point*

*to a likely diagnosis of bacterial keratitis in this patient.*

*4. Bacteria that cause microbial keratitis can be divided into*

*categories based on the clinical condition of the cornea.*

*Staphylococcus, Streptococcus, Pseudomonas,*

*Enterobacteriaceae, Moraxella, and Klebsiella have all been*

*isolated from healthy corneal tissue. Staphylococcus aureus,*

*Staphylococcus epidermidis, alpha-hemolytic and betahemolytic*

*Streptococcus, Pseudomonas, and Proteus have*

*more commonly been isolated from compromised corneas.*

*Pseudomonas, Staphylococcus, and fungi have been isolated*

*from pediatric corneas.*

*5. Some bacteria produce a characteristic clinical appearance.*

*Pseudomonas typically has a yellowish-green discharge that*

*sticks to the corneal surface. The gram-positive cocci, such*

*as S. aureus and Streptococcus pneumoniae, often produce*

*round or oval ulcers with distinct borders that are graywhite*

*and dry in appearance. There is frequently a severe*

*anterior chamber reaction that may include a sterile*

*hypopyon. Gram-negative rods usually produce a wet,*

*soupy infiltrate that may spread to involve the entire cornea*

*and typically are associated with a severe anterior chamber*

*reaction with hypopyon formation.*

*6. When bacterial keratitis is suspected, appropriate laboratory*

*workup is indicated. This usually consists of scraping the*

*ulcer margins and sending the specimen for bacterial (and*

*in some cases fungal) cultures.*

*8.2 Test Interpretation*

*The diagnosis of bacterial keratitis is generally made by taking a*

*thorough history and performing a clinical examination. Accurate*

*laboratory studies can aid in proper diagnosis and appropriate*

*antimicrobial therapy. Culture swabs from the lids and*

*conjunctivae of both eyes should be plated directly onto culture*

*media. In addition, contact lens can be placed directly onto culture*

*media or swabs of contact lens cases or cleaning solutions*

*can be performed. Calcium alginate swabs that contain inert*

*materials are preferable to cotton-tipped applicators that contain*

*fatty acids, which may inhibit bacterial growth.*

*The cornea of the affected eye should then be anesthetized*

*and a flame-sterilized spatula (Kimura) or calcium alginate*

*swab used to take a corneal specimen. Multiple scrapings from*

*affected areas should be performed to increase the yield of live*

*organisms. The specimens should be plated on blood agar, chocolate*

*agar, Sabouraud’s agar, thioglycolate broth, brain-heart*

*infusion broth, and glass slides. The bacteria typically begin to*

*grow within 24 to 48 hours and sensitivities to antimicrobial*

*agents can be examined usually 24 hours later. In this case, the*

*cultures grew out a Streptococcus species.*

*8.3 Diagnosis*

*Streptococcal corneal ulcer, left eye.*

*8.4 Medical Management*

*The prognosis for a central Streptococcal corneal ulcer is fair.*

*The mainstay of treatment is antimicrobial therapy consisting*

*of broad-spectrum topical fortified antibiotics or topical antibiotic*

*therapy tailored to the Gram stain. Caution should be exercised*

*when the Gram stain is used alone, as there has been only*

*a 60% correlation between the Gram stain and the organisms*

*that are later cultured. The severity of the keratitis should be*

*used as a guide to the intensity and frequency of treatment.*

*Topical fortified antibiotics or fluoroquinolones may be used on*

*peripheral ulcers. Central ulcers usually require a combination*

*of topical fortified antibiotics and fluoroquinolones. Severe*

*cases, including imminent perforation, may require subconjunctival*

*injection of antibiotics as well as hospitalization for*

*intravenous antibiotics.*

*Antibiotic choices include aminoglycosides, cephalosporins,*

*fluoroquinolones, penicillins, synthetic penicillins, erythromycin,*

*bacitracin, polymyxin, chloramphenicol, vancomycin, tetracycline,*

*sulfonamides, and rifampin. Typical therapy includes*

*gram-positive and gram-negative coverage with two topical*

*fortified agents every hour for 36 hours. Often, a fluoroquinolone*

*may be substituted for one of the fortified antibiotics. If*

*there are signs of clinical improvement, then the frequency of*

*the antibiotic may be reduced. After 48 to 72 hours, coverage*

*may be switched to every 3 to 4 hours and to regular-strength*

*drops after 96 hours. Once sterility has been achieved, adjunctive*

*agents such as corticosteroids, cycloplegics, and enzyme*

*inhibitors (doxycycline) may also be used. Corticosteroid drops*

*may be cautiously started, with their role being to reduce damage*

*produced by invading polymorphonuclear leukocytes and*

*their destructive enzymes and to decrease visual loss from*

*postinflammatory scarring. The National Eye Institute sponsored*

*a randomized, double-masked, placebo-controlled trial*

*looking to see if there was benefit to starting steroids in*

*patients with culture-positive bacterial ulcers, namely called*

*the SCUT trial (Steroids for Corneal Ulcers Trial). Participants*

*with culture-positive bacterial ulcers were assigned to a 3-week*

*tapering regimen of prednisolone sodium phosphate 1% beginning*

*48 hours after starting topical moxifloxacin 0.5%. The primary*

*end point was best spectacle-corrected visual acuity at 3*

*months. Secondary end points included best spectacle-corrected*

*visual acuity at 3 weeks, infiltrate/scar size, time to reepithelialization,*

*and adverse events including corneal perforation.*

*Results showed that patients who started steroid on days*

*2 or 3 versus day 4 showed one line better vision at 3 months.*

*Also, importantly, there were no serious safety concerns except*

*in patients found to have Nocardia-positive ulcers in which*

*there was a larger scar and poorer visual outcome. Subconjunctival*

*injections of antibiotics can be used in patients with suboptimal*

*compliance. Unfortunately, they can be associated with*

*pain and scarring of the conjunctiva.*

*Fig. 8.1 Corneal stroma with a central, dense, gray-white, necroticappearing*

*infiltrate and loss of the overlying corneal epithelium.*

*Fig. 8.2 Condensation of gray-white stromal opacity and partial*

*corneal re-epithelialization.*

*Other therapeutic modalities include collagen shields and*

*bandage contact lenses. Collagen shields can be impregnated*

*with a variety of antibiotic solutions. They can then deliver antibiotics*

*in a sustained release fashion usually over a 24-hour time*

*period. They can be useful in cases of noncompliance. Unfortunately,*

*they can be dislodged and lost. Bandage contact lenses or*

*self-retained amniotic grafts may be used in nonhealing epithelial*

*defects once the cornea is sterile. Corneal glue with a bandage*

*contact lens may be used to prevent total chamber collapse*

*as the patient awaits definitive surgical intervention.*

*8.5 Surgical Management*

*Surgical management should be reserved for cases of medical*

*failure. Structural integrity of the anterior segment should be*

*maintained with surgical glue if possible. If a large perforation*

*has occurred, then a penetrating corneal transplant procedure*

*encompassing all the infected tissue can be performed to retain*

*the structural integrity of the globe. Every attempt to sterilize*

*the cornea should be made prior to surgical repair in order to*

*prevent reinfection of the graft. Corneal grafts performed in*

*actively inflamed or infected corneas are at high risk for failure.*

*A conjunctival flap is not indicated in cases of perforation.*

*Corneal scarring is a common sequela of bacterial keratitis.*

*When in the central visual axis, it can lead to significant ocular*

*morbidity. Contact lenses (in particular, rigid gas permeable*

*and scleral lenses) can be used to regularize the corneal surface.*

*Phototherapeutic keratectomy can be used to remove anterior*

*stromal scarring. Penetrating keratoplasty or deep anterior*

*lamellar keratoplasty can be used to remove deep central or*

*anterior stromal scarring. Healthy corneal tissue should be preserved*

*as much as possible.*

*8.6 Rehabilitation and Follow-up*

*Once bacterial keratitis has been successfully treated, the patient*

*should have any risk factors for the development of recurrence*

*evaluated and corrected if possible. Discontinuation of*

*contact lenses or modification of wearing habits may be suggested.*

*Lid, lacrimal, or conjunctival dysfunction should be*

*treated. In cases of severe scarring, surgical modalities may be*

*considered.*

~~~~~CASE 9 Keratoconjunctivitis Sicca—Dry Eye~~~~~

*9 Keratoconjunctivitis Sicca—Dry Eye*

*Aaron Wang, Scheffer C. G. Tseng, and Weldon W. Haw*

*Abstract*

*In this chapter, we present a case of a patient with dry eyes. The*

*chapter describes typical symptoms, exam findings, differential*

*diagnosis, test and interpretation, and management for dry eyes.*

*Keywords: dry eyes, meibomian gland, tear film, lipids, mucin,*

*staining, Schirmer’s test, osmolarity, blink, punctal plugs, Sjögren’s*

*syndrome*

*9.1 History*

*A 56-year-old man with a history of diabetes mellitus and a*

*chief complaint of ocular irritation in both eyes was referred by*

*an ophthalmologist for a second opinion under the impression*

*of an unstable ocular surface due to dry eye in his right eye. He*

*complained of burning, foreign body sensation, sandy-gritty*

*feeling, and redness, more in his right eye. These symptoms*

*were worse in the morning and also in the later part of the day,*

*and made him unable to read or drive comfortably. He still has*

*preserved emotional lacrimation. He stated that he slept on his*

*stomach, preferring his right side.*

*While taking the history, it was noted that his blink rate was*

*reduced in both eyes. His best-corrected visual acuity was 20/40*

*in the right eye and 20/20 in the left eye. External examination*

*did not reveal features suggestive of rosacea. There were no palpable*

*preauricular nodes. The lid position and relationship to the*

*globe were normal, while the lid tension was loose and floppy. Lid*

*tension was graded as 2 + in the right eye and 1 + in the left eye.*

*On slit-lamp examination, the meibomian secretion was normal*

*as its fluid appeared clear and was easily expressible. The height of*

*the tear meniscus was low in the upper and lower lids of both*

*eyes. Both tarsal and bulbar conjunctivae were diffusely injected*

*with the tarsal conjunctiva, showing a mixed papillary and follicular*

*response. Ocular sensitivity was markedly reduced as measured*

*by a Cochet–Bonnet esthesiometer. The tear breakup time in each*

*eye was less than 2 seconds. Fluorescein showed superficial punctate*

*staining and rose bengal staining was positive over the exposure*

*zone, more prominent in the right eye. Intraocular pressure*

*was 15 and 16mm Hg, in the right and left eye, respectively. Fluorescein*

*clearance test (FCT) revealed marked delayed dye clearance*

*and decreased tear secretion (▶Fig. 9.1) in both eyes. The lens and*

*the fundus were unremarkable in both eyes.*

*Differential Diagnosis—Key Points*

*1. The ocular surface comprises the corneal and conjunctival*

*epithelia extending from the upper to the lower eyelid*

*mucocutaneous border. A healthy ocular surface requires a*

*stable preocular tear film made by external adnexa. Through*

*neuroanatomic feedback control, the ocular surface epithelia*

*and the preocular tear film work as a unit to provide clear*

*vision, maintain comfort, and serve as the first line of defense*

*against microbial infections when the eye is open.1*

*2. The preocular tear film is composed of lipids, electrolyteand*

*protein-containing aqueous fluid, and mucins. Under*

*normal circumstances, aqueous tears are primarily secreted*

*by the main lacrimal gland, spread over the entire ocular*

*surface by lid blinking, and then cleared from the eye into*

*the nose through the nasolacrimal drainage system, which*

*includes the superior and inferior puncta and canaliculi, the*

*lacrimal sac, and the nasolacrimal duct. It has long been*

*recognized that decreased tear secretion by lacrimal glands*

*results in the disease state of aqueous tear deficiency (ATD),*

*i.e., keratoconjunctivitis sicca. However, a stable tear film*

*depends not only on necessary tear components but also on*

*other hydrodynamic elements, including the spreading and*

*clearance of tears. Integration of the compositional and*

*hydrodynamic factors of the ocular surface defense occurs*

*via a neuronal reflex involving the sensory input of the first*

*branch of the trigeminal nerve (V1) and the efferent output*

*of the parasympathetic branch and the motor branch of the*

*facial nerve (VII) (▶Fig. 9.2).*

*3. ATD in the above case was aggravated by the patient’s*

*diabetes mellitus, which affects the corneal sensory nerve*

*and thus interrupts the corneal nerve–mediated reflexes*

*(▶Fig. 9.2). This is essentially a neurotrophic state (as*

*evidenced by the esthesiometer) which has led to*

*insufficient aqueous tear secretion, low tear meniscus (less*

*than 0.2 mm), decreased blink rate, and punctate keratitis*

*(as seen with the rose bengal and fluorescein staining) in*

*the exposure zone. Prolonged exposure tends to be worse*

*in the later part of the day and during activities such as*

*reading or driving. Thus, this patient’s dry eye symptoms*

*such as burning and foreign body sensation were more*

*pronounced during these occasions.*

*4. The patient’s reduced eyelid blinking also resulted in*

*delayed tear clearance (DTC) (▶Fig. 9.1). It has been*

*recognized that DTC is further aggravated by floppy eyelids2*

*(▶Fig. 9.3). Floppy eyelids are known to be associated with*

*papillary conjunctivitis and ocular inflammation, which are*

*worse on the side the patient sleeps on; and ocular*

*symptoms tend to be worsened upon awakening.3*

*Symptoms of ocular inflammation such as redness tend to*

*be worse in the morning due to the underlying DTC,*

*especially in the eye corresponding with the side of sleep.2*

*5. The stimulation of lacrimation depends on the cumulative V1*

*stimulation from cornea, conjunctiva, lid margin, and nasal*

*mucosa4 and from cortical influences, e.g., emotional*

*lacrimation. The presence or absence of reflex tearing under*

*maximal stimulation of V1 has been regarded as a reliable*

*index of the capability of the lacrimal gland to produce*

*aqueous fluid.5 Loss of reflex tearing is the hallmark of*

*Sjögren’s syndrome (SS)-type ATD and can be used to*

*distinguish this from non-SS-type ATD (keratoconjunctivitis*

*sicca). SS-type ATD also manifests more intense rose bengal*

*staining and squamous metaplasia, indicative of severe ocular*

*surface damage, and it correlates with the extent of*

*lymphocyte infiltration in the lacrimal glands.6 Given that there*

*was preserved emotional tearing, this patient’s lacrimal glands*

*were functioning and his ATD was likely not of the SS-type.*

*9.2 Test Interpretation*

*The entire spectrum of tear dynamics includes secretion with*

*or without stimulation (i.e., basal or reflex tearing), and clearance.*

*FCT measures basal tearing, reflex tearing, and clearance,*

*and can help diagnosis unstable tear film and DTC (see the following*

*list and ▶Table 9.1).2*

*9.2.1 How to Perform Fluorescein*

*Clearance Test*

*● Instill one drop of 0.5% proparacaine in the fornix and then*

*blot eye dry.*

*● Instill 5 μL of 0.25% Fluress with a pipette.*

*● Allow normal blink.*

*Fig. 9.2 Neuroanatomic integration.*

*Fig. 9.3 External examination showing floppy eyelids.*

*Fig. 9.1 Fluorescein clearance test.*

*Table 9.1 Interpretation of fluorescein clearance test*

*Basal secretion Reflex*

*secretion*

*Tear clearance*

*Wetting length*

*of first two*

*strips*

*Wetting length*

*of last strip vs.*

*first two strips*

*Dye visible*

*after*

*15 minutes?*

*Normal ≥ 3mm Last strip > first*

*two strips*

*No*

*DTC ≥ 3mm Last strip > first*

*two strips*

*Yes*

*ATD with*

*reflex*

*< 3mm Last strip > first*

*two strips*

*May be delayed*

*ATD without*

*reflex*

*< 3mm Last strip > first*

*two strips*

*Usually delayed*

*Abbreviations: ATD, aqueous tear deficiency; DTC, delayed tear*

*clearance.*

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*● Perform the Schirmer test for 1 minute at 10 minutes and*

*again at 20 minutes. Insert the strip into the inferior fornix of*

*each eye at a position two-thirds lateral to the medial*

*caruncle. Keep the eyes closed for 1 minute, measured with a*

*timer.*

*● Perform nasal stimulation with a cotton tip applicator after*

*30 minutes to elicit maximal sensation and repeat the*

*Schirmer test for 1 minute.*

*For patients with normal tear secretion and clearance, each*

*strip should have a wetting length equal to or greater than*

*3mm. The intensity of fluorescein dye fades with time under*

*the blue light and should no longer be seen after 15 minutes*

*(i.e., from the second pair of strips on). After 15 minutes (i.e.,*

*the second pair of strips), the wetting length should increase*

*because of waning of the topical anesthetics. If this does not*

*happen, the wetting length can be further increased at the final*

*interval of 30 minutes (i.e., the third pair of strips) by nasal stimulation.*

*A wetting length of near zero millimeters in the first*

*and second pairs of strips from this patient (▶Fig. 9.1) suggested*

*ATD. A wetting length of the last strip greater than the*

*first two sets (▶Fig. 9.1) also supported this diagnosis. The fact*

*that the dye was clearly visible in the last two sets (▶Fig. 9.1)*

*supported the presence of DTC. The underlying cause for ATD*

*was neurotrophic keratopathy secondary to diabetes mellitus*

*and that for DTC was decreased blink rate and floppy eyelids.*

*Variations of Schirmer’s testing can also be performed. Typically,*

*Schirmer’s strips are placed for 5 minutes, with eyes*

*closed, with or without anesthetic drops, and with or without*

*stimulation with a cotton tip applicator. A wetting length of*

*greater than 10mm is generally accepted as normal, keeping in*

*mind that anesthesia would decrease reflex tearing, while stimulation*

*would increase it.*

*Fluorescein, rose bengal, and lissamine green are useful*

*stains to analyze the pattern of dryness of the ocular surface.*

*Fluorescein is also used to determine the tear breakup time.*

*Fluorescein is instilled and the patient is asked not to blink. The*

*patient has an unstable tear film if a dry area appears before 10*

*seconds.*

*There are emerging technologies for the diagnosis of dry*

*eyes.7 Reflective meniscometry and optical coherence tomography*

*can measure tear meniscus shape, volume, height, and*

*thickness. Videokeratographers can analyze tear firm stability,*

*and interferometers (e.g., LipiView, TearScience Inc., Morrisville,*

*NC) can analyze tear lipid layer thickness and uniformity.*

*Tear osmolarity have been found to be increased in dry eyes*

*and could be measured (e.g., TearLab, TearLab Corporation, San*

*Diego, CA). Tear proteins can also be analyzed as well for proinflammatory*

*markers (e.g., InflammaDry Detector, Rapid Pathogen*

*Screening Inc, Sarasota, FL). High levels of inflammatory*

*biomarkers may lead to earlier diagnosis of dry eyes. Measuring*

*the temperature of the ocular surface (e.g., Ocular Surface Thermographer,*

*Tomey Corporation, Japan) after opening the eyes*

*for 10 seconds can also help diagnose dry eyes.*

*9.3 Diagnosis*

*Keratoconjunctivitis sicca due to ATD secondary to diabetes*

*mellitus–induced neurotrophic keratitis, associated with DTC*

*from reduced blink rate and floppy eyelids.*

*9.4 Medical Management*

*Treatments are tailored based on the underlying cause*

*(▶Table 9.2). For ATD, the patient will start with frequent*

*application of artificial tears. Preservative-free tear substitutes*

*are preferred to avoid potential medicamentosa from the preservatives.*

*Ophthalmic gels and ointments can have a greater*

*duration of effect than drops. Eye inserts (such as Lacrisert,*

*Bausch & Lomb) are placed in the lower fornix, and slowly dissolve*

*and lubricate the eye over an entire day. Because tear fluids*

*contain complex factors, supplementation of conventional*

*tear substitutes may not be adequate. In severe ATD, especially*

*those with SS type, eye drops prepared from a patient’s autologous*

*serum may be necessary.8,9 Tear-stimulating drugs include*

*pilocarpine and cevimeline, which are cholinergics. Topical*

*cyclosporine, a T-cell suppressant, is thought to reduce lacrimal*

*gland lymphocyte infiltration and thereby also increase tear*

*production, especially for SS-type ATD.*

*To treat dry eyes associated with DTC, it is essential to reduce*

*ocular inflammation. Corticosteroids eye drops or ointments*

*(e.g., prednisolone, fluorometholone, loteprednol etabonate)*

*can be used, although they are not ideal for long-term use due*

*to possible side effects (cataracts, glaucoma, infections, etc.).*

*Antibiotics such as tetracyclines (oral) and macrolides (oral or*

*topical) can help control inflammation (as well as can topical*

*cyclosporine). These antibiotics have been reported to have*

*anticollagenase and antimatrix metalloproteinase properties.10*

*Table 9.2 Therapeutic Management for treating dry eye*

*Goal Modality Treatment*

*Replace aqueous fluid Topical treatment Artificial tears (preferably preservative-free),*

*autologous serum*

*Conserve aqueous fluid Punctal occlusion Punctal plugs, thermal cautery*

*Reduce evaporation Cover Eye shields or goggles, contact lens*

*Reinforce lipid layer Meibomian lipid replacement, warm compresses, lid*

*hygiene*

*Reduce exposure Reduce palpebral aperture Tarsorrhaphy/Botox-induced ptosis*

*Increase blink Encouragement*

*Increase lacrimal gland secretion Parasympathetic stimulation Pilocarpine, cevimeline*

*Suppress lacrimal gland inflammation Cyclosporine*

*9.5 Surgical Management*

*For moderate and severe ATD, punctal occlusion with thermal*

*cauterization or punctal plugs can be performed. The consideration*

*of the former over the latter for punctal occlusion is based*

*on the absence of reflex tearing. The use of permanent occlusion*

*is generally reserved for patients with proven SS-type ATD.*

*To maximize punctal fibrosis, the use of topical steroid preparations*

*should be avoided immediately after treatment. With*

*punctal occlusion, artificial tear substitutes become more effective.*

*Intrinsic inflammatory irritation has to be eliminated first*

*because punctal occlusion invariably induces DTC. Other surgical*

*therapies are directed at reducing exposure by creating a*

*conjunctival flap or by decreasing the palpebral fissure (ptosis*

*with botulinum toxin injections or tarsorrhaphy). Repairing*

*abnormal lids such as ectropion is also necessary to prevent*

*exposure.*

*Special contact lenses (e.g., scleral or bandage contact lenses)*

*as well as self-retained amniotic membrane tissue can also be*

*used to protect the ocular surface and trap moisture. If meibomian*

*gland disease is contributing to an unstable tear film,*

*warm compresses done at home or thermal pulsations with*

*Lipiflow (TearScience Inc., Morrisville, NC) could unblock oils to*

*help with tear-film stability. Intense-pulse light therapy and lid*

*massage have also been performed for people with severe dry*

*eyes.*

~~~~~CASE 10 Postsurgical Corneal Edema~~~~~

*10 Postsurgical Corneal Edema*

*Weldon W. Haw*

*Abstract*

*Corneal edema can occur following cataract surgery. In most*

*cases, the edema is temporary and resolves with time. In some*

*instances, corneal edema persists and requires management.*

*Risk factors for persistent corneal edema include preexisting*

*low endothelial cell density, Fuchs’ endothelial dystrophy, and*

*complicated surgery. Postoperative corneal edema may be*

*managed medically with a combination of topical steroids,*

*hypertonic ophthalmic solutions, and topical ophthalmic aqueous*

*suppressants. Surgical alternatives may be used for nonresolving*

*corneal edema refractory to medical management. In*

*the past, penetrating keratoplasty was traditionally performed.*

*Advances in techniques have allowed for a number of evolving*

*endothelial keratoplasty procedures such as DMEK (Descemet’s*

*membrane endothelial keratoplasty) and DSAEK (Descemet’s*

*stripping automated endothelial keratoplasty), which allow for*

*more rapid visual rehabilitation.*

*Keywords: corneal edema, Fuchs’ corneal dystrophy, corneal*

*transplant, endothelial transplant, DSAEK, DMEK*

*10.1 History*

*A 55-year-old man presented with a chief complaint of*

*decreased vision (especially at night) in both eyes for 1 year.*

*Past medical history was remarkable for diabetes mellitus for*

*10 years, which had been well controlled with oral medications.*

*Past ocular history was unremarkable. There was no family history*

*of systemic or ocular diseases.*

*Best corrected visual acuity was 20/50 in the right eye and*

*20/100 in the left eye. Pupillary examination and ocular motility*

*were unremarkable. The intraocular pressures (IOPs) were*

*12 and 13mm Hg in the right and left eyes, respectively. There*

*was no visual field loss by confrontation finger counting. Slitlamp*

*examination was normal other than moderate nuclear*

*sclerosis of the crystalline lens in both eyes, left worse than*

*right. Fundus examination did not show any evidence of diabetic*

*retinopathy. Potential acuity testing revealed a visual*

*potential of 20/25 in each eye. A clinical diagnosis of cataract in*

*both eyes was made and cataract surgery of the left eye was*

*recommended for visual rehabilitation.*

*The patient underwent an uncomplicated phacoemulsification*

*via temporal clear corneal incision with implantation of a*

*posterior chamber acrylic intraocular lens in the left eye. The*

*visual acuity was 20/100 with an IOP of 18mm Hg on the first*

*postoperative day. Slit-lamp examination revealed diffuse corneal*

*edema in the central cornea as well as around the incision*

*site (▶Fig. 10.1), and the patient complained of persistent*

*blurred vision without major discomfort.*

*Differential Diagnosis—Key Points*

*The patient is experiencing poor visual outcome immediately*

*after cataract extraction secondary to corneal edema. The*

*differential diagnosis should include the following:*

*1. Preexisting endothelial disease or dysfunction.*

*a) Low endothelial cell density without the presence of*

*corneal guttata can occur in a small portion of the*

*population.*

*b) Corneal guttata and Fuchs’ corneal endothelial*

*dystrophy are relatively common preexisting corneal*

*endothelial disorders. These conditions usually occur*

*after 50 years of age with a female preponderance.*

*Corneal guttatae are initially evident centrally and*

*spread toward the corneal periphery. The corneal*

*endothelial cells of Fuchs’ corneal endothelial*

*dystrophy are larger and more polymorphic than*

*those of normal individuals. Descemet’s membrane*

*is usually thickened. Diurnal fluctuation of vision*

*is common in patients with advanced corneal*

*edema.*

*c) Past ocular history of an acute rise of IOP such as that*

*seen with acute angle closure glaucoma resulting in*

*reduction of corneal endothelial cell density should also*

*be considered as a cause of low preoperative endothelial*

*cell counts.*

*d) Abnormality of endothelial cell morphology and function*

*has also been reported in diabetic patients with no*

*known corneal dystrophy.*

*2. Surgical trauma.*

*a) Direct injury to the corneal endothelium by instruments*

*or intraocular lens can cause diffuse or discrete patches*

*of edema. This type of edema usually occurs in the*

*central or temporal cornea around the incision site.*

*b) Detachment of Descemet’s membrane by incisional*

*blades or misdirection of the surgical instruments*

*intraoperatively can also cause corneal edema. It is*

*usually most visible at the entry wound.*

*c) Prolonged endothelial exposure to the ultrasound and/or*

*irrigating solutions during phacoemulsification can also*

*cause diffuse corneal edema. This is especially common*

*in patients with dense/mature cataracts requiring*

*additional phacoemulsification time, patients with miotic*

*pupils (i.e., diabetics and pseudoexfoliation syndrome*

*patients), shallow or hyperopic anatomic anterior*

*chambers, or anterior placement of the*

*phacoemulsification incision, which allow close proximity*

*of the ultrasound tip to the endothelium.*

*d) Other surgical complications, such as a vitreous strand to*

*the wound, vitreous prolapse with corneal endothelial*

*contact, malpositioning of the intraocular lens, wound*

*leaks with shallow anterior chamber, or hypotony with*

*choroidal effusion, may result in corneal edema.*

*e) Thermal injury to the corneal endothelium may be*

*caused by phaco probe or cryoprobe (in intracapsular*

*cataract extraction).*

*3. Toxicity.*

*a) Various chemical contaminants may result in diffuse*

*endothelial damage. This is frequently accompanied by*

*other evidence of intraocular toxicity such as a fixed and*

*dilated pupil.*

*b) Antibiotics in high concentrations are common offending*

*agents. Errors in diluting medications may occur.*

*Perioperative topical or subconjunctival antibiotics may*

*enter the anterior chamber through an unsealed wound.*

*c) Intracameral epinephrine is occasionally used for patients*

*with inadequate pupillary dilatation such as is seen with*

*pseudoexfoliation syndrome. Endothelial toxicity and*

*corneal edema may be caused by sodium bisulfite, which*

*is used as an antioxidant for epinephrine. Preservativefree*

*epinephrine is recommended for intracameral use.*

*d) Intracameral injection of lidocaine HCl, one of the*

*anesthetic methods used for phacoemulsification, may*

*also cause endothelial toxicity by its preservative (methyl*

*paraben). Preservative-free preparations of lidocaine are*

*recommended to avoid endothelial toxicity.*

*e) Detergents used for cleaning ophthalmic instruments,*

*such as ethoxylated fatty acid (a cleaning solution in*

*ultrasonic bath), benzalkonium chloride (a preservative*

*solution), or chlorhexidine (an antiseptic used for*

*preparing facial skin prior to surgery), can cause direct*

*damage to the corneal endothelium. Ethylene oxide used*

*for gas sterilization of ophthalmic instruments is also*

*potentially toxic to the corneal endothelium.*

*4. Excessive postoperative inflammation.*

*a) Inflammation may lead to short-term endothelial*

*dysfunction and long-term endothelial cell loss. Active*

*inflammation can compromise endothelial cell functions,*

*especially in older patients who may already have*

*marginal corneal function before inflammation.*

*b) The degree of postoperative inflammation is dependent*

*on many factors: preexisting conditions, surgical*

*technique, fluids and instrumentation, intraocular lens*

*choice, and medications used.*

*c) Patients with a history of uveitis such as juvenile*

*rheumatoid arthritis, Vogt–Koyanagi–Harada disease, or*

*recurrent granulomatous uveitis are at increased risk of*

*excessive postoperative inflammation.*

*5. Postoperative IOP elevation.*

*a) Under normal conditions, the IOP tends to*

*counterbalance the swelling pressure of the cornea. The*

*difference between these two values is termed imbibition*

*pressure. The endothelial pump plays a major role in*

*keeping this dynamic balance of corneal hydration. If the*

*increase of IOP postoperatively exceeds the swelling*

*pressure in the presence of compromised endothelial*

*function, the net flux of water is into the cornea resulting*

*in corneal edema.*

*b) The use of viscoelastic substances (i.e., dispersive*

*viscoelastic agents) for corneal endothelial protection*

*during surgery has been associated with elevation of*

*postoperative IOP.*

*c) Pupillary block glaucoma due to iris–intraocular lens*

*adhesion can also cause postoperative IOP elevation.*

*6. Long-term use of topical ophthalmic medication.*

*a) Preoperative ocular conditions requiring long-term use of*

*topical ophthalmic medications may be associated with*

*compromised endothelial function. Preservatives such as*

*benzalkonium chloride or thimerosal found in the ocular*

*medications have been associated with progressive*

*corneal endothelial cell damage.*

*10.2 Test Interpretation*

*1. Specular microscopy of the fellow eye.*

*a) This patient presented with unexpected corneal edema*

*after apparently atraumatic cataract surgery. In the*

*absence of preoperative specular microscopy in the*

*operated eye, the status of the corneal endothelium in the*

*fellow eye is the best parameter of preoperative*

*endothelial cell function.*

*b) The minimum corneal endothelial cell density required to*

*maintain corneal deturgescence varies from person to*

*person. A cornea with endothelial density less than*

*1,000 cells/mm2 is known to be at increased risk of corneal*

*decompensation. The routine use of preoperative specular*

*microscopic examination to screen patients for*

*unexpected low endothelial cell counts has been*

*controversial.*

*c) Noncontact specular microscopy is generally more*

*comfortable for patients than contact microscopy. The*

*latter, however, gives a wider field of view, though with*

*less resolution.*

*d) One less expensive method of estimating endothelial*

*cell counts is by inserting a reticule in the eyepiece of the*

*Fig. 10.1 Postsurgical corneal edema: a diffuse corneal edema was*

*noted in the central cornea and at the temporal incision site.*

*slit-lamp biomicroscope and comparing the endothelial*

*mosaics with diagrams of cells with known density.*

*Although convenient and inexpensive, this method is*

*difficult to master and time consuming.*

*2. Pachymetry.*

*a) Corneal pachymetry is a useful method of estimating*

*endothelial function.*

*b) The normal cornea measures 0.52 ± 0.02mm centrally and*

*approximately 0.65mm in the periphery.*

*c) Corneal pachymetry can be helpful in identifying patients*

*with a central corneal thickness greater than 0.6 mm.*

*These patients may have marginal corneal endothelial*

*function and are more susceptible to postoperative*

*corneal decompensation than normal individuals.*

*d) Corneal pachymetry can also be used postoperatively to*

*monitor the recovery of endothelial function.*

*10.3 Diagnosis*

*After a detailed examination of the fellow eye, a low endothelial*

*cell density in the absence of guttata was noted by specular*

*microscopy in this patient. The unexpected postoperative corneal*

*edema in the operated eye was attributed to a preexisting*

*low endothelial density of undetermined etiology.*

*10.4 Medical Management*

*The goals of management of early postsurgical corneal edema*

*are to maximize visual function and to minimize patient discomfort.*

*10.4.1 Control of Inflammation*

*Because persistent inflammation can have a detrimental effect*

*on the corneal endothelial barrier functions, it is essential to*

*control inflammation as soon as possible. Most clinicians treat*

*patients with strong topical steroids such as prednisolone acetate*

*1% as often as every 1 hour for acute postoperative corneal*

*edema. Subconjunctival corticosteroid injection may be considered*

*for severe inflammation.*

*10.4.2 Control of IOP*

*If there is a documented elevation of IOP, topical antiglaucoma*

*medications or systemic carbonic anhydrase inhibitors should*

*be used to control it.*

*10.4.3 Topical Hypertonic Solution*

*Topical hyperosmotic agents can facilitate removal of fluid from*

*the edematous cornea. A 5% sodium chloride solution or ointment*

*is commonly used.*

*10.4.4 Therapeutic Hydrophilic Contact*

*Lens*

*In patients with early corneal decompensation and mild edema,*

*a thin hydrophilic lens, fitted flat to allow maximum contact*

*between the lens and the irregular epithelium, may be helpful*

*in restoring vision and maximizing patient comfort.*

*10.5 Surgical Management*

*10.5.1 Penetrating Keratoplasty*

*Prior to the routine use of endothelial keratoplasty (EK), restoration*

*of vision in an eye with irreversible corneal edema*

*required a penetrating keratoplasty (PK) to replace the damaged*

*endothelial cells. A final decision about proceeding with*

*PK should be deferred for 2 to 3 months after postoperative corneal*

*decompensation is noted. In some patients with temporary*

*corneal endothelial dysfunction, clarity can be regained within*

*this time frame.*

*The prognosis for PK in this type of patient is generally very*

*good with a success rate better than 85%. The long-term success*

*of PK, however, often depends on the quality of postoperative*

*care.*

*10.5.2 Postoperative Care of PK Eyes*

*Postsurgical Complications*

*The following postsurgical complications may occur following*

*penetrating keratoplasty: wound leak, flat anterior chamber,*

*iris incarceration in the wound, IOP, primary endothelial failure,*

*endophthalmitis, epithelial defect, or down-growth.*

*Evaluation of Postoperative Astigmatism by*

*Corneal Topography*

*Astigmatism is the most frequent complication of PK. Severe*

*astigmatism can adversely affect postoperative visual outcome.*

*Using a surgical technique that may reduce the occurrence of*

*postoperative astigmatism should be considered. In patients*

*with a moderate to severe degree of astigmatism, relaxing incisions*

*or wedge corneal resection may be considered.*

*Differential Diagnosis of Graft Rejection*

*versus Acute Graft Failure*

*Acute graft failure usually occurs shortly after PK. It may be*

*related to poor preservation of, or surgical trauma to, the donor*

*tissue. In this situation, corneal edema persists despite medical*

*treatment.*

*Corneal allograft rejection can occur at any time after transplantation*

*but rarely occurs within 2 weeks of surgery. One*

*should carefully look for signs of graft rejection such as severe*

*anterior segment inflammation, corneal stromal infiltrates or*

*edema, keratic precipitate, or rejection line. Frequent topical*

*corticosteroid is the mainstay of treatment for corneal allograft*

*rejection. Periocular or systemic steroids may be considered for*

*severe rejection or in noncompliant patients. Systemic immunotherapy*

*with cyclosporin A may be needed in selective*

*patients.*

*10.5.3 Endothelial Keratoplasty*

*Given the high incidence of corneal astigmatism after PK and*

*potential for wound dehiscence, partial-thickness corneal transplants*

*were devised as a way of diminishing these postoperative*

*complications. These methods involve selectively transplanting*

*the damaged endothelial layer of the cornea while leaving the*

*Postsurgical Corneal Edema*

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*majority of the corneal stromal and anterior layers intact. With*

*the advent of EK techniques, surgical and healing time is*

*reduced, visual rehabilitation is more rapid, and graft rejection*

*rates are less common.*

*Descemet’s Stripping Automated Endothelial*

*Keratoplasty (DSAEK)*

*This technique involves manually stripping away host endothelium*

*and Descemet’s membrane, while leaving behind the posterior*

*stroma of the host cornea. A graft composed of donor*

*endothelium, Descemet’s membrane, and a thin layer of posterior*

*stromal is then transplanted onto the posterior surface of*

*the stripped host cornea. Currently, eye banks are able to harvest*

*and provide surgeons with precut corneal tissues for transplantation.*

*This procedure has been extremely successful in*

*patients with isolated corneal endothelial pathology and is now*

*the most commonly performed procedure.*

*Descemet’s Membrane Endothelial*

*Keratoplasty (DMEK)*

*Though DSAEK has become an extremely successful procedure,*

*there have been limitations on final visual acuity secondary to*

*light scatter from the graft–host stromal interface. Thus, methods*

*have been devised to try to reduce DSAEK graft thickness to help*

*achieve better visual outcomes. The most popular current technique*

*involves transplanting only endothelial cells and Descemet’s*

*membrane. In patient outcome studies from individuals undergoing*

*DMEK, the visual acuity data have been excellent and often*

*exceed acuity seen in DSAEK patients in appropriate surgical candidates.*

*As the techniques of this procedure are further perfected,*

*this technique has promise to further increase in*

*popularity for individuals with endothelial pathology.*

*10.6 Rehabilitation and Follow-up*

*The patient was managed with topical corticosteroids and*

*hypertonic saline solution four times a day for 1 week. The*

*corneal edema resolved completely after the treatment and the*

*final best corrected visual acuity was 20/20 (▶Fig. 10.2).*

~~~~~CASE 11 Dellen~~~~~

*11 Dellen*

*Weldon W. Haw*

*Abstract*

*Dellen represents an area of peripheral, localized corneal thinning*

*related to desiccation of the epithelial and subepithelial*

*tissues. They occur adjacent to areas of limbal elevation resulting*

*from filtering blebs, dermoids, chemosis etc. Dellen must be*

*distinguished from more fulminant disease states such as*

*inflammatory or autoimmune peripheral ulcerative keratitis.*

*Dellen can be successfully managed with lubrication with preservative-*

*free tears, ointment, and/or punctal occlusion. If there*

*is persistent dellen, oral doxycycline, vitamin C, with or without*

*a bandage contact lens, or self-retained amniotic membrane*

*graft may be required. Further surgical intervention may be*

*warranted in refractory dellen such as surgical removal of the*

*offending conjunctival elevation or amniotic membrane with*

*tarsorrhaphy.*

*Keywords: dellen, corneal thinning*

*11.1 History*

*A 55-year-old man with a history of glaucoma that required*

*multiple filtration procedures in the right eye was found to*

*have elevated intraocular pressure on maximal medical therapy.*

*A repeat trabeculectomy procedure was performed. In*

*order to avoid the previous surgical site, the trabeculectomy*

*flap was established at the 7 o’clock position, which resulted in*

*a moderately elevated filtering bleb extending from the 5 to 8*

*o’clock positions.*

*Two weeks after surgery, peripheral corneal thinning was*

*noted adjacent to the filtering bleb (▶Fig. 11.1). Fluorescein*

*instillation revealed pooling with a small area of epithelial cell*

*loss.*

*Differential Diagnosis—Key Points*

*1. A delle represents an area of localized corneal thinning due*

*to desiccation of the epithelial and subepithelial tissues that*

*results from poor tear coverage over a specific area*

*(▶Fig. 11.2). This localized interruption in the tear film is*

*most commonly due to some form of limbal elevation (e.g.,*

*filtering bleb, dermoid, conjunctival elevation following*

*muscle or scleral buckling surgery), which therefore tends*

*to produce desiccation and delle formation at the periphery*

*of the cornea, especially in the setting of dry eye. Because*

*of the location, the correct diagnosis is often not*

*considered, and inflammatory causes of peripheral corneal*

*thinning are invoked.*

*2. While delle formation is a relatively benign process,*

*inflammatory causes of peripheral corneal thinning can*

*have disastrous consequences for the eye and might be*

*associated with severe systemic diseases. These should*

*therefore be considered in the differential diagnosis, along*

*with degenerative causes of peripheral corneal thinning.*

*3. Inflammatory causes of peripheral corneal thinning include*

*Mooren’s ulceration, thinning associated with scleritis of*

*various causes, and autoimmune processes such as*

*rheumatoid arthritis, systemic lupus erythematosus,*

*relapsing polychondritis, inflammatory bowel disease, and*

*vasculitis syndromes such as Wegener’s granulomatosis,*

*temporal arteritis, polyarteritis nodosa, and Churg–Strauss*

*angiitis. Systemic evaluation is required to rule out*

*inflammatory disease in those cases that are often*

*accompanied by significant ocular inflammation and corneal*

*infiltration. While noninfiltrated, relatively quiet peripheral*

*corneal melting can occur in association with disorders such*

*as rheumatoid arthritis, systemic lupus erythematosus, or*

*relapsing polychondritis, an epithelial defect is almost*

*always present in active disease, and an adjacent mass that*

*could disturb tear distribution is unlikely to be present.*

*4. Degenerative causes of localized peripheral corneal thinning*

*include furrow degeneration, Terrien’s marginal*

*degeneration, pellucid marginal degeneration, and Fuchs’*

*superficial marginal keratitis. Characteristics of furrow*

*degeneration include an elderly patient with isolated,*

*noninflammatory, nonprogressive, shallow peripheral*

*thinning between the limbus and the arcus senilis. Terrien’s*

*marginal degeneration is characterized by superficial*

*vascularization of thinned peripheral cornea preceded by a*

*distinct lipid line. As opposed to the typically wellcircumscribed*

*area involved in dellen, pellucid marginal*

*degeneration extends over a narrow arcuate band and is not*

*associated with any adjacent elevation that might impede*

*tear distribution. Fuchs’ superficial marginal keratitis is*

*characterized by intermittent, recurrent episodes of ocular*

*irritation accompanied by marginal infiltrates that result in*

*progressive marginal superficial stromal thinning and, in*

*advanced cases, pseudopterygium over the area of thinning.*

*Fig. 11.1 A filtering bleb is evident extending from the 5 o’clock to the*

*8 o’clock positions. Note the pooling of fluorescein in the peripheral*

*corneal delle that has developed adjacent to the filtering bleb. (This*

*image is provided courtesy of John P. Whitcher, MD, San Francisco,*

*CA.)*

*11.2 Test Interpretation*

*Dellen are typically associated with the following clinical characteristics.*

*Underlying dry eye or meibomian gland dysfunction*

*may be present. The area of thinning is usually well circumscribed,*

*“saucerlike,” with sloping edges. There is often an*

*obvious adjacent elevation responsible for the localized interruption*

*in tear distribution. As the patient blinks, the tear film is disrupted*

*over the area of thinning. This can often be demonstrated*

*more clearly by highlighting the tear film with a drop of fluorescein.*

*If too much fluorescein is instilled, it will often pool in the*

*depression giving the appearance that an epithelial defect is*

*present. The epithelium, however, is usually intact along the base*

*of the delle, and this can be demonstrated by gently removing*

*the excess fluorescein from the excavation with a spear-tip cellulose*

*sponge. It should be recognized, however, that due to the*

*epithelial trauma that might accompany chronic desiccation, epithelial*

*breakdown, scarring, and true tissue loss can occur, so that*

*a delle evolves into a true noninfectious corneal ulcer.*

*The definitive diagnostic test for a delle is to rehydrate the*

*area, which will result in thickening of the corneal stroma and*

*resolution of the localized thinning. This is best achieved by*

*applying a generous quantity of a viscous lubricating agent such*

*as a 1% methylcellulose solution or ophthalmic lubricating ointment,*

*and patching the eye shut for 15 to 30 minutes. Under*

*these conditions, a delle should rapidly rehydrate, so that the*

*cornea returns to near-normal thickness. Usually, because of*

*the relative localized stromal edema, the cornea appears mildly*

*opacified in the former area of the delle.*

*When perilimbal conjunctiva is removed, exposed sclera may*

*also become thinner secondary to interference of the wetting*

*effect of the tear film and a scleral delle may also form.*

*11.3 Diagnosis*

*Delle in right eye due to dry eye in the setting of a filtering bleb.*

*11.4 Medical Management*

*Dellen are due to inadequate tear distribution, dry eye, and lid*

*disease such as meibomitis and blepharitis. These risk factors*

*should be treated. Dry eye treatments include supplementation*

*with preservative-free artificial tears, bland ophthalmic lubricating*

*ointment, or punctal occlusion. Although rarely needed,*

*oral doxycycline and/or vitamin C may also help further prevent*

*keratolysis for more extreme thinning. A bandage contact*

*lens or self-retained amniotic membrane graft can be placed*

*within the clinic setting to enhance healing of the epithelial*

*surface. The stability of the tear film is affected by the health of*

*the oil layer produced by the lid’s meibomian glands: lid treatments*

*such as heat compresses and gentle massage directed to*

*the meibomian glands might be helpful in relieving meibomian*

*gland inspissation and reduced tear breakup time. New techniques*

*such as LipiFlow Thermal Pulsation System (Johnson and*

*Johnson Vision) been approved for use in patients with severe*

*meibomian gland dysfunction.*

*11.5 Surgical Management*

*In the most severe cases, surgery may be required. Secured*

*amniotic membrane grafting and/or a limited tarsorrhaphy*

*may be required for progressive or nonhealing dellen unresponsive*

*to medical management. In many cases, the localized elevation*

*precipitating delle formation (such as with filtering blebs*

*or following conjunctival surgery) cannot easily be resolved.*

*Removal of the offending structure is not a reasonable option in*

*such cases. However, a mass such as a pyogenic granuloma or*

*dermoid may be amenable to surgical excision.*

*11.6 Rehabilitation and Follow-up*

*Since delle formation represents a relatively benign process, little*

*is usually required in the way of visual rehabilitation. However,*

*patients should be observed and treated over the long*

*term for signs and symptoms of dry eye that are contributing*

*factors to dellen formation.*

~~~~~CASE 12 Graft Rejection Following Penetrating Keratoplasty~~~~~

*12 Graft Rejection Following Penetrating Keratoplasty*

*Aaron Wang, Matthew R. Jones, and Weldon Haw*

*Abstract*

*In this chapter, we present a case of a patient with graft rejection*

*after penetrating keratoplasty. The case describes typical*

*symptoms, exam findings, differential diagnosis, and medical*

*and surgical management for graft rejection.*

*Keywords: keratoplasty, graft rejection, corneal edema, keratic*

*precipitates*

*12.1 History*

*A 30-year-old man presented with complaints of redness, photophobia,*

*and blurred vision in his right eye for 1 week. Past*

*ocular history included keratoconus, for which he had undergone*

*penetrating keratoplasty (PK) in the right eye 5 months*

*earlier. At his examination 1 month earlier, a visual acuity of*

*20/60 in the right eye with improvement to 20/30 with pinhole*

*had been recorded.*

*Examination revealed a visual acuity of 20/400 in the right*

*eye without improvement with pinhole. Visual acuity was 20/*

*20 in the left eye with a rigid gas permeable contact lens. Intraocular*

*pressure was 17mm Hg in both eyes. Slit-lamp examination*

*was notable for 2 + ciliary flush in the right eye. A broken,*

*exposed interrupted suture with a surrounding infiltrate was*

*noted in the graft at the 11 o’clock meridian. Marked stromal*

*edema extended 2mm into the graft from the site of the broken*

*suture. A line of keratic precipitates demarcated the central*

*edge of the stromal edema. The anterior chamber showed*

*1 + cell and flare. The left eye was quiet with a well-positioned*

*rigid gas permeable contact lens, with thinning and mild protrusion*

*of the central cornea. A Fleischer ring was present.*

*12.2 Test Interpretation*

*The diagnosis of graft rejection after PK is made predominantly*

*by slit-lamp examination. Occasionally, in questionable cases,*

*ultrasonic pachymetry can be helpful in detecting a subclinical*

*increase in graft thickness suggestive of endothelial dysfunction.*

*Similarly, a decrease in corneal thickness can be a useful*

*early sign that a severe rejection episode is responding to treatment*

*even if the edematous graft appears unchanged.*

*12.3 Diagnosis*

*OD: (1) Broken suture with suture abscess. (2) Endothelial corneal*

*graft rejection. OS: Keratoconus.*

*12.4 Medical Management*

*Timely intervention in the management of endothelial rejection*

*is critical to prevent irreversible endothelial damage. As such,*

*patients must be educated to seek evaluation within 24 hours*

*of any new symptom of photophobia, foreign body sensation,*

*red eye, or decreased vision.*

*Broken sutures should be removed at the slit lamp. If no infiltrate*

*exists, prophylactic treatment with a broad-spectrum*

*antibiotic in drop or ointment form should be instituted (e.g.,*

*Polytrim four times a day for 2 to 3 days; bacitracin ointment*

*three time a day for 2 to 3 days). If a suture abscess is present,*

*culturing should be considered and the frequent application of*

*a broad-spectrum fluoroquinolone or other fortified antibiotic*

*Differential Diagnosis—Key Points*

*1. New symptoms in a patient with a PK (foreign body*

*sensation, decreased visual acuity, photophobia, red eye)*

*should be evaluated immediately. The chances of a graftthreatening*

*problem in a patient with such symptoms are*

*high, and successful management depends on timely*

*presentation and intervention.*

*2. Broken sutures in the postoperative period after PK are*

*common. If not removed immediately, they can lead to*

*vascularization, suture abscess, or rejection.*

*3. After PK, patients may present with the signs and*

*symptoms of iritis without signs of graft rejection. Such*

*patients may or may not have a previous history of uveitis.*

*Iritis should be treated as a “forme fruste” of allograft*

*rejection.*

*4. Rejection after PK may take one of three major forms:*

*epithelial rejection, subepithelial rejection, or endothelial*

*rejection.*

*5. Epithelial rejection presents with a slightly elevated graywhite*

*epithelial ridge inside the graft–host junction that*

*stains with fluorescein and may extend for 360 degrees. The*

*ridge represents sensitized lymphocytes that are rejecting*

*the donor epithelium (▶Fig. 12.1). The host stem cells*

*replace the epithelium behind the advancing ridge.*

*Epithelial rejection occurs most commonly within the first*

*year after PK.*

*Subepithelial rejection consists of multiple round subepithelial*

*infiltrates scattered over the graft, similar in appearance to*

*postadenoviral subepithelial infiltrates.*

*Endothelial rejection may present with one or more of the*

*following features: ciliary injection, keratic precipitates,*

*stromal edema, anterior chamber cell, and flare. Signs of*

*advanced rejection include superficial and deep vascularization*

*of the graft or a linear deposit of keratic precipitates*

*(Khodadoust’s line) (▶Fig. 12.2). Endothelial rejection is the*

*most common cause of graft failure.*

*6. Risk factors for endothelial rejection include stromal*

*vascularization, large-diameter grafts, eccentric grafts, and*

*repeat grafts. Any cause of inflammation in the*

*postoperative period including iritis, mild trauma, epithelial*

*or subepithelial rejection, or broken sutures can trigger*

*endothelial rejection.*

*Graft Rejection Following Penetrating Keratoplasty*

*35*

*(e.g., ciprofloxacin every hour around the clock) may be necessary.*

*In the presence of an abscess, topical corticosteroid frequency*

*is typically reduced or discontinued for the first several*

*days. After control of the abscess is achieved, the steroid can be*

*increased judiciously to treat excessive inflammation or rejection*

*if present.*

*While epithelial and subepithelial rejections do not significantly*

*affect the health of the graft directly, they can trigger*

*endothelial rejection if left untreated. Both epithelial and subepithelial*

*rejections typically respond quickly to moderate doses*

*of topical corticosteroids (e.g., prednisolone acetate 1% four*

*times a day for 1 week, with subsequent tapering to baseline*

*corticosteroid levels).*

*Endothelial rejection should be managed aggressively by*

*using frequent topical corticosteroids. The initial frequency of*

*topical steroid depends on the severity of the rejection episode.*

*For mild rejection consisting of one to several keratic precipitates*

*and a mild anterior chamber reaction, application of a topical*

*steroid such as prednisolone acetate 1% four to six times*

*daily and tapered over 6 weeks may be sufficient. For more*

*severe episodes with the presence of many keratic precipitates*

*and corneal edema, hourly application of topical steroids*

*should be instituted. A cycloplegic agent (e.g., scopolamine*

*0.25% three times a day) can be used to help stabilize the*

*blood–aqueous barrier and increase patient comfort in more*

*severe cases. In severe or recalcitrant cases of endothelial rejection,*

*systemic steroids (e.g., prednisone 80mg orally daily) and/*

*or subconjunctival/transseptal steroids (e.g., triamcinolone*

*40 mg/mL) can be used to supplement topical therapy.*

*12.5 Surgical Management*

*If no improvement is noted in the amount of edema after several*

*weeks of therapy, the steroids should be tapered and consideration*

*given to repeat PK. Although repeat PK is often*

*successful in these cases, repeat grafts have a higher risk of failure.*

*This is particularly true if deep stromal vessels are present,*

*which is often the case after severe or prolonged rejection*

*episodes.*

*Descemet’s stripping automated endothelial keratoplasty*

*(DSAEK) is also an excellent option after failed PK, especially for*

*corneas with acceptable topography and refractive outcome*

*before failure. In DSAEK, the abnormal endothelium is stripped*

*and replaced with a new posterior corneal lenticule (corneal*

*stroma, Descemet’s membrane, and endothelium). DSAEK has*

*become the popular choice for isolated endothelial dysfunction.*

*Recent studies have shown that DSAEK after failed PK provides*

*greater wound stability, reduced suture-related complications,*

*and similar graft survival rates and visual outcomes compared*

*with a repeat PK. Also, graft dislocation and postoperative complication*

*rates of DSAEK after failed PK are similar to those of*

*primary DSAEK.*

*Perioperatively, prophylactic systemic steroids or, less commonly,*

*cyclosporin A can be considered in particularly high-risk*

*cases. Human leukocyte antigen matching of donor tissue to the*

*recipient has not been convincingly demonstrated to reduce*

*graft rejection in high-risk patients. There is, however, some*

*evidence that ABO blood type matching may be of some benefit*

*and can be considered in high-risk patients.*

*12.6 Rehabilitation and Follow-up*

*Scheduling of follow-up care during the treatment of endothelial*

*rejection varies depending on the severity of the episode,*

*but typically ranges from 2 to 4 days in more severe cases to 1*

*week in less severe cases. As it becomes apparent that the rejection*

*process is under control, the frequency of the follow-up*

*visits can be decreased as topical steroids are tapered. Attention*

*can then be returned to visual rehabilitation of the eye. Residual*

*astigmatism is addressed via suture lysis, glasses, or rigid contact*

*lens fitting as is appropriate.*

~~~~~CASE 13 Blepharitis~~~~~

*13 Blepharitis*

*Weldon W. Haw*

*Abstract*

*Blepharitis may be associated with staphylococcal eyelid colonization,*

*seborrhea, and meibomian gland dysfunction. Blepharitis*

*may result in a chronic, relapsing condition that results in*

*significant ocular surface discomfort. Dry eye disease and rosacea*

*are conditions often associated with blepharitis. Clinical*

*examination of the eyelids and ocular surface is often diagnostic.*

*Several ancillary diagnostic tests may also be informative,*

*including tear breakup time, corneal/conjunctival staining pattern,*

*measurements of tear osmolarity, and metalloproteinase-*

*9 levels. Therapy includes a number of topical and oral pharmaceutical*

*agents. Topical steroids in a short-pulse fashion may be*

*useful for extremely symptomatic ocular surface disease. Eyelid*

*hygiene and cleaning can be useful in maintenance and control*

*of this chronic condition. Occasionally, more aggressive intervention*

*may be appropriate such as LipiFlow. Suspicion for malignancy*

*in refractory, unilateral blepharitis must be considered.*

*Keywords: blepharitis, meibomian gland dysfunction, staphylococcal*

*blepharitis, seborrheic blepharitis, dry eye, ocular rosacea,*

*ocular surface disease, LipiFlow, lid hygiene*

*13.1 History*

*A 42-year-old woman with no past ocular history presents with*

*complaints of bilateral itching, burning, foreign body sensation,*

*and crusting eyelids in the morning. Although she has experienced*

*these symptoms intermittently over the last 2 years, her*

*symptoms have recently become worse. She denies taking any*

*ocular medications. Her symptoms are unrelated to any systemic*

*illness including allergy, rosacea, or flulike symptoms.*

*Her visual acuity is 20/20 in both eyes without correction*

*and her intraocular pressures are normal. Slit-lamp examination*

*reveals mild erythema of the eyelid margin associated with*

*scaling, crusting formations around the base of the eyelashes*

*(▶Fig. 13.1). Evidence of trichiasis (misdirected eyelashes),*

*madarosis (loss of eyelashes), poliosis (whitening of the eyelashes),*

*and ulceration of the eyelid is also seen (▶Fig. 13.2).*

*There is mild conjunctival hyperemia associated with mild papillary*

*reaction of the inferior tarsal conjunctiva. The tear lake in*

*both eyes is diminished. Rose bengal dye examination of the*

*cornea was remarkable for inferior, superficial punctate epithelial*

*erosions. A Schirmer test was performed and revealed mild*

*aqueous tear deficiency in both eyes.*

*Differential Diagnosis—Key Points*

*1. The differential diagnosis for this set of nonspecific*

*symptoms is extensive and includes a variety of conditions*

*such as allergic conjunctivitis, dry eye syndrome, giant*

*papillary conjunctivitis, pediculosis, atopic and vernal*

*conjunctivitis, medicamentosa, and many other disease*

*entities. Therefore, important historical features include*

*contact lens wear, recent exposure to infected individuals,*

*presence of dermatologic conditions (i.e., eczema, rosacea),*

*seasonal component, unilateral versus bilateral symptoms,*

*and use of ocular medications.*

*2. There are multiple classifications of blepharitis. Marginal*

*blepharitis is most commonly classified according to etiology.*

*This includes blepharitis from staphylococcal colonization*

*(Staphylococcus aureus and Staphylococcus epidermis),*

*seborrhea, meibomian gland dysfunction, or a combination*

*of any of the above. Seborrheic blepharitis is characterized by*

*oily, greasy deposits of the anterior eyelid usually associated*

*with seborrheic dermatitis. There may be mild conjunctival*

*infection and inferior punctate epithelial erosions. Patients*

*with meibomian gland dysfunction (posterior blepharitis)*

*have pouting or metaplastic meibomian gland orifices,*

*prominent vasculature crossing the mucocutaneous junction,*

*foamy or turbid meibomian secretions, eventual atrophy of*

*the meibomian glands, and rosacea. There may be mild to*

*moderate conjunctival infection, papillary reaction of the*

*tarsal conjunctiva, and inferior punctate epithelial erosions*

*with occasional scarring and neovascularization.*

*This patient has the characteristics of staphylococcal*

*blepharitis. Staphylococcal blepharitis has more potential to*

*demonstrate structural damage. There may be evidence of*

*poliosis, madarosis, and lid ulceration. Examination of the*

*cornea may also reveal inferior punctate epithelial erosions,*

*infiltrates, neovascularization, thinning, and phlyctenules.*

*Staphylococcal blepharitis may lead to several forms of keratitis*

*including marginal infiltrates and phlyctenules. Marginal*

*infiltrates are sterile gray-white infiltrates along the peripheral*

*cornea at the 2, 4, 8, and 10 o’clock positions. Phlyctenules are*

*focal, triangular, elevated, inflammatory nodules occurring on*

*the limbus, cornea, or conjunctiva.*

*3. In cases of severe unilateral or asymmetric disease resistant*

*to therapy, it is always important to consider the possibility*

*of an underlying malignancy. Rarely, sebaceous cell*

*carcinoma, basal cell carcinoma, or squamous cell carcinoma*

*may masquerade as blepharitis. The presence of a nodular*

*mass, recurrent chalazia, extensive fibrosis or ulceration, and/*

*or loss of normal lid architecture should lead to careful*

*reevaluation of the diagnosis. However, our patient had a*

*history, exam, and course typical of blepharitis.*

*4. Multiple conditions may be associated with blepharitis.*

*Aqueous tear deficiency is common in patients with seborrheic*

*blepharitis or meibomian gland dysfunction and may be*

*present in as many as 50% of patients with staphylococcal*

*blepharitis. Seborrheic dermatitis may affect 95% of patients*

*who also have a seborrheic blepharitis. Meibomian gland*

*dysfunction is also associated with seborrheic dermatitis (74%)*

*and acne rosacea (51%). These conditions should be identified*

*and addressed during the treatment regimen. Our patient did*

*have symptoms related to dry eyes and on clinical examination*

*revealed evidence of an associated aqueous tear deficiency*

*(inferior punctate keratopathy, diminished tear lake, and a*

*positive Schirmer’s test).*

*Cornea and External Disease*

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*13.2 Test Interpretation*

*Clinical examination is paramount in the diagnosis of blepharitis.*

*However, specific diagnostic tests may be useful in selected*

*patients. Eyelid cultures may be useful in patients with recurrent*

*or persistent anterior inflammatory blepharitis refractory*

*to medical management. In this same population, aqueous tear*

*deficiency may be detected by a positive Schirmer’s test or*

*characteristic fluorescein, lissamine green, or rose bengal corneal*

*staining pattern. An unstable tear breakup time of*

*less than 10 seconds may help confirm meibomian gland dysfunction.*

*There are several clinically relevant point-of-care diagnostic*

*modalities that may also be useful in assessing and quantifying*

*concurrent ocular surface disease. Noninvasive, commercially*

*available systems can quantify tear osmolarity and levels of*

*metalloproteinase-9. These tests may be performed within the*

*clinic setting, give immediate results, are reimbursable, and*

*have high degree of specificity and sensitivity in diagnosing*

*moderate to severe ocular surface disease. In addition, the*

*dynamic tear film and anatomy of the meibomian gland can be*

*directly assessed through imaging techniques (e.g., LipiView).*

*13.3 Diagnosis*

*Anterior blepharitis, staphylococcal type.*

*13.4 Medical Management*

*It should be emphasized to the patient that blepharitis is a*

*chronic and relapsing condition that requires repetitious and*

*fastidious maintenance of eyelid hygiene. The primary goals*

*of treatment include minimizing structural damage and*

*controlling symptoms. In staphylococcal blepharitis, the eyelid*

*bacterial colonization may be reduced by meticulous mechanical*

*debridement of eyelid scales with a cotton-tip applicator or*

*lid scrub with a mild shampoo once or twice a day. Commercial*

*and prescription-based lid cleansing solutions (i.e., hypochlorous*

*acid 0.01%) are available and demonstrate broad-spectrum*

*activity against microorganisms commonly found on the eyelids,*

*including S. epidermis and methicillin-resistant S. aureus.*

*Frequent or rough handling of the eyelids is to be avoided, as*

*this may lead to mechanically induced lid inflammation. The*

*application of topical antibiotic ointment before bedtime with*

*activity against S. aureus may also be appropriate (i.e., erythromycin,*

*sulfacetamide, bacitracin) in severe cases. In refractory*

*cases, eyelid bacterial culture and sensitivity testing may be*

*useful in directing antibiotic therapy.*

*A brief course of topical steroids may help reduce hypersensitivity*

*and sterile inflammatory reactions to staphylococcal antigens*

*(i.e., marginal keratitis and phlyctenular conjunctivitis).*

*Preservative-free artificial tears administered four to eight*

*times per day may be useful in treating an associated aqueous*

*tear deficiency in these patients. Warm compresses may also*

*help relieve discomfort during active phases and soften adherent*

*eyelid debris.*

*Gentle massage of the eyelids may help mechanically express*

*meibomian secretions in patients with meibomitis. In addition,*

*some patients with concurrent meibomian gland dysfunction*

*may benefit from the usage of oral omega-3 fatty acid supplementation.*

*One to three grams per day of a high-quality omega-*

*3 fatty acid (DHA/EPA) may improve the quality of the ocular*

*surface. In some patients with recurrent meibomitis, the addition*

*of topical azithromycin ophthalmic solution or erythromycin*

*ointment, oral minocycline, doxycycline 50 to 100mg orally*

*twice a day, or tetracycline 250mg orally four times a day for 4*

*weeks may be useful in providing symptomatic relief for*

*severely affected patients. Indefinite use of these topical and*

*oral antibiotics may be required to maintain control over blepharitis*

*symptoms and should be tapered to the lowest dosage*

*to maintain control of the patient’s meibomian gland dysfunction.*

*It should be noted that doxycycline, minocycline, and tetracycline*

*are contraindicated in young children, as these may*

*lead to dental staining. These medications should also be*

*avoided in pregnant or nursing women.*

*Fig. 13.1 Blepharitis. Note the crusting debris at the base of the*

*eyelashes.*

*Fig. 13.2 Blepharitis. Note the disruption of normal eyelid margin*

*architecture and the loss of eyelashes (madarosis).*

*Blepharitis*

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*13.5 Surgical Management*

*In cases of atypical, refractory unilateral cases, an eyelid biopsy*

*may be indicated to evaluate for malignancy. Basal cell carcinomas*

*and squamous cell carcinomas are the most common*

*malignancies mistaken for blepharitis. Rarely, sebaceous cell*

*carcinoma may masquerade as chronic, unilateral blepharitis or*

*as a recurrent chalazion. Melanoma has also rarely been*

*reported to masquerade as blepharitis. Patients may also*

*require surgical management of eyelid or eyelash malposition*

*from progressive structural damage and scarring. Point-of-care*

*therapeutic interventions such as LipiFlow thermal pulsation*

*system and intense pulsed light may be useful for refractory*

*meibomian gland dysfunction.*

*13.6 Rehabilitation and Follow-up*

*Patients with mild blepharitis may be followed as needed or at*

*their next routine visit. In more severe cases, initial follow-up*

*may require a return visit in 3 to 6 weeks depending on the*

*severity of the symptoms. If patients are prescribed topical steroids,*

*earlier initial follow-up may be indicated in order to evaluate*

*response and to assess intraocular pressure. Often,*

*patients require a maintenance regimen of lid hygiene, artificial*

*tears, and warm compresses. However, this regimen may be*

*tailored to the severity of the patient’s symptoms. During follow-*

*up, it is important to emphasize to the patient the relapsing*

*and chronic nature of the disease. Reinforcing the*

*maintenance regimen may also prevent exacerbations in the*

*disease process.*

~~~~~CASE 14 A Nearly Mature Cataract in a Patient with Glaucoma~~~~~

*14 A Nearly Mature Cataract in a Patient with Glaucoma*

*I. Howard Fine and Charles C. Lin*

*Abstract*

*This chapter presents a challenging surgical case in a monocular*

*patient with congenital glaucoma and zonular compromise. The*

*authors present advanced surgical pearls to safely remove the*

*cataract and prevent a dropped lens, iris trauma, and corneal*

*decompensation.*

*Keywords: cataract, mature, corectopia, zonular weakness,*

*small pupil*

*14.1 History*

*A 34-year-old Caucasian woman was referred by a glaucoma*

*specialist for evaluation of a nearly mature cataract in her right*

*eye. She had a complex ocular history including a phthisical left*

*eye and congenital glaucoma status post numerous surgical*

*procedures in the right eye including goniotomies, peripheral*

*iridectomies, sphincterotomies, and a trabeculectomy.*

*On examination, visual acuity was finger counting in the*

*right and no light perception in the left. Examination of the*

*right eye suggested that the patient was using her superior*

*nasal peripheral iridotomy as an entrance pupil. There was a*

*relatively thick-walled but functioning filtering bleb in the*

*superior nasal quadrant. Intraocular pressure (IOP) was 20mm*

*Hg without glaucoma medications. A few corneal guttae were*

*observed. The anterior chamber was deep and quiet. The iris*

*was highly atrophic throughout its entire periphery, with very*

*little sphincter tissue. The pupil measured 3mm and did not*

*dilate due to 360 degrees of posterior synechiae. There were*

*multiple sphincterotomies at the pupillary margin and a large*

*radial cut at the 12 o’clock position (▶Fig. 14.1). There was a*

*dense, nearly mature cataract, an absence of zonules visible*

*through the large superior nasal iridectomy, and questionable*

*zonular status in the areas of broad peripheral iridectomies in*

*two other quadrants. There was no view of the right fundus.*

*Differential Diagnosis—Key Points*

*The diagnosis was obvious, but unique challenges existed in the*

*surgical approach to this cataract. The bleb was functional and*

*necessary for IOP control. Corneal endothelial cell loss due to*

*multiple previous surgical procedures indicated a risk for corneal*

*decompensation. The pupil presented perhaps the largest*

*surgical challenge. Any attempt to manipulate or stretch it could*

*result in tearing of the 12 o’clock radial sphincterotomy out to*

*the periphery with loss of entrance pupillary function. In*

*addition, the atrophic nature of the entire iris was such that any*

*thoughts of surgical repair seemed impossible.*

*There are multiple cataract surgical considerations in this*

*case, including (1) zonular integrity with the risk for potential*

*loss of the cataract into the posterior segment; (2) potential*

*for postoperative inflammation and secondary glaucoma; and*

*(3) difficult and potentially inaccurate preoperative*

*measurements and intraocular lens (IOL) power calculations,*

*and corneal decompensation.*

*14.2 Test Interpretation*

*The patient was unable to undergo a reliable refraction. Keratometry*

*measurements showed 7 diopters of against-the-rule*

*astigmatism. Corneal topography revealed 6 diopters of astigmatism*

*that did not correlate with keratometry measurements.*

*Axial length measured 30mm and the horizontal white-towhite*

*measurement was greater than 14 mm. Endothelial cell*

*count was not performed since surgery was necessary regardless*

*of the status of the endothelium. B-scan ultrasonography*

*revealed that the retina was flat.*

*14.3 Diagnosis*

*Mature cataract with zonular compromise, advanced glaucoma*

*status post multiple surgeries including a trabeculectomy with*

*a functioning filtering bleb, atrophic iris with radial sphincterotomies,*

*and blind phthisical fellow eye.*

*14.4 Medical Management*

*Intermittent use of glaucoma medications and massage of the*

*bleb.*

*14.5 Surgical Management*

*The anatomical complexities of this case required unique surgical*

*modifications. For the paracentesis and clear corneal incision,*

*a 16-mm Fine/Thornton ring was utilized for fixation of*

*the globe as it had a sufficiently large diameter to avoid traumatizing*

*the bleb.*

*Considering the tenuous status of the cornea given the history*

*of numerous prior intraocular surgeries, special efforts*

*were taken to protect the endothelium. A side-port incision*

*was made and the anterior chamber was partially filled with*

*Viscoat, a dispersive viscoelastic solution. The cohesive viscoelastic*

*substance Provisc was injected directly on the anterior*

*lens capsule, forcing the dispersive Viscoat to the periphery of*

*the anterior chamber to sequester the area of missing zonules*

*and superiorly in a soft-shell under the endothelium.*

*With a combination of blunt and viscodissection, the posterior*

*synechiae were lysed, and a Morcher iris-expander ring*

*was inserted utilizing two hooks (▶Fig. 14.2). This device is*

*inserted by compression into the pupillary space, which then*

*expands. Flanges on the top and bottom allow it to surround a*

*pupil, much as a tire rim surrounds a tire, and holes in the*

*flanges allow for intraocular manipulation. The expander ring*

*maintained a broad angle of contact with the pupil as it was*

*inserted and allowed stretching of the pupil without concentrating*

*forces on the 12 o’clock radial sphincterotomy, thus*

*avoiding extension of the tear. An alternative device that may*

*be considered is the Malyugin ring, which comes in 6.2- and*

*7.0-mm diameters. While this device is often used in cataract*

*surgery for mechanical pupillary dilation, because of its mechanism*

*of action with four points of pressure, it may exert a*

*Lens*

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*tearing force on the sphincterotomy at 12 o’clock position, rendering*

*it suboptimal in this case.*

*Following placement of the iris-expander ring, a continuous*

*curvilinear capsulorrhexis was performed. A Morcher capsular*

*tension ring was inserted into the capsular bag utilizing a forceps*

*and a Lester hook. This device expands the equatorial zone*

*of the capsule and transmits any focal force on the capsule to*

*the entire zonular apparatus. Without the capsular tension ring,*

*any focal force on the capsule would be transmitted only to the*

*adjacent zonules, with much greater risk of damage. Thus, the*

*ring adds a margin of safety when operating on cataracts in the*

*presence of a compromised zonular apparatus. In addition, it*

*facilitates centration of the bag and IOL postoperatively since*

*the outward force of the ring opposes fibroses of the capsule,*

*unopposed by compromised zonules. At this point, additional*

*ultraviscous viscoelastic such as Healon 5 (Johnson and Johnson*

*Vision) may be injected into the area of zonular weakness to*

*prevent vitreous prolapse.*

*Cortical cleaving hydrodissection and hydrodelineation were*

*performed. Choo choo chop and flip phacoemulsification was*

*done. This is a uniquely safe technique for removing nuclear*

*material because the nucleus is disassembled with mechanical*

*forces in the form of chopping and the resulting pieces are evacuated*

*largely by high vacuum with low-power modulation*

*ultrasound energy. It is an endolenticular technique. Utilizing*

*either a reverse Kelman tip or a 30-degree bevel-down straight*

*tip enables one to approach nuclear material from above, pulling*

*it up to the tip rather than getting underneath to mobilize*

*and evacuate it. Ultrasound energy is concentrated at the upper*

*levels of the endolenticular space, remote from the posterior*

*capsule and the corneal endothelium. In addition, the technique*

*allows for fixation of the lens between the two instruments*

*(the chop instrument and the phaco tip) during lollipopping of*

*the nucleus and scoring and chopping. Therefore, no downward*

*force is exerted on the capsule or zonules during lollipopping*

*the nucleus by the phaco tip.*

*Phacoemulsification took place with an effective phaco time*

*of 6.4 seconds and an average ultrasonic energy of under 13.7%.*

*The cortex, partially held in by the endocapsular tension ring,*

*was carefully irrigated and aspirated. Cortex was stripped tangential*

*to the capsulorrhexis rather than centrally in order to*

*help pull it around the endocapsular tension ring. The capsular*

*bag and anterior chamber were refilled with Provisc after*

*which a bolus of the dispersive Viscoat was placed in the center*

*of the capsulorrhexis. A 6-diopter foldable silicone IOL was*

*injected into the capsular bag without complication.*

*During removal of residual viscoelastic, vitreous presented*

*through the superior nasal iridectomy. Healon 5 was injected*

*into the anterior chamber and the main wound was closed with*

*a suture. A separate paracentesis was made and a split port*

*anterior vitrectomy performed, which provides a more stable*

*anterior chamber. Viscoelastic was injected into the anterior*

*chamber and the iris-expander ring was removed utilizing a*

*Lester hook. The remainder of the residual viscoelastic was*

*removed from the anterior segment with a vitrector to avoid*

*vitreous coming to the incision through the zonular defect*

*in the superior nasal iridectomy. Finally, stromal hydration*

*was performed to seal the incision and the paracentesis. The*

*immediate postoperative appearance of the eye is seen in*

*▶Fig. 14.3.*

*Fig. 14.1 Intraoperative surgeon’s image, sitting temporally. Fig. 14.2 The iris-expander ring in place.*

*Fig. 14.3 Immediate postoperative appearance of the eye with the*

*capsular tension ring visible in the superior nasal peripheral iridectomy.*

*A Nearly Mature Cataract in a Patient with Glaucoma*

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*14.6 Rehabilitation and Follow-up*

*She was started on topical prednisolone acetate, ofloxacin, and*

*diclofenac three times daily. Given her history of advanced glaucoma*

*and monocular status, the patient was closely followed for*

*an IOP spike and examined twice daily over the next 3 days.*

*Timolol and brimonidine were started prophylactically to control*

*her IOP, which remained below 20mm Hg. A prostaglandin analog*

*was avoided to minimize the risk of postoperative inflammation*

*and macular edema. In addition, a carbonic anhydrase*

*inhibitor was avoided to minimize the risk of exacerbating corneal*

*edema, a known side effect of this class of medications.*

*By postoperative week 1, she had experienced an enormous*

*increase in correctable acuity to 20/80. She uses a computer at*

*work, grows flowers, and is very aware of colors and the brightness*

*of objects. Two years postoperatively, her IOP remains in*

*the low teens on no glaucoma medication.*

~~~~~CASE 15 Retained Lens Material after Cataract Extraction~~~~~

*15 Retained Lens Material after Cataract Extraction*

*Ruwan A. Silva and Charles C. Lin*

*Abstract*

*This chapter discusses the complications and management strategy*

*for retained lens fragments following cataract surgery. Acute*

*postoperative complications such as glaucoma and inflammation*

*are addressed, along with an in-depth analysis of the need for*

*and timing of pars plana vitrectomy and lensectomy.*

*Keywords: retained lens fragment, cataract, complication, lens*

*particle glaucoma, vitrectomy*

*15.1 History*

*A 47-year-old man with a history of bungee cord trauma to the*

*left eye had undergone a complicated cataract surgery 9*

*months earlier. He was lost to follow-up and presented to the*

*retina clinic with a 2-month history of decreased vision, redness,*

*and pain in the left eye. His visual acuity was 20/20 OD*

*and 20/400 OS. Intraocular pressures (IOPs) were 12 and*

*38mm Hg in the right and left eyes, respectively. His pupils*

*were reactive to light with no relative afferent pupillary defect.*

*Examination of the right eye was unremarkable aside from a*

*mild cataract. Slit-lamp biomicroscopy of the left eye revealed*

*mild conjunctival injection, 2 + anterior chamber cell and flare,*

*iridodonesis, ectopia lentis, and prolapsed vitreous. Gonioscopy*

*of the left eye demonstrated a wide open angle with lens fragments*

*noted inferiorly. Dilated fundus examination of the left*

*eye revealed a posterior vitreous detachment with his crystalline*

*lens subluxated inferiorly in the anterior vitreous. His macula,*

*retinal vessels, and optic nerve were unremarkable.*

*15.2 Test Interpretation*

*Determining the etiology of an eye with acute pain and elevated*

*IOP involves careful assessment of the anterior chamber. Initial*

*evaluation of all patients with glaucoma should therefore include*

*gonioscopy to evaluate the anterior chamber angle, since the*

*mechanism of outflow disruption often affects management. In*

*the setting of an acute rise in IOP, this can be confounded by corneal*

*edema. Lowering of the IOP may be required before a view*

*of the anterior chamber angle is possible. The above case is*

*archetypal in demonstrating the importance of gonioscopic evaluation*

*in determining the etiology and subsequent management*

*of a patient’s elevated IOP. The finding of fluffy lens particles in*

*the chamber angle is pathognomonic for lens particle glaucoma.*

*In this case, the patient’s history is also invaluable as the timing*

*of the patient’s symptoms were telling and assisted in ruling*

*out several types of glaucoma. Additionally, the distant history*

*of trauma provided insight into the complicated nature of his*

*cataract surgery.*

*15.3 Diagnosis*

*Lens particle glaucoma.*

*Differential Diagnosis—Key Points*

*1. Angle-closure glaucoma should be considered in any patient*

*presenting with eye pain and blurred vision with a markedly*

*elevated IOP on examination. Gonioscopy demonstrating an*

*open angle in this patient, however, definitively rules out*

*this possibility.*

*2. Phacolytic glaucoma typically presents with conjunctival*

*injection, decreased vision, pain, and ocular hypertension in*

*the presence of an open angle, similar to this case. Our*

*patient, however, did not demonstrate the milky white*

*aqueous humor or pseudohypopyon characteristic of*

*phacolytic glaucoma. These putatively represent*

*inflammatory cells and high-molecular-weight lens proteins*

*released through the anterior lens capsule of a mature or*

*hypermature lens.*

*3. Phacoantigenic glaucoma represents an acute, type III*

*hypersensitivity reaction against lens antigens after*

*violation of the lens capsule by penetrating lens trauma. The*

*patient’s clinical history is not consistent with this diagnosis,*

*as the disease usually presents within 2 weeks of ocular*

*trauma or surgery. Additionally, the hallmark*

*granulomatous keratic precipitates of this disease were*

*absent on physical examination.*

*4. Iridocyclitis must be included in the differential when a*

*patient presents with a painful red eye, elevated IOP, and*

*anterior chamber reaction. Typically, the IOP is lower than in*

*the fellow eye due to inflammation of the ciliary body, but it*

*can be markedly elevated when inflammatory debris*

*obstructs the trabecular meshwork. Unilateral uveitis in a*

*young male patient is commonly associated with HLA-B27.*

*Typically, however, the IOP is reduced with HLA-B27-related*

*anterior uveitis.*

*5. Angle-recession glaucoma should be considered in cases*

*involving elevated IOP following a history of blunt trauma.*

*Gonioscopy in angle recession shows widening of the ciliary*

*body (which represents separation of the longitudinal and*

*circular muscles of the ciliary body). Fortunately, only a*

*small percentage of these patients will develop glaucoma*

*with that risk increased if the angle recession involves over*

*half of the patient’s angle.*

*6. Lens particle glaucoma is the most likely diagnosis given the*

*patient’s history and physical examination. This disease*

*usually presents several weeks after disruption of the lens*

*capsule through surgery or ocular trauma, although it may*

*occur months to years later. Lens particles released from the*

*trauma are thought to obstruct aqueous outflow and*

*increase IOP. Associated inflammation may also contribute*

*to the elevation of IOP. The lens remnants found in the*

*anterior chamber on gonioscopy in this case support the*

*diagnosis of lens particle glaucoma.*

*15.4 Medical Management*

*A patient with lens particle glaucoma who presents with an*

*acute pressure elevation must be managed aggressively. Salient*

*issues are control of the IOP and inflammation. Initial treatment*

*should include multiple IOP-lowering agents, frequent corticosteroids,*

*and cycloplegics/mydriatics.*

*The duration and magnitude of IOP elevation that can be tolerated*

*depends on the age of the patient, the health of the optic*

*nerve, and the vascular perfusion of the eye. Younger patients*

*can tolerate a markedly elevated pressure for a longer period*

*before suffering detectable visual field loss. Patients who have*

*known preexistent glaucomatous damage are less likely to tolerate*

*a markedly elevated pressure, and early surgical intervention*

*may be necessary to prevent further optic nerve damage.*

*Microvascular disease also affects the optic nerve’s tolerance to*

*elevated IOP.*

*Multiple aqueous suppressants should be employed. In this*

*case, a topical beta-blocker, an alpha-2-adrenergic agonist, and*

*both a topical and a systemic carbonic anhydrase inhibitor were*

*employed. Miotics should be avoided to prevent posterior synechiae*

*formation, although in a case where the patient’s lens*

*complex has been dislocated this is of little concern. Prostaglandin*

*analogs are typically not used in the inflamed eye.*

*Hyperosmotic agents should be reserved for the markedly elevated*

*pressure and are a short-term measure. Glycerin should*

*be avoided in the diabetic patient, but isosorbide and mannitol*

*are acceptable emergency measures to lower the pressure.*

*Frequent topical corticosteroids are necessary to control the*

*inflammation. Although suppression of the immune response*

*might delay resorption of the lens particles, their use is essential*

*in an eye with severe inflammation. Periocular or systemic*

*corticosteroids might also be considered. Cycloplegics/mydriatics*

*relax the ciliary body and prevent posterior synechiae.*

*15.5 Surgical Management*

*While the incidence of retained lens fragments following cataract*

*surgery is rare, complications including ocular hypertension*

*and retinal detachment are not uncommon. Despite these*

*worrisome sequelae, the majority of patients can be expected*

*to do well, especially when a posterior chamber intraocular lens*

*(IOL) was placed at the time of cataract surgery.*

*The timing of vitreoretinal surgery is controversial. While*

*urgent intervention is recommended for uveitis, vitreous prolapse,*

*retinal detachment, elevated IOP, or hemorrhage, the traditional*

*approach of performing a pars plana vitrectomy and*

*lensectomy within 1 week after cataract extraction for cases*

*not involving the above has been questioned. Specifically, several*

*series have shown no correlation between final visual*

*acuity and vitrectomy timing when the surgery was performed*

*within 1 month of cataract extraction. The risk of retinal*

*detachment and secondary glaucoma, however, has been*

*reported to be higher in patients in whom vitrectomy was*

*delayed for over 1 month. The benefits of delaying immediate*

*vitrectomy include improved corneal recovery, abatement of*

*intraocular inflammation, and softening of lens material before*

*secondary surgery. Delaying vitrectomy may also be a reasonable*

*choice as it is sometimes possible to avoid a vitrectomy*

*altogether. Spontaneous resorption of the lens material may*

*occur when there is minimal retained lens material or it is predominantly*

*composed of cortex. However, complications such*

*as chronic inflammation, disabling visual floaters, and refractory*

*cystoid macular edema may expedite the need for vitreoretinal*

*surgery.*

*When vitreoretinal surgery is pursued, surgical technique*

*can vary widely. Adjuvant use of triamcinolone acetonide,*

*employment of heavy liquids, and routine 360-degree prophylactic*

*retina laser retinopexy have all been reported. While*

*most surgeons employ microincisional vitrectomy surgery (23*

*gauge or smaller), use of a phacofragmatome to remove*

*retained lens material requires at least one 20-gauge sclerotomy.*

*Regardless of technique, several steps remain paramount.*

*First, a thorough vitrectomy removing all vitreous adhesion to*

*the retained lens material is critical (▶Fig. 15.1). Because manipulation*

*of lens material incarcerated in vitreous humor yields*

*unwanted traction on the retina, the importance of this step*

*cannot be overstated. Once the lens material is free from the*

*vitreous and a peripheral vitrectomy has been completed, the*

*retained lens material is engaged with the phacofragmatome*

*and elevated away from the retina. Subsequent fragmentation*

*and aspiration of the lens material is then performed in the*

*midvitreous cavity (▶Fig. 15.2). After larger lens material has*

*been removed, smaller lens particles can then be removed from*

*the eye using a vitrector (▶Fig. 15.3). Finally, inspection of the*

*peripheral retina for retinal breaks is performed.*

*15.6 Rehabilitation and Follow-up*

*In the case presented, the patient was initially placed on topical*

*ocular hypotensives (timolol, dorzolamide, and brimonidine) as*

*well as topical atropine and prednisolone acetate by the referring*

*physician. As his pressure remained elevated and placement*

*of an IOL was necessary, he underwent pars plana*

*vitrectomy, lensectomy, and IOL placement 4 days after*

*Fig. 15.1 A thorough pars plana vitrectomy is performed with care*

*taken to remove any vitreous strands connected to the retained lens*

*material. presentation. Postoperatively, his IOP improved to 12mm Hg*

*without any topical medications and his final uncorrected visual*

*acuity was 20/30 in the left eye.*

~~~~~CASE 16 Fibrin Deposition on Intraocular Lenses~~~~~

*16 Fibrin Deposition on Intraocular Lenses*

*Christopher N. Ta*

*Abstract*

*Fibrin deposition over the intraocular lens implant typically*

*occurs 2 to 14 days following intraocular surgery. Symptoms*

*include decreased vision, red eye, pain, and photophobia.*

*Examination demonstrates cellular anterior chamber (AC) reaction*

*without the presence of a hypopyon. The fibrin finding*

*ranges from strands in the AC to dense fibrinous membrane covering*

*the pupil. It is important to rule out endophthalmitis.*

*Inflammation from surgery causes a breakdown of the blood–*

*aqueous barrier, allowing fibrinogen to leak out from blood vessels*

*into the AC. The main treatment is topical steroid, such as*

*prednisolone. Recombinant tissue plasminogen activator (tPA) is*

*another treatment option. This can be given by intracameral*

*injection. Potential complications of intracameral tPA injection*

*are AC turbidity, cornea edema, elevated intraocular pressure,*

*bleeding, corneal toxicity, band keratopathy, and endophthalmitis.*

*Keywords: fibrin, anterior chamber reaction, intraocular lens,*

*postoperative inflammation, plasminogen activator*

*16.1 History*

*A 59-year-old Caucasian woman presented to the eye clinic*

*after intraocular surgery in the right eye, with a chief complaint*

*of photophobia. Five days earlier, she had undergone combined*

*cataract extraction with posterior chamber intraocular lens*

*(IOL) implantation and trabeculectomy with mitomycin C in the*

*right eye. Her left eye had undergone the same procedures 1*

*month prior to presentation. Her past medical history was significant*

*only for hypertension. Her ocular medications were*

*prednisolone acetate 1% every 2 hours and ofloxacin four times*

*a day in both eyes.*

*Her visual acuity was 20/60 OD and 20/200 OS. Slit-lamp*

*examination of the right eye revealed mild conjunctival injection*

*with a low bleb. The cornea was clear. The anterior chamber*

*had moderate cells and flare with no hypopyon. There was*

*a meshwork of fibrin deposition on the IOL (▶Fig. 16.1). Examination*

*of the left eye revealed a low bleb, clear cornea, and rare*

*cells in the anterior chamber. The IOL was in good position.*

*Dilated fundus exam was unremarkable in both eyes except for*

*moderate and severe glaucomatous cupping of the right and left*

*optic nerves, respectively. The poor vision in the left eye was*

*secondary to advanced glaucoma.*

*Differential Diagnosis—Key Points*

*1. Fibrinous reaction in the anterior chamber typically presents*

*between days 2 and 14 after intraocular surgery. The*

*patient may complain of decreased vision, redness, pain,*

*and photophobia. Slit-lamp examination reveals a cellular*

*anterior chamber reaction without the presence of a*

*hypopyon. The fibrin can present as strands on the IOL, in*

*the pupillary plane, or on the iris itself. In a more severe*

*inflammatory reaction, there can also be a fibrinous*

*membrane covering the pupil.*

*2. Endophthalmitis is always in the differential diagnosis,*

*particularly if a hypopyon is present. However, patients with*

*endophthalmitis usually have more severe symptoms, such*

*as pain and poor vision. Examination reveals injected and*

*chemotic conjunctiva with a severe cellular reaction in the*

*anterior chamber and potentially a hypopyon. There may*

*also be cells in the anterior vitreous.*

*3. The pathophysiology of fibrin deposition on the IOL is*

*immune-mediated. From the surgical trauma, there is*

*increased blood–aqueous permeability. The breakdown in*

*the blood–aqueous barrier allows fibrinogen from blood*

*plasma, a precursor of fibrin, to leak out of blood vessels*

*and into the anterior chamber. In the presence of*

*inflammatory mediators, such as prostaglandins, along with*

*thrombin and activated coagulation factors, fibrinogen is*

*converted to fibrin. Pathologically, fibrin appears as fine*

*proteinaceous fibers in a meshwork. There may be*

*associated macrophages and giant cells.*

*4. The incidence of fibrinous uveitis is less than 4% after*

*normal uncomplicated cataract extraction and IOL*

*implantation, but can be as high as 54%, depending on the*

*patient population and study. Certain conditions that are*

*associated with an increase in vascular permeability*

*predispose to fibrin formation. These include diabetes,*

*hypertension, pseudoexfoliation syndrome, uveitis,*

*prolonged surgery, and previous intraocular surgery. Local*

*factors that may increase the likelihood of developing a*

*fibrinous reaction are surgical manipulation of the iris and*

*incomplete removal of the lens cortex and epithelial cells. In*

*addition, intraoperative use of a long-acting miotic agent,*

*can result in posterior synechiae and pigmented membrane*

*formation over the anterior optic. Prior history of intraocular*

*surgery particularly in the recent past, even if done in the*

*fellow eye, is also a risk factor for developing fibrinous*

*uveitis.*

*5. Fibrin deposition indicates a severe inflammatory reaction.*

*Complications of fibrinous uveitis are posterior synechiae,*

*loss of iris function, membrane formation on the IOL,*

*dislocation of the IOL, and glaucoma. The risk for*

*developing cystoid macular edema is increased with*

*intraocular inflammation, particularly if the posterior*

*capsule is compromised. Posterior capsular opacification is*

*generally due to lens epithelial migration and proliferation,*

*but the presence of fibrin and inflammation may trigger*

*this process.*

*6. The intraocular pressure (IOP) may be high due to*

*secondary glaucoma, such as pupillary block or clogging*

*of the trabecular meshwork from inflammatory cells. The*

*IOP can also be low due to inflammation of the ciliary*

*body.*

*16.2 Test Interpretation*

*It is important, albeit sometimes challenging, to differentiate*

*postoperative fibrinous uveitis from endophthalmitis. The time*

*of onset and symptoms are similar between the two diagnoses,*

*except that more severe symptoms accompany endophthalmitis.*

*Examination findings of ciliary injection, chemosis, severe*

*anterior chamber reaction, hypopyon, and vitritis suggest*

*endophthalmitis. An anterior chamber and vitreous aspirate for*

*culture and intravitreal injection of antibiotics should be considered*

*when endophthalmitis is suspected.*

*16.3 Diagnosis*

*Right eye: Postoperative fibrin deposition on the IOL.*

*16.4 Medical Management*

*The goal of treatment is to reduce inflammation and restore the*

*blood–aqueous barrier. A topical steroid, such as prednisolone,*

*is the mainstay of treatment. The usual dose is prednisolone*

*acetate 1%, one drop four to six times a day, and up to hourly,*

*depending on the level of inflammation. In severe cases, particularly*

*in patients with a history of uveitis, systemic steroids*

*may be required to control the inflammation.*

*In high-risk patients, preoperative topical nonsteroidal antiinflammatory*

*and/or topical steroid agents may prevent or*

*minimize fibrin deposition. In addition, intraoperative subconjunctival*

*steroid injection can minimize postoperative inflammation.*

*Recombinant tissue plasminogen activator (tPA) can have a*

*dramatic effect in breaking down fibrin in severe cases of fibrin*

*deposition. tPA converts plasminogen to plasmin, which lyses*

*fibrin to fibrin-split products. tPA has been shown to be effective*

*with an intracameral injection of doses as low as 3 μg.*

*Complications with the use of intracameral tPA are rare but can*

*include anterior chamber turbidity, corneal edema, elevated*

*IOP, bleeding, corneal toxicity, and band keratopathy. The risk of*

*bleeding increases with a shorter interval from the time of surgery.*

*There is also the risk of introducing infectious microorganisms*

*into the anterior chamber with a tPA injection.*

*16.5 Surgical Management*

*In the acute postoperative period, additional surgery in an*

*already inflamed eye is not advisable, except when there are*

*obvious indications for surgery, such as a dislocated IOL or*

*intractable glaucoma. In cases when the IOL is the cause of*

*inflammation (e.g., an anterior chamber lens that is rubbing*

*against the iris), it is reasonable to remove the IOL. Once the*

*acute postoperative phase has passed and the eye is quiescent,*

*if the fibrin deposition has not resolved, an anterior chamber*

*washout with fibrin membranectomy may be considered in*

*cases that are particularly visually significant.*

*16.6 Rehabilitation and Follow-up*

*Medical treatment is usually successful in eliminating inflammation*

*and fibrin deposition. However, these patients are at*

*risk for developing infectious keratitis from topical steroid use,*

*secondary glaucoma, and cystoid macular edema. Eye examinations*

*should be done at a regular interval to follow visual acuity,*

*IOP, and signs of infection or recurrent inflammation.*

~~~~~CASE 17 Subluxated Crystalline Lens~~~~~

*17 Subluxated Crystalline Lens*

*David F. Chang and Bryan S. Lee*

*Abstract*

*Ophthalmologists should remember the systemic implications*

*of bilateral lens subluxation, including the life-threatening cardiac*

*abnormalities associated with Marfan’s syndrome. Unilateral*

*subluxation is often caused by trauma, although*

*pseudoexfoliation may also be a cause. Bilateral subluxation is*

*most frequently caused by hereditary systematic disorders,*

*such as Marfan’s syndrome. Glasses or contact lenses may be*

*adequate medical management for some patients. When surgery*

*is required, the ophthalmologist must choose between an*

*anterior and posterior approach. Phacoemulsification requires*

*gentle handling of the weakened zonules, and surgeons should*

*be familiar with capsular hardware such as capsule retractors,*

*capsule tension rings, and sutured capsule tension rings and*

*segments. The intraocular lens (IOL) may be placed in the capsular*

*bag or in the sulcus if the support is adequate, but a*

*sutured lens or anterior chamber IOL may be required. Pars*

*plana vitrectomy is more suitable for posteriorly dislocated*

*lenses or severe vitreous prolapse.*

*Keywords: Marfan’s syndrome, zonulopathy, lens subluxation,*

*complex cataract*

*17.1 History*

*A 41-year-old man with Marfan’s syndrome presents with complaints*

*of variable decreased vision and bothersome glare in his*

*left eye. The patient has a family history of Marfan’s syndrome,*

*but no history of trauma. Visual acuity is 20/70 with –5.00 D*

*correction in the left eye, compared to 20/20 with a –0.75 D*

*correction in the right eye. The left crystalline lens is subluxated*

*superiorly with diaphanous zonules exposed across an area of*

*at least six clock hours inferiorly (▶Fig. 17.1). There is no phacodonesis*

*and no vitreous prolapse. Dilated examination of the*

*asymptomatic right eye revealed a very subtle inferior zonular*

*dialysis. The intraocular pressure and fundus examination are*

*normal.*

*Differential Diagnosis—Key Points*

*1. The most common cause of a unilateral dislocated or*

*subluxated lens is trauma, and the history is usually*

*diagnostic. Less common causes of acquired lens*

*subluxation are pseudoexfoliation and eye rubbing*

*associated with atopy.*

*2. Bilateral subluxated crystalline lenses are usually associated*

*with a hereditary systemic disorder. The most common of*

*these is Marfan’s syndrome, which is autosomal dominant.*

*Autosomal-recessive etiologies include homocystinuria*

*(usually down-and-out subluxation), the Weill–Marchesani*

*syndrome, hyperlysinemia, and sulfite oxidase deficiency.*

*Mental retardation is usually associated with the metabolic*

*genetic disorders. A full medical and metabolic workup*

*should be considered with nontraumatic bilateral lens*

*subluxation to evaluate the cause. Homocystinuria can be*

*diagnosed by a sodium nitroprusside test of the urine.*

*Medical and ophthalmologic examinations of family*

*members may contribute useful information.*

*3. Marfan’s syndrome is the most common hereditary disorder*

*associated with lens subluxation, which occurs in 75% of*

*affected individuals. Typical physical findings include tall*

*stature, long, thin extremities, arachnodactyly joint laxity,*

*pectus excavatum, kyphoscoliosis, and decreased*

*subcutaneous fat. Establishing the diagnosis is important*

*both for genetic counseling and because of the cardiac*

*implications of this syndrome. Echocardiography should be*

*performed to rule out mitral or aortic valve abnormalities*

*and progressive dilation of the ascending aorta, since a*

*dissecting aortic aneurism may cause sudden death. In*

*Marfan’s syndrome, the lens is usually dislocated in an*

*upward or up-and-out direction. Aside from ectopia lentis,*

*ocular associations may include axial myopia, glaucoma,*

*and retinal detachment.*

*4. A careful ophthalmologic exam should be performed on any*

*patient with a subluxated lens. Although a dilated exam is*

*necessary to determine the extent of lens decentration or*

*subluxation, phacodonesis may be more evident in the*

*undilated eye because of associated iridodonesis.*

*Gonioscopy may disclose a traumatic angle recession. A*

*careful peripheral retinal exam should be performed*

*because patients with Marfan’s syndrome and*

*homocystinuria are predisposed to retinal detachment.*

*Fig. 17.1 Upward subluxation of crystalline lens in left eye of this*

*patient with Marfan’s syndrome.*

*17.2 Diagnosis*

*Lens subluxation (ectopia lentis) associated with Marfan’s syndrome.*

*17.3 Medical Management*

*A subluxated lens can be managed conservatively unless significant*

*visual symptoms or complications arise. Lens-induced*

*optical errors such as myopic shift, lenticular astigmatism, anisometropia,*

*and prism effect can often be corrected with spectacles*

*or contact lenses. Lens subluxation in a pediatric patient*

*may cause amblyopia, which must be aggressively treated and*

*monitored.*

*If the crystalline lens is partially dislocated out of the pupillary*

*axis, aphakic contact lenses might be effective. Cycloplegics*

*can be used to increase this aphakic aperture. Conversely, miotics*

*can be employed to minimize monocular diplopia or optical*

*aberrations arising from the lens edge. Neodymium: yttriumaluminum-*

*garnet (Nd:YAG) laser zonulysis has been used to*

*further clear the visual axis of an incompletely dislocated lens.*

*A completely dislocated crystalline lens should be well tolerated*

*and may remain within the eye indefinitely.*

*A forward shift of the crystalline lens due to zonular laxity*

*may result in pupillary block and angle-closure glaucoma. A*

*peripheral laser iridotomy may address this problem in the*

*short term. More severe zonular laxity may lead to forward dislocation*

*of the lens into the anterior chamber with resulting*

*endothelial cell loss and corneal decompensation. The prolapsed*

*lens can be repositioned by reclining the dilated patient*

*so that the lens falls back behind the pupil—either spontaneously*

*or with manual pressure applied against the cornea. Pharmacologic*

*miosis is used to trap the mobile lens posteriorly.*

*Recurrence of these complications would be an indication for*

*surgical lensectomy.*

*17.4 Surgical Management*

*There are two different approaches to surgical removal of a subluxated*

*or dislocated crystalline lens—phacoemulsification or*

*pars plana lensectomy with vitrectomy. Phacoemulsification is*

*done with the expectation or hope of preserving the lens capsule*

*for intraocular lens (IOL) support. Depending on the extent*

*of zonulopathy with an intact bag, intracapsular fixation of the*

*IOL can be done with or without a sutured intracapsular device.*

*Alternatively, sulcus implantation of a three-piece foldable IOL*

*might be an option. In the absence of sufficient capsular support,*

*a three-piece posterior chamber IOL can be implanted*

*with iris or scleral suture fixation, or with intrascleral tunnel*

*haptic fixation. Other options would be an anterior chamber*

*IOL or iris-claw IOL. If the patient is left aphakic, and an aphakic*

*contact lens is not tolerated, a secondary IOL implantation can*

*be performed at a later stage.*

*17.4.1 Phacoemulsification*

*Depending on the severity of zonulopathy and the individual*

*surgeon’s experience, phacoemulsification may be elected with*

*the goal of preserving the capsular bag or enough residual*

*capsule to support a posterior chamber IOL. However, phacoemulsification*

*of a subluxated lens is among the most challenging*

*of cases for an anterior segment surgeon. These eyes are*

*highly predisposed to zonular dialysis, posterior capsule rupture,*

*vitreous loss, and a dropped nucleus.*

*During phacoemulsification, care must be taken to avoid*

*worsening the zonular dialysis. Self-retaining capsule retractors*

*(▶Fig. 17.2) should be inserted through limbal stab incisions*

*after completion of a capsulorhexis. These act as artificial zonules*

*to support and recenter a subluxated capsular bag and to*

*restrain the equatorial capsule from being aspirated by the*

*phaco or irrigation-aspiration tips. Capsule retractors also facilitate*

*safe rotation of the nucleus by improving torsional counterfixation*

*of the entire capsular bag. Although flexible iris*

*retractors can be used for this purpose, capsule retractors are*

*longer, sturdier, and less likely to slip off of the capsulotomy*

*edge during phaco.*

*The technique of horizontal phaco chop, which utilizes*

*inwardly directed manual forces to reduce stress on the capsular*

*bag, is advantageous in these eyes. Regardless of the phaco*

*technique, one should consider bringing larger sections of*

*nucleus out of the capsular bag where they can be subchopped*

*or emulsified within the supracapsular space. Repeatedly inflating*

*the capsular bag with a dispersive ophthalmic viscosurgical*

*device will restrain the flaccid posterior capsule and equatorial*

*capsule from being inadvertently aspirated.*

*By employing capsule retractors, capsular tension ring (CTR)*

*implantation can usually be delayed until after completing cortical*

*cleanup to avoid trapping the cortex within the capsular*

*fornices. The capsular retractors should be left in place to counter*

*the lateral decentering forces of the CTR as it is injected. The*

*retractors can then be removed prior to IOL implantation.*

*A CTR can be implanted at any point after the capsulorhexis*

*is completed. The primary function of a CTR, however, is to*

*resist subsequent capsular contraction, which can be concentric*

*or asymmetric due to uneven zonular integrity. Posterior dislocation*

*of the entire IOL–capsular bag complex may occur years*

*later. For this reason, placing a single piece acrylic IOL without*

*an additional capsular device may be problematic because this*

*type of IOL is not amenable to suturing if it decenters.*

*Fig. 17.2 During surgery in this case, three capsule retractors hook the*

*capsulotomy and support the capsular bag in the meridian of the large*

*inferior zonular dialysis. The surgeon and the microscope are oriented*

*temporally.*

*There are several different surgical approaches to centering*

*and fixating a subluxated capsular bag. The Cionni and Malyugin*

*ring modifications incorporate a small loop with a terminal*

*eyelet onto the CTR for scleral suture fixation of the endocapsular*

*ring (▶Fig. 17.3). With the Cionni ring, the loop and eyelet*

*emanate from one proximal section of the CTR. In contrast, one*

*end of the Malyugin ring terminates in the eyelet, which allows*

*this ring to be more easily injected (▶Fig. 17.3a). With either*

*device, the CTR is endocapsular and the small loop extends*

*around the capsulotomy edge out of the bag so that the eyelet is*

*located in the ciliary sulcus (behind the iris and just in front of*

*the anterior capsule) (▶Fig. 17.3b). The loop is normally positioned*

*so that the sutured eyelet will anchor the ring to the*

*sclera in the area of missing zonules. Prior to insertion of the*

*Cionni or Malyugin CTRs, the needles of a double-armed 9–0*

*polypropylene (Prolene) or CV-8 Gore-Tex sutures are preplaced*

*through the eyelet (▶Fig. 17.3a). Passing the needles*

*through either a Hoffman pocket or a half-thickness scleral*

*groove will then allow scleral fixation of the eyelet in the meridian*

*of the zonular dialysis (▶Fig. 17.3c). After implanting and*

*orienting the Cionni or Malyugin ring, tying the knot will recenter*

*the ring and the capsular bag prior to placement of the IOL*

*(▶Fig. 17.3c).*

*A three-piece foldable IOL may be inserted into the capsular*

*bag or in the sulcus, as was done in this case with optic-capsulorhexis*

*capture (▶Fig. 17.4a). The haptics are oriented away*

*from the inferior zonular dialysis. Pupil constriction confirms*

*excellent centration of the IOL (▶Fig. 17.4b).*

*A second method utilizes the Ahmed capsular tension segment,*

*which is a partial PMMA ring with the Cionni modified*

*fixation loop for scleral fixation. The segment may be placed at*

*any time during the surgery after capsulorhexis creation, and*

*can be used intraoperatively as a capsular supporting device by*

*placing an iris hook through the eyelet of the positioning loop.*

*After the cataract has been removed, the same segment can be*

*Fig. 17.3 (a) Capsular bag fixation using a Malyugin modified CTR.*

*Prior to insertion, a double-armed 9–0 polypropylene suture is*

*preplaced through the eyelet at the leading end of the ring. (b) As the*

*CTR is inserted with the preloaded injector, the loop and eyelet are*

*brought out of the capsular bag so that the eyelet is positioned within*

*the ciliary sulcus (behind the iris and in front of the anterior capsule).*

*After passing the two needles through a half-thickness scleral groove*

*located inferiorly, the 9–0 polypropylene suture tips are tied resulting*

*in centration of the updrawn capsular bag. (c) The knot falls within the*

*half-thickness scleral groove to prevent erosion through the overlying*

*conjunctiva.*

*Fig. 17.4 A three-piece foldable silicone IOL has been placed in the*

*ciliary sulcus with optic-capsulorhexis capture. (a) The haptics are in*

*the sulcus and oriented away from the inferior zonular dialysis. (b)*

*Pupil constriction confirms excellent centration of the IOL.*

*Lens*

*52*

*secured permanently to the sclera with a suture through the*

*positioning loop. At this point, an additional standard CTR may*

*also be placed inside the capsular bag to make the support*

*more uniform.*

*17.4.2 Pars Plana Lensectomy and*

*Vitrectomy*

*Although this approach can be used to remove any significantly*

*subluxated lens, it is preferred if the lens descends too posteriorly*

*while the patient is supine because of severe zonular loss*

*or laxity. A second indication would be significant prolapse of*

*vitreous into the anterior chamber. Under these circumstances,*

*the goals include a complete removal of all lens material and a*

*thorough vitrectomy carried out peripherally to the vitreous*

*base. A separate limbal incision must then be made for the IOL*

*implantation, which may be performed at the same time or as a*

*second stage procedure.*

*17.5 Rehabilitation and Follow-up*

*In the absence of any randomized comparison studies, the optimal*

*IOL to implant in a young patient lacking capsular support*

*is very open to debate. If appropriately sized and positioned,*

*anterior chamber IOLs have the advantage of stable long-term*

*fixation and a predictable effective lens position. Iris-claw IOLs*

*do not depend on precise sizing. Scleral or iris suture fixation of*

*a posterior chamber IOL is more difficult and may be complicated*

*by intraocular hemorrhage, pigment dispersion, optic tilt*

*or decentration, and unintended refractive error because of its*

*unpredictable axial position. Polypropylene knots may biodegrade*

*or break over time, and exposed scleral knots may erode*

*through the conjunctiva. Another approach would be intrascleral*

*tunnel haptic fixation as first described by Scharioth and*

*popularized by Agarwal as a “glued” IOL. Potential concerns*

*include hemorrhage, tilting, unpredictable IOL position, hypotony,*

*and haptic damage. This may be more difficult in patients*

*with thin sclera, such as those with Marfan’s syndrome.*

~~~~~CASE 18 Congenital Cataract~~~~~

*18 Congenital Cataract*

*Edward H. Wood and Nandini G. Gandhi*

*Abstract*

*This chapter concisely reviews the entire approach one should*

*take when presented with a congenital cataract. From initial*

*diagnosis to differential diagnosis generation, workup, and ultimately*

*medical and surgical management, this chapter includes*

*up-to-date information and considerations for the care of*

*patients with congenital cataracts.*

*Keywords: congenital cataract, leukocoria, amblyopia, cataract*

*surgery, lens opacity*

*18.1 History*

*A pediatrician noticed white pupils in a 10-day-old infant and*

*made the diagnosis of bilateral cataracts. The mother had had*

*an uncomplicated pregnancy with no rash or febrile illness, the*

*infant was born at term, and maternal serologies were all negative.*

*There was no family history of congenital or childhood cataracts.*

*The infant was referred to an ophthalmologist for*

*further workup and management.*

*On examination, the child demonstrated a poor wince to light*

*in both eyes, reactive pupils with no relative afferent pupillary*

*defect, and normal extraocular movements. The globes were soft*

*to palpation. The eyelids and conjunctiva were normal and the*

*corneas were clear and normal in diameter. The lenses had central*

*white opacities bilaterally (▶Fig. 18.1). There was no view to*

*the posterior segment in either eye. B-scan ultrasonography was*

*performed, which revealed no retinal detachment or mass.*

*Differential Diagnosis—Key Points*

*1. Congenital cataract is defined as a lens opacity that is*

*present at birth or develops within the first year of life. It is a*

*common cause of blindness in children, occurring in an*

*estimated 1 in 10,000 live births.*

*2. Early detection is the most important factor in determining*

*the eventual visual outcome. In general, the earlier the*

*onset, the more amblyogenic the cataract will be; lens*

*opacities that become visually significant prior to 2 to 3*

*months of age are the most amblyogenic.*

*3. The first important diagnostic distinction to make is*

*whether the leukocoria is secondary to a cataract or another*

*structural abnormality. While cataract is the most common*

*cause of leukocoria, other causes such as retinoblastoma,*

*retinopathy of prematurity, Coats’ disease, retinal*

*detachment, and persistent hyperplastic primary vitreous*

*(PHPV) must be considered when evaluating an infant or*

*child with a cataract. PHPV is a unilateral condition causing*

*developmental arrest of the eye, and is the most common*

*ocular syndrome associated with congenital cataract. This*

*entity should be suspected in any eye that is even slightly*

*small, and is often associated with a retrolental stalk,*

*posterior cataract, and elongated, anteriorly rotated ciliary*

*processes.*

*4. The etiology of cataracts follows the rule of thirds. Onethird*

*are idiopathic, one-third are related to a systemic*

*syndrome or disease such as chromosomal abnormalities,*

*metabolic disorders, and intrauterine infections, and onethird*

*occur as an isolated inherited trait (usually autosomal*

*dominant). Two-thirds of cases of congenital cataracts are*

*bilateral, and the prevalence of underlying systemic disease*

*is higher in bilateral cases. Considerations for underlying*

*etiology are shown in ▶Table 18.1.*

*5. There are a variety of morphologies of congenital cataracts*

*that may indicate etiology and/or visual significance, as*

*outlined in ▶Table 18.2. The opacity may involve the entire*

*lens or it may be localized. In general, opacities localized to*

*the embryonic or fetal nucleus often leave the peripheral*

*lens cortex optically clear.*

*Fig. 18.1 Central nuclear congenital cataract.*

*18.2 Test Interpretation*

*Following a review of medical and family history, a careful*

*examination including ophthalmoscopy with dilated pupils is*

*the best technique for diagnosing a congenital cataract and*

*associated abnormalities. In the event that a hand-held slit*

*lamp is not available, either the direct ophthalmoscope or the*

*indirect ophthalmoscope with a 20-D lens can provide a magnified*

*view of the anterior segment. In addition, older infants can*

*sometimes be held up to the slit lamp for examination.*

*After confirming the presence of a cataract, the first consideration*

*is whether or not the opacity is visually significant. Infants*

*younger than 2 months often do not demonstrate consistent fixation.*

*Thus, visual significance should be expected with any of*

*the following features: (1) central opacities greater than 3mm in*

*diameter or posterior opacities greater than 1mm (if in the center*

*of the posterior capsule), (2) significantly decreased view of*

*the posterior pole with ophthalmoscopy, (3) strabismus associated*

*with a unilateral cataract, or (4) nystagmus associated with*

*bilateral cataracts. Central opacities less than 3mm in diameter,*

*peripheral opacities, and punctate opacities with intervening*

*clear zones are thought to have less visual significance to varying*

*degrees. Infants older than 2 months can undergo testing of fixation*

*preference and behavior, objection to occlusion, tests of preferential*

*looking (such as teller acuity cards), optokinetic*

*nystagmus, and, in rare cases, visually evoked potentials.*

*The next consideration is to determine whether the cataract*

*is an isolated finding in an otherwise healthy child or whether*

*Table 18.1 Underlying etiologies of congenital cataracts*

*Bilateral Unilateral*

*Idiopathic 50% of cases #1 cause*

*Familial (hereditary) Usually AD; also X-linked, AR*

*Chromosomal Trisomy 21, 13, 18, other*

*Metabolic disorders Galactosemia, Fabry’s disease, Wilson’s disease, mannosidosis,*

*diabetes mellitus, parathyroid abnormalities*

*Renal disorders Lowe’s syndrome, Alport’s syndrome*

*Intrauterine infections Toxoplasmosis, rubella, cytomegalovirus, varicella, syphilis Rarely, consider maternal history*

*Musculoskeletal disease Conradi–Hünermann syndrome, Albright’s syndrome, myotonic*

*dystrophy*

*Craniofacial syndromes Hallerman–Streiff, Rubinstein–Taybi, Smith–Lemli–Opitz*

*Ocular anomalies Anterior segment dysgenesis, coloboma, aniridia Persistent hyperplastic primary vitreous*

*(PHPV), retinal detachment, anterior segment*

*dysgenesis, lenticonus, coloboma*

*Trauma Less likely Consideration, rule out child abuse*

*Abbreviations: AD, autosomal dominant; AR, autosomal recessive.*

*Table 18.2 Morphology and systemic associations of congenital cataracts*

*Morphology Associations*

*Nuclear Confined to embryonic or fetal nucleus Idiopathic, rubella (pearly white),*

*microphthalmos*

*Lamellar Affect particular lamella extending anteriorly and posteriorly, may have*

*associated arcuate opacities, i.e., “riders”*

*Most common; idiopathic, AD, metabolic,*

*infectious*

*Coronary Occur in deep cortex surrounding nucleus like a crown Idiopathic, rarely hereditary*

*Cerulean Distributed blue punctate opacities Idiopathic, Down’s syndrome*

*Sutural Follows anterior or posterior Y suture Idiopathic, may occur with others*

*Anterior Polar Flat—central, usually less than 3mm and visually insignificant, one-third*

*bilateral*

*Pyramidal—surrounded by cortical opacity, more visually significant*

*Idiopathic, persistent pupillary membrane,*

*aniridia, Peters’ anomaly, anterior lenticonus,*

*microphthalmos*

*Epicapsular star Star-shaped distribution of golden flecks on anterior lens capsule Persistent pupillary membrane*

*Posterior polar Posterior centralized opacity Idiopathic, persistent hyaloid remnants*

*(spectrum: Mittendorf’s dot to PHPV), posterior*

*lenticonus*

*Membranous Occurs when lamellar material resorbs, leaving residual chalky lens material*

*between anterior and posterior capsule*

*Hallerman–Streiff*

*“Oil droplet” Central round opacity Galactosemia*

*“Christmas tree” Distributed multicolored flecks Myotonic dystrophy, hypoparathyroidism*

*“Sunflower” Greenish brown discoloration of anterior lens capsule Wilson’s disease*

*Abbreviations: AD, autosomal dominant; PHPV, persistent hyperplastic primary vitreous.*

*Congenital Cataract*

*55*

*the cataract is part of a systemic disorder. Unilateral cataracts in*

*a healthy baby often need no workup aside from determining*

*the family history and that the mother did not have a febrile illness*

*or rash during pregnancy that would point to an intrauterine*

*infection. Infants with bilateral cataracts should be sent for*

*laboratory testing of blood and urine. Blood tests for TORCH*

*titers as well as levels of glucose, calcium, and phosphorus are*

*recommended to rule out intrauterine infections and metabolic*

*disorders. Urine tests include amino acids (to rule out Lowe’s*

*syndrome) and the reducing substances galactose-1-phosphate*

*uridyltransferase and galactokinase (to rule out galactosemia).*

*If the child is dysmorphic, genetic counseling is appropriate; if*

*there is failure to thrive, a more thorough search for metabolic*

*diseases by the pediatrician may be necessary. Our patient*

*underwent laboratory testing and genetic consultation, which*

*failed to reveal an underlying genetic syndrome.*

*An ophthalmic ultrasound examination is indicated if the cataract*

*is so dense that there is no view of the retina. This examination*

*allows indirect visualization of the retina and vitreous so*

*that PHPV and other disorders of the posterior portion of the*

*eye are seen if present.*

*Occasionally, it is necessary to have an examination under*

*anesthesia. Certainly, while the child is anesthetized for cataract*

*extraction, an examination should be performed to confirm the*

*preoperative findings. As congenital cataracts can be associated*

*with glaucoma, it is important to measure intraocular pressure*

*during the exam under anesthesia if it could not be measured*

*preoperatively.*

*18.3 Diagnosis*

*Bilateral idiopathic congenital cataract.*

*18.4 Medical Management*

*There is no medical treatment of congenital cataract. However,*

*some children have central cataracts that allow good vision if,*

*and only if, the pupil is pharmacologically dilated. These children*

*can enjoy improved vision when treated chronically with*

*mydriatics such as atropine once a day or once every other day.*

*Because atropinic agents can cause systemic side effects in*

*babies, a low dose is used. In addition, nonvisually significant*

*cataracts may be observed with regular follow up, and patching*

*therapy for amblyopia treatment is often initiated to promote*

*optimal visual development.*

*18.5 Surgical Management*

*If the cataract is large and dense enough to interfere with visual*

*development, surgical removal should be performed as soon as*

*possible. If surgery is not undertaken at the appropriate time,*

*dense amblyopia will result. However, cataract surgery prior to*

*4 weeks of age may increase the risk of secondary glaucoma.*

*Therefore, it is generally suggested that unilateral cataracts*

*undergo extraction at age 4 to 6 weeks. It is recommended that*

*bilateral cataracts be removed by 10 weeks of life.*

*An important postoperative issue in these surgeries is*

*whether an intraocular lens (IOL) is implanted or not. If chosen,*

*the IOL power should initially target hyperopia (initially*

*corrected with spectacles and allowing for emmetropization*

*during the myopic shift of the growing eye) or emmetropia*

*(potentially maximizing clear vision during critical period, with*

*likely need for myopic correction later in life). IOLs are generally*

*not advised in children younger than 1 year, and are reasonably*

*well tolerated by children aged 1 to 2 years and older who have*

*had late maturation of congenital cataracts. The disadvantages*

*of IOLs include increased inflammation, secondary membrane/*

*capsule opacification, and difficulty predicting the appropriate*

*lens power in a growing eye.*

*Compared to cataract surgery in adults, surgery in infants is*

*technically more difficult. Not only is the eye much smaller and*

*therefore harder to approach, but also the anterior capsule is*

*tough and elastic and the posterior capsule must be removed to*

*prevent inevitable postoperative opacification. Also, the iris has*

*a strong propensity to adhere to the posterior capsule and vitreous,*

*requiring pupil dilation for several weeks after surgery.*

*Postoperative complications include posterior capsular opacification*

*(nearly universal in cases without posterior capsulectomy/*

*capsulotomy), secondary membrane formation (especially in*

*microphthalmic, uveitic, or postoperatively inflamed eyes),*

*glaucoma (occurs in 20% of eyes, higher incidence if performed*

*prior to 4 weeks), and retinal detachment (rare, usually late*

*complication).*

*18.6 Rehabilitation and Follow-Up*

*Excellent refractive correction together with appropriate occlusion*

*therapy is essential in order to treat the deprivation*

*amblyopia that results from congenital cataracts. This aspect of*

*postoperative management requires patience and perseverance*

*from both the ophthalmologist and the parents. If amblyopia is*

*not aggressively treated, the child will develop severe and irreversible*

*poor vision in the affected eye. Therefore, if there is no*

*IOL, the child must be fitted with contact lenses or glasses*

*immediately after the surgery. For the patient with bilateral cataracts,*

*glasses can be a better alternative since they are much*

*easier for the parents to manage (▶Fig. 18.2). The power should*

*be selected to make the patient myopic, because much of the*

*infant’s visual world is at near. For the unilateral patient, however,*

*contact lenses are preferred, because unilateral correction*

*by glasses produces intolerable distortion and image disparity*

*between the operated and unoperated eyes.*

*Glaucoma can occur following congenital cataract surgery.*

*Long-term follow-up of patients is necessary since glaucoma*

*may become manifest many years after the surgery.*

*Fig. 18.2 Postoperative optical correction with aphakic spectacles.*

~~~~~CASE 19 Ocular Hypertension~~~~~

*19 Ocular Hypertension*

*Don C. Nguyen and Kuldev Singh*

*Abstract*

*This chapter goes through in detail the diagnostic and clinical*

*considerations when encountering a patient with high intraocular*

*pressure. A typical clinical vignette will be described, followed*

*by analysis of other potential diagnoses in the*

*differential. We will also discuss crucial exam features to look*

*for when trying to discern a patient with a primary or secondary*

*glaucoma, or solely intraocular hypertension. The chapter*

*will also review the interpretation of different tests as well as*

*their utility in ocular hypertension patients, including optical*

*coherence tomography, visual field testing, and pachymetry.*

*Important elements of the Ocular Hypertension Treatment*

*Study (OHTS) will be reviewed. Key findings during slit-lamp*

*exam and gonioscopy are also discussed, as well as findings*

*seen in secondary glaucoma syndromes such as pigment dispersion*

*and pseudoexfoliation. Lastly, we will analyze the significance*

*of certain risk factors when determining whether or*

*not to treat patients with ocular hypertension, as well the medical*

*and surgical management of high intraocular pressure, and*

*how frequent physicians should follow these patients.*

*Keywords: ocular hypertension, glaucoma suspect, glaucoma,*

*pigment dispersion, pseudoexfoliation, Ocular Hypertension*

*Treatment Study*

*19.1 History*

*A 42-year-old Caucasian man was referred to the eye clinic after*

*being told by an optometrist that his eye pressures were high and*

*that he might have glaucoma. Past medical history and family history*

*were unremarkable. He was not taking any medications.*

*Ocular examination revealed visual acuity of 20/20 OU without*

*correction. Pupils and motility were normal. Anterior segment biomicroscopic*

*examination was unremarkable with a clear cornea*

*and lens. Intraocular pressures (IOPs) were 27mm Hg OD and*

*28mm Hg OS. Gonioscopy revealed angles open to the ciliary body*

*band 360 degrees with moderate pigmentation of the trabecular*

*meshwork. Dilated funduscopic examination revealed symmetric*

*optic nerves with normal cupping (▶Fig. 19.1, ▶Fig. 19.2). The*

*cup-to-disc ratio was 0.2, with an intact neuroretinal rim OU. The*

*macula, vessels, periphery, and vitreous were normal in appearance.*

*A 24–2 Humphrey automated perimetry was performed,*

*which revealed no visual field defects in either eye.*

*Differential Diagnosis—Key Points*

*1. The finding of elevated IOP in the presence of normalappearing*

*optic nerves and visual fields makes idiopathic*

*ocular hypertension (OHTN) the most likely diagnosis.*

*2. If there has been focal or generalized injury to ganglion cells*

*related to this elevated IOP, the diagnosis of primary openangle*

*glaucoma (POAG) should be considered. As early*

*injury in POAG is sometimes difficult to detect by nerve*

*examination and visual field testing, the distinction between*

*OHTN and POAG is not always easy to discern. In addition to*

*stereoscopic optic nerve assessment, spectral domain*

*optical coherence tomography (SD-OCT) can be used to*

*assess and follow optic nerve structure which can be*

*compromised prior to functional abnormalities noted on*

*perimetry.*

*3. If gonioscopy revealed an abnormal angle (i.e., narrow,*

*densely pigmented trabecular meshwork, peripheral*

*anterior synechiae, neovascularization), secondary causes of*

*elevated IOP should be investigated. Unfortunately, these*

*secondary causes of elevated IOP are often referred to as*

*“glaucoma” even when the optic nerve and visual field are*

*normal.*

*4. Diseases such as pigmentary dispersion syndrome (PDS)*

*and pseudoexfoliation syndrome can result in secondary IOP*

*elevation. These diseases are associated with characteristic*

*features that are generally visible on slit-lamp examination,*

*such as pigmentation of the corneal endothelium*

*(Krukenberg’s spindle), heavily pigmented trabecular*

*meshwork, and spokelike iris transillumination of the iris*

*with PDS. Once again, patients with these conditions and*

*elevated IOP are often referred to as having pigmentary or*

*pseudoexfoliative glaucoma rather than OHTN.*

*19.2 Test Interpretation*

*1. Measurement of IOP is crucial in making the diagnosis.*

*While newer measurement modalities have been introduced*

*in recent years, Goldmann applanation tonometry remains*

*the gold standard. Measurement by the tonopen or*

*pneumotonometer may be more convenient or accurate in*

*certain settings, especially in the presence of corneal disease*

*as well as for patients with physical limitations.*

*Fig. 19.1 The right optic nerve.*

*Glaucoma*

*60*

*2. Central corneal thickness (CCT) should be measured in all*

*ocular hypertensive patients to determine the context of*

*each individual’s IOP reading and overall glaucoma risk. The*

*Ocular Hypertension Treatment Study (OHTS) has shown*

*that those with greater corneal thickness are at lower risk of*

*developing POAG. It is noteworthy that while CCTwas found*

*to be an independent risk factor for the development of*

*POAG in OHTS, there is no validated algorithm for converting*

*the IOP obtained from applanation tonometry to a “true” IOP.*

*Slit-lamp examination to rule out causes of IOP elevation*

*secondary to ocular conditions or syndromes is critical. Eyes*

*with ocular conditions associated with transient or*

*permanent elevated IOP may more commonly require*

*therapy than idiopathic OHTN, even in the absence of optic*

*nerve damage. An example of this is seen in patients with*

*rubeosis iridis who may require panretinal*

*photocoagulation.*

*3. Gonioscopy should be used to rule out a narrow or closed*

*angle, which may be associated with IOP elevation. Transient*

*IOP elevation is fairly commonly seen with occludable angles.*

*Laser peripheral iridotomy may not only reverse the IOP*

*elevation but also prevent other secondary problems*

*associated with angle closure.*

*4. The optic nerve is best examined under stereoscopic*

*magnification. The fundus contact lens is the gold standard*

*but is sometimes cumbersome and makes subsequent*

*fundus photography difficult. The Hruby lens approaches the*

*contact lens in stereopsis and magnification. The 78-D and*

*90-D lenses, when used with the slit lamp, exaggerate*

*stereopsis. Nevertheless, these lenses are easy to use and, in*

*most cases, give a good estimate of the cup-to-disc ratio and*

*other characteristics of the optic nerve. The red-free light on*

*the slit lamp can be used to better view the neuroretinal rim*

*and identify any defects in peripapillary nerve fiber layer.*

*Focal cupping, thinning of the rim, nerve fiber layer dropout,*

*or significant disc asymmetry should make one consider*

*changing the diagnosis from ocular OHTN to POAG. SD-OCT*

*and other imaging modalities such as scanning laser*

*ophthalmoscopy may provide valuable additional*

*information to help discern between these two groups of*

*patients.*

*5. Automated perimetry has become the gold standard in visual*

*field testing. Static threshold techniques can be highly*

*sensitive in picking up even subtle visual field defects. Many*

*patients are unable to undergo automated perimetry due to*

*physical or nonphysical limitations and thus require manual*

*perimetry. Although a high IOP should significantly raise*

*your level of suspicion, the presence of focal optic nerve*

*thinning with a correlating visual field defect alone should*

*make one consider the diagnosis of POAG.*

*19.3 Diagnosis*

*Ocular hypertension.*

*19.4 Medical Management*

*The decision of whether and when to begin IOP-lowering therapy*

*in a patient with OHTN is a difficult one. If structural and*

*functional assessment reveals normal optic nerves in both eyes,*

*you are treating a risk factor for glaucoma development (i.e.,*

*IOP elevation) and not the disease itself. Once you begin treatment,*

*you may be committing a patient to a lifetime of*

*unnecessary therapy. On the other hand, if you do not treat, the*

*elevated IOP may result in undetected optic nerve damage and*

*visual field loss. Such a delay could potentially jeopardize the*

*patient’s vision, especially as he or she ages.*

*Many ophthalmologists will determine an arbitrary IOP cutoff*

*above which medical therapy is almost always initiated. Epidemiologic*

*studies looking at this issue have failed to show a*

*single “magic” number above which all patients should be*

*treated. Instead of having an inflexible cutoff IOP, one should*

*individualize each patient’s treatment or observation plan*

*based on the number of coexisting risk factors.*

*Factors other than thin CCT that may lead one to treat*

*patients with IOPs in the mid to high 20 s include race and positive*

*family history, but it should be noted that neither of these*

*risk factors was found to be significantly related to the development*

*of glaucoma in OHTS. Nevertheless, black populations*

*have a higher prevalence of glaucomatous optic neuropathy*

*than whites in most parts of the world and, thus, might be considered*

*for treatment earlier in the course of the disease.*

*The age of a patient may also be important. An 80-year-old*

*patient with normal nerves and visual fields is less likely to suffer*

*significant vision loss over a lifetime secondary to elevated*

*IOP than an individual in his or her 40 s. The prescriber must*

*take into consideration the cumulative lifetime cost and added*

*morbidity of initiating treatment for each individual patient*

*and whether the benefits of such therapy outweigh the risks.*

*19.5 Surgical Management*

*Laser trabeculoplasty and glaucoma filtration surgery are usually*

*not to be recommended in patients with OHTN. The potential*

*complications, especially with filtration surgery, should not*

*be risked in eyes with healthy optic nerves.*

*Fig. 19.2 The left optic nerve.*

*19.6 Rehabilitation and Follow-up*

*Ocular hypertensive patients, whether or not they are treated*

*with IOP-lowering therapy, should initially be seen at least*

*every 6 to 12 months. Yearly visual field testing and/or OCT,*

*and dilated optic nerve examination are recommended.*

*Patients who are treated with IOP-lowering therapy should be*

*seen within 4 weeks after initiation of treatment to see if the*

*medication is effective. After the therapy has been modified and*

*the IOP is stable, examination every 4 to 6 months is recommended*

*for at least 2 years. If the OHTN has been stable for many*

*years, examination every 6 to 12 months may be adequate.*

~~~~~CASE 20 Open-Angle Glaucoma~~~~~

*20 Open-Angle Glaucoma*

*Bac Tien Nguyen and Sally Byrd*

*Abstract*

*To help distinguish primary open-angle glaucoma from other*

*forms of glaucoma and other disease processes, the chapter covers*

*both clinical findings and diagnostic testing as they are*

*related to glaucoma. These discussion points include key features*

*of the clinical examination, with particular focus on*

*gonioscopy and funduscopic findings, visual field testing, optic*

*nerve head imaging, and central corneal thickness. The numerous*

*medical and surgical interventions used in the treatment of*

*primary open-angle glaucoma are explored and discussed in*

*the chapter. The surgical interventions highlighted include traditional*

*glaucoma filtering surgery, laser procedures, modern*

*minimally invasive glaucoma surgery, and micropulse transscleral*

*cyclophotocoagulation.*

*Keywords: glaucoma, intraocular pressure, optic nerve cupping,*

*visual field, retinal nerve fiber layer, laser trabeculoplasty, trabeculectomy,*

*seton device, cyclophotocoagulation, minimally*

*invasive glaucoma surgery*

*20.1 History*

*A 51-year-old African American man presented for a routine*

*eye exam. He had no past ocular problems and no current visual*

*complaints. Past medical history was remarkable for mild*

*emphysema for which he used inhalers.*

*Examination revealed visual acuities of 20/20 in each eye,*

*with a refraction of –3.00 + 2.25 Å~ 110 OD and –2.25 + 2.00 Å~*

*86 OS. The pupils reacted normally with no afferent pupillary*

*defect. Anterior slit-lamp examination was unremarkable, and*

*pressures by applanation tonometry were 26mm Hg OD and*

*32mm Hg OS. Gonioscopy was performed and the angles were*

*noted to be grade IV in both eyes with a clear view of the ciliary*

*body band for 360 degrees. There was 1 + pigment of the trabecular*

*meshwork. On funduscopic exam, the optic nerves*

*were noted to be as pictured in ▶Fig. 20.1a, b. There were no*

*abnormalities of the retina or vessels. Automated visual fields*

*were also obtained and are shown in ▶Fig. 20.2a, b.*

*20.2 Test Interpretation*

*A careful physical exam is crucial in making the diagnosis of*

*POAG.*

*1. This patient had elevated IOPs which would support a*

*diagnosis of glaucoma, although approximately 33 to 50% of*

*patients with POAG will present with pressures under*

*21mm Hg at the time of their initial presentation.*

*Furthermore, approximately one-sixth of patients who*

*have other characteristic features of POAG will have*

*IOPs consistently lower than 21mm Hg. These patients*

*are often classified as having normal or low tension*

*glaucoma.*

*2. Careful slit-lamp examination is important to rule out*

*other secondary causes of glaucoma. Evaluation of the*

*cornea may reveal pigment deposits (Krukenberg’s*

*spindle) characteristic of pigmentary glaucoma, keratic*

*precipitates suggestive of a secondary inflammatory*

*glaucoma, or corneal edema seen in some variations of*

*iridocorneal endothelial (ICE) syndrome and herpes*

*keratitis even at lower IOPs. Cell and flare in the anterior*

*chamber would additionally support a diagnosis of*

*inflammatory glaucoma. Examination of the iris should*

*look to rule out peripheral transillumination defects*

*consistent with pigmentary glaucoma; pupillary margin*

*atrophy; gray-white flakes around the pupil; and anterior*

*stromal pigment dusting seen with pseudoexfoliation; the*

*rubeotic vessels of neovascular glaucoma; and the*

*distortion, atrophy, and corectopia characteristic of the*

*ICE syndromes.*

*3. Gonioscopy is, of course, essential for diagnosis of POAG and*

*necessary to rule out angle closure, as well as other*

*secondary causes of glaucoma such as traumatic angle*

*recession and the high iris insertion of juvenile glaucoma.*

*Heavy trabecular meshwork pigmentation would be*

*suggestive of pigmentary or pseudoexfoliative glaucoma.*

*Differential Diagnosis—Key Points*

*1. The findings of elevated intraocular pressure (IOP), open*

*angles, optic nerve cupping, and arcuate visual field defects*

*put the diagnosis of primary open-angle glaucoma (POAG)*

*at the top of the list.*

*2. Secondary open-angle glaucomas, such as pigmentary and*

*pseudoexfoliation, might also be considered, but this*

*patient did not display the corneal endothelial pigment*

*deposits, iris transillumination defects, or heavy trabecular*

*meshwork pigment seen in pigmentary glaucoma, nor the*

*fibrillar deposits, anterior iris pigment dusting, or trabecular*

*meshwork pigment often seen with pseudoexfoliation.*

*3. Chronic angle closure should be ruled out by careful*

*gonioscopy.*

*4. Occasionally, the optic nerve atrophy that follows anterior*

*ischemic optic neuropathy (AION) can lead to cupping*

*which mimics that seen in glaucoma. Usually, optic nerve*

*pallor is the more distinguishing feature, however, and the*

*condition is not associated with elevated IOPs. Additionally,*

*AION often occurs in nerves with very small tight cups, and*

*the fellow or less involved eye should be assessed for this*

*finding.*

*5. Congenital optic nerve findings such as an optic nerve pit,*

*limited optic nerve colobomas, tilted discs, and disc drusen*

*may lead to visual field findings that simulate glaucoma,*

*and a careful examiner should keep these anomalies in*

*mind.*

*6. Retinal lesions such as a retinal scar or branch retinal vein or*

*artery occlusion may also mimic the findings of glaucoma*

*on visual field examination.*

*Fig. 20.1 (a) Examination of the right disc showed generalized enlargement of the cup with increased thinning of the inferior rim. (b) The left disc also*

*shows generalized cup enlargement with more marked thinning of the inferior neural rim.*

*Fig. 20.2 (a) An early superior arcuate defect is noted in the right eye. (b) A more advanced superior arcuate defect is seen in the left eye.*

*4. Examination of the optic nerve is best done under*

*stereoscopic magnification through a dilated pupil and*

*should document not only the overall disc size and cup-todisc*

*ratio, but also evidence of focal thinning or notching of*

*the neural rim and the presence of optic disc hemorrhages.*

*The nerve fiber layer should be assessed with a red-free*

*light. Other disc anomalies that could also result in visual*

*field changes, such as disc drusen, optic pits, tilted nerves,*

*and disc pallor, should be searched for and documented*

*when present. The retina should also be carefully examined,*

*particularly for lesions that might explain visual field defects*

*found to be present.*

*5. Visual field testing is best measured using automatic static*

*threshold techniques or careful manual kinetic and static*

*testing. Glaucoma classically leads to a visual field defect in a*

*nerve fiber bundle distribution. Examples of this include*

*arcuate or Bjerrum’s scotomas, nasal steps, paracentral*

*scotomas, and temporal wedges. Glaucoma, however, may*

*also lead to visual field constriction or diffuse depression*

*that may be more difficult to recognize.*

*6. Central corneal thickness (CCT) measurement can typically*

*be obtained through the use of ultrasound corneal*

*pachymeters. Below average CCT measurements may lead to*

*the underestimation of IOP, while above average CCT*

*measurements may lead to an overestimation of IOP.*

*Obtaining a CCT measurement can help stratify a patient’s*

*risk for glaucoma and subsequent progression of disease.*

*Modern imaging technologies such as anterior segment*

*optical coherence tomography (OCT) and certain corneal*

*topography and tomography systems can also be used to*

*measure CCT.*

*7. Retinal nerve fiber layer and optic nerve head imaging can*

*now provide quantitative measurements of structural*

*changes seen with glaucoma. A variety of different*

*technologies, including confocal scanning laser*

*ophthalmoscopy, scanning laser polarimetry, and OCT, are*

*available to clinicians to obtain these quantitative images*

*and measurements. These imaging modalities can aid the*

*clinician in the diagnosis of and subsequent monitoring of*

*glaucoma. Clinical correlation must be used when*

*interpreting the results of these studies. The studies should*

*be used as an adjunct to the clinical and visual field*

*examinations.*

*20.3 Diagnosis*

*Primary open-angle glaucoma.*

*20.4 Medical Management*

*Management of glaucoma is primarily aimed at lowering the*

*IOP below a target level felt to be safe (unlikely to cause further*

*nerve damage) for a particular patient. Target pressures are*

*generally set at a pressure at least 20% below the pretreatment*

*level, but lower target pressures may be indicated depending*

*on the pretreatment IOP levels and the degree of optic nerve*

*damage already present. Medical agents for lowering IOP*

*include β-blockers, both selective and nonselective, topical and*

*oral carbonic anhydrase inhibitors, prostaglandin analogs,*

*adrenergic agonists, and miotics. Choice of treatment is based*

*on a number of factors including severity of the disease, the*

*patient’s age, compliance issues, known side effects, and concomitant*

*systemic disorders. It is often prudent to start a medication*

*in one eye only, to better separate its effectiveness from*

*normal fluctuations in eye pressure.*

*20.5 Surgical Management*

*Surgery is indicated when medical management fails to*

*adequately control the IOPs and there is evidence of disease*

*progression, or in some cases as initial therapy depending on*

*the severity of the glaucoma and other mitigating factors.*

*1. Laser trabeculoplasty is a commonly performed procedure in*

*the treatment of glaucoma. It can be used as an initial*

*therapy for certain patients, or as an alternative or adjunct to*

*medical therapy. It is useful in patients who are unable to*

*use medication reliably.While many of the early studies*

*investigated the usage of argon laser trabeculoplasty (ALT),*

*there has been a shift to selective laser trabeculoplasty (SLT).*

*SLT is performed by using a 53- nm Nd:YAG laser, placing*

*400-μm spots around 360 degrees of trabecular meshwork.*

*SLT acts by increasing aqueous outflow and results in*

*significant IOP lowering similar to ALT, with less*

*inflammation, less discomfort, and greater success when*

*repeated compared to ALT. Patients should be pretreated*

*with apraclonidine or other medications to prevent acute*

*pressure spikes and should have their pressures rechecked 1*

*to 2 hours after the procedure.*

*2. Trabeculectomy allows for aqueous humor to leave the*

*anterior chamber into the subconjunctival space and thus*

*lower IOP. Trabeculectomy surgery, alone or combined with*

*medical treatment, is reported as having an initial success*

*rate in previously unoperated eyes of 75 to 95%. In eyes that*

*have failed previous surgery, however, the success rate may*

*be as low as 36%. Antimetabolite agents such as 5-*

*fluorouracil and mitomycin C may greatly increase the*

*success rates by preventing scarring, but must be used*

*judiciously to prevent complications such as long-term*

*hypotony and bleb leaks. Careful follow-up after*

*trabeculectomy surgery is required to monitor and possibly*

*treat potential complications, as well as to intervene if signs*

*of early surgical failure are noted.*

*3. Implantation of various seton devices, such as the Baerveldt,*

*Molteno, or Ahmed implants, uses a tube to provide a*

*channel for aqueous humor to flow from the anterior*

*chamber to a reservoir plate underneath Tenon’s capsule.*

*These devices are usually reserved for patients who have*

*failed multiple filtering surgeries or those who are at high*

*risk of trabeculectomy failure such as conjunctival scarring*

*or certain types of glaucoma. Recent studies have*

*investigated the use of seton device as a primary surgery*

*prior to trabeculectomy.*

*4. Traditional transscleral cyclodestructive procedures using*

*cryoablation or laser are less predictable and carry a higher*

*risk of phthisis. They are therefore usually reserved for*

*patients who have failed multiple other procedures, those*

*who have extremely poor visual prognosis, and those who*

*are otherwise too medically unstable to undergo incisional*

*glaucoma surgery. Endoscopic cyclophotocoagulation has*

*been used to provide laser energy to the ciliary processes*

*under direct visualization with less risk of phthisis and*

*inflammation. A newer procedure using micropulse*

*transscleral cyclophotocoagulation may be more promising*

*procedure that also has lower risk of phthisis but longer*

*term studies are required.*

*5. The use of minimally invasive glaucoma surgery is a growing*

*field in the treatment of glaucoma. A number of new*

*procedures and devices have been developed including*

*trabecular meshwork micro-bypass stents, intracanalicular*

*scaffolding devices, supraciliary microstents, ab interno*

*trabeculotomy, ab interno canaloplasty, and subconjunctival*

*filtering devices. The long-term efficacy and safety of these*

*devices and procedures still under investigation*

*20.6 Rehabilitation and Follow-up*

*The frequency of follow-up examinations is generally based on*

*severity of the disease, achievement of target IOP levels, evidence*

*of disease progression, and duration of control. It is important at*

*each visit to determine possible medication side effects and*

*compliance problems and to assess visual acuity and IOP. Evaluation*

*of the optic nerve and repeat visual field testing may be performed*

*somewhat less frequently, again depending on the*

*factors mentioned above. Baseline stereoscopic photos of the*

*optic nerves are important when evaluating subtle changes in*

*the nerves over time. Indications for adjusting therapy include*

*failure to achieve the target IOP, evidence of progressive optic*

*nerve damage or visual field decline, and development of side*

*effects or compliance problems with the prescribed medications.*

~~~~~CASE 21 Primary Angle-Closure Glaucoma~~~~~

*21 Primary Angle-Closure Glaucoma*

*Peter A. Netland and Eitan S. Burstein*

*Abstract*

*In this chapter, the authors discuss the diagnostic methods, differential*

*diagnosis, and management of acute angle-closure*

*glaucoma.*

*Keywords: angle-closure glaucoma, narrow glaucoma, management,*

*iridotomy, gonioscopy*

*21.1 History*

*A 55-year-old woman presented with a history of several hours*

*of discomfort and blurred vision in the left eye.*

*Examination showed vision of 20/20 in the right eye and 20/*

*60 in the left eye. Intraocular pressures (IOPs) were 14 and*

*52mm Hg in the right and left eyes, respectively. The pupil was*

*sluggish and middilated in the left eye. Slit-lamp examination*

*of the left eye showed mild congestion of the episcleral and*

*conjunctival blood vessels. There was mild corneal epithelial*

*edema and a shallow peripheral anterior chamber (▶Fig. 21.1).*

*The midperipheral iris was bowed anteriorly (▶Fig. 21.2).*

*Examination of the lens showed mild nuclear sclerosis. Gonioscopy*

*of the left eye revealed a marked convexity of iris contour*

*and no visible anterior chamber angle structures (▶Fig. 21.3).*

*Gonioscopy of the right eye demonstrated an open, narrow*

*anterior chamber angle. The optic nerve cups were small in*

*both eyes.*

*The left eye was treated with medical therapy and laser iridotomy,*

*which opened the anterior chamber angle and reduced*

*the IOP to normal (▶Fig. 21.4).*

*Differential Diagnosis—Key Points*

*1. In this patient, the IOP was elevated and gonioscopy*

*demonstrated a closed anterior chamber angle in the left*

*eye. The differential diagnosis should include the clinical*

*types of angle-closure glaucoma. The most common*

*type of primary angle-closure glaucoma in the United*

*States is pupillary block angle-closure glaucoma. Other*

*causes of primary angle-closure glaucoma include*

*plateau iris configuration. In the patient described in the*

*case history, the midperipheral iris was bowed anteriorly*

*(iris bombé) and touched the cornea peripherally. The*

*fellow eye had a narrow, potentially occludable anterior*

*chamber angle. The predominant mechanism is pupillary*

*block, although it is possible that the patient had some*

*component of plateau iris. Reexamination and*

*provocative testing after iridectomy would identify any*

*plateau iris configuration. Recent evidence suggests that*

*the physiological properties of the iris play a role in*

*angle-closure glaucoma. Iris volume, when measured by*

*anterior segment optical coherence tomography, has*

*been observed to increase after dilation in eyes with*

*narrow anterior chamber angles that are predisposed to*

*angle closure.*

*2. Abnormalities of the lens may cause angle-closure*

*glaucoma. In phacomorphic glaucoma, a cataractous and*

*intumescent lens may cause closure of the anterior*

*chamber angle. Trauma or hereditary disorders may cause*

*anterior lens subluxation and angle-closure glaucoma. In*

*rare cases, exfoliation syndrome or idiopathic factors may*

*cause sufficient weakening of the zonules, anterior lens*

*movement, and angle closure. Drug sensitivity to*

*sulfonamides or other drugs may cause various problems,*

*including acute myopia, lens swelling, and uveal effusions,*

*which may be associated with angle-closure glaucoma. This*

*patient was not using any of the medications associated*

*with angle closure, nor did she have any findings associated*

*with lens-induced angle-closure glaucoma.*

*3. The patient described an acute onset of her problem in the*

*left eye. She denied repeated, brief episodes of these*

*symptoms in the past, suggesting that she had not had*

*intermittent angle closure. The time course described by*

*the patient and the lack of any findings such as iris atrophy,*

*anterior lens opacities (glaukomflecken), or peripheral*

*anterior synechiae indicate an acute process rather than*

*chronic angle-closure glaucoma.*

*4. Other disorders may cause symptoms and signs of acute*

*angle-closure glaucoma. In neovascular glaucoma,*

*neovascularization of the iris and angle may lead to*

*peripheral anterior synechia formation and ultimately to*

*closure of the angle. In uveitic glaucomas, keratic*

*precipitates may form and anterior segment inflammation*

*may lead to angle closure due to synechia formation, except*

*in glaucomatocyclitic crisis, in which the angle remains*

*open. Nanophthalmos and other congenital malformations*

*may be associated with closure of the anterior chamber*

*angle. Malignant glaucoma, due to posterior diversion of*

*aqueous flow, is associated with a shallow axial and*

*peripheral anterior chamber. Secondary causes of angleclosure*

*glaucoma include posterior segment tumors,*

*choroidal effusions, postsurgical changes, and other*

*disorders. The patient described in this chapter did not have*

*the history and physical findings associated with these other*

*disorders.*

*21.2 Test Interpretation*

*In the history, the patient should be asked about blurred vision,*

*colored halos around lights, pain, and eye redness. Previous episodes*

*of similar symptoms and the duration of the symptoms*

*should be documented. Inciting and associated factors, such as*

*close work, emotional state, or ambient light level, may be identified.*

*Patients with a family history of angle-closure glaucoma*

*have a higher risk for angle-closure glaucoma compared with*

*the general population. Epidemiologic studies have shown that*

*certain factors may be associated with angle-closure glaucoma.*

*The incidence of angle-closure glaucoma is highest between 55*

*Primary Angle-Closure Glaucoma*

*67*

*and 70 years. Although angle closure may occur in eyes with*

*any refractive error, it is most common in hyperopic eyes. The*

*incidence of angle-closure glaucoma varies in different ethnic*

*groups. In the Caucasian American population, angle-closure*

*glaucoma is about one-fifth as common as open-angle glaucoma.*

*Compared with Caucasians, acute angle-closure glaucoma*

*is less common in the African American population and*

*more common in certain Asian populations.*

*In the physical examination, the slit-lamp biomicroscope*

*should be used to evaluate for signs associated with angle-closure*

*glaucoma, including conjunctival and episcleral hyperemia,*

*corneal edema, and central and peripheral anterior*

*chamber depth. There may be a mild anterior chamber inflammatory*

*reaction, and the iris may have a convex configuration.*

*The appearance of the lens should be noted. Signs of previous*

*episodes of angle-closure glaucoma should be documented,*

*including iris atrophy, glaukomflecken, and peripheral anterior*

*or posterior synechiae.*

*An essential part of the examination is gonioscopy, which is*

*required to determine whether or not the patient has closure of*

*the anterior chamber angle. In principle, high-frequency ultrasound*

*(“ultrasound biomicroscopy”) could also determine*

*whether the angle is open or closed. Topical application of glycerin*

*may minimize corneal edema and facilitate gonioscopy.*

*Compression gonioscopy may be useful to determine whether*

*the closure of the angle is appositional or synechial. Anterior*

*segment optical coherence tomography can also be used to*

*evaluate eyes with angle closure. In ▶Fig. 21.5a, there is peripheral*

*touch of the iris to the cornea, with iris bombé and a closed*

*anterior chamber angle. In ▶Fig. 21.5b, the patient has been*

*Fig. 21.3 Gonioscopic view of the anterior chamber angle of the left*

*eye. The midperipheral iris is bowed anteriorly and the anterior*

*chamber angle is closed.*

*Fig. 21.4 Gonioscopic view of the anterior chamber angle of the left*

*eye after laser iridotomy. The iris is mildly convex but has a more flat*

*appearance compared with the preoperative configuration. The*

*anterior chamber angle is open.*

*Fig. 21.1 Slit-lamp biomicroscopy of the left eye. The conjunctiva and*

*episclera were mildly hyperemic, and the cornea was mildly*

*edematous. The pupil was middilated and the iris had a markedly*

*convex configuration. The IOP was 52mm Hg.*

*Fig. 21.2 High-power magnification view of the anterior segment of*

*the left eye. The slit beam clearly demonstrates the marked convexity*

*of the iris (iris bombé). The peripheral anterior chamber is absent.*

*treated with laser peripheral iridotomy, which has flattened*

*the convex configuration of the iris and opened the anterior*

*chamber angle.*

*Basic elements of the eye examination should be performed,*

*including measurement of vision and IOP. Assessment of the*

*refractive status is helpful, because hyperopic eyes are at*

*increased risk for developing angle-closure glaucoma. The*

*appearance of the optic nerve should be documented when*

*possible. The visual field should be evaluated, although this*

*may be postponed in many cases until after the acute attack*

*has been adequately treated. Dilation of the pupil should be*

*deferred until after iridotomy or iridectomy.*

*Examination of the fellow eye usually reveals a shallow anterior*

*chamber and a narrow angle. Although provocative testing*

*may be helpful for certain patients considered at risk for angleclosure*

*glaucoma, there is no need to perform provocative tests*

*on the fellow eye in a patient who has developed angle-closure*

*glaucoma. Approximately half of the fellow eyes in patients*

*with acute angle-closure glaucoma will develop acute attacks*

*within 5 years. Prophylactic iridotomy is indicated for the fellow*

*eye, after the eye with the acute attack has been treated*

*and is stable.*

*21.3 Diagnosis*

*Right eye: Narrow anterior chamber angle, at risk for subsequent*

*angle-closure glaucoma. Left eye: Acute primary angleclosure*

*glaucoma.*

*21.4 Medical Management*

*In eyes with angle-closure glaucoma, medical therapy is administered*

*to lower the IOP rapidly and, ideally, to open the anterior*

*chamber angle. Medical therapy usually improves the*

*clarity of the cornea prior to definitive surgical treatment.*

*Osmotic drugs may be useful in the treatment of eyes with*

*angle-closure glaucoma. Isosorbide and glycerol are administered*

*orally and have an onset of effect within 1 hour. Isosorbide*

*causes less nausea and vomiting compared with glycerol.*

*In contrast with glycerol, isosorbide is not metabolized and*

*does not have a significant caloric content. In patients with*

*severe nausea and vomiting, intravenous mannitol may be*

*administered. Osmotic drugs should be used with caution or*

*avoided in patients with renal and cardiovascular disease, or*

*those dehydrated by vomiting.*

*Intravenous acetazolamide may effectively and rapidly lower*

*the IOP in eyes with angle-closure glaucoma. Acetazolamide*

*may be administered orally, but the maximum effect occurs at*

*about 2 hours, which is significantly later than after intravenous*

*administration. Carbonic anhydrase inhibitors may be*

*administered topically, but the adsorption and effect are variable*

*because of the inflammation and edema in the setting of*

*acute angle-closure glaucoma.*

*Topical cholinergic drugs may constrict the pupil and open*

*the anterior chamber angle in some eyes with angle-closure*

*glaucoma. Treatment may be initiated with a drop of 2% pilocarpine*

*administered every 5 minutes for three doses. In some*

*eyes, the pupil is unresponsive because of ischemia and paralysis*

*of the iris sphincter due to extremely high IOP. In rare cases,*

*paradoxical worsening of the angle-closure may occur due to*

*forward movement of the lens and iris after treatment with*

*cholinergic drugs.*

*Other topical antiglaucoma medications may be administered,*

*including topical beta-blockers and alpha-2 agonists.*

*These drugs are commonly used in treating angle-closure glaucoma,*

*but their usefulness is limited by variable absorption and*

*slow onset of action. Prostaglandin analogs are less useful in*

*treatment of an acute attack of angle-closure glaucoma because*

*of their slow onset of action.*

*Topical corticosteroids should be used to treat the marked*

*inflammatory reaction associated with angle-closure glaucoma.*

*Pain may be treated with analgesics, and vomiting may be*

*treated with antiemetics. However, the focus of therapy for pain*

*and vomiting should be on treating the underlying cause of*

*these problems, which is the angle-closure glaucoma.*

*21.5 Surgical Management*

*Laser iridotomy is definitive therapy and the treatment of*

*choice for angle-closure glaucoma with a component of pupillary*

*block. When corneal clarity permits visualization of the*

*iris, iridotomy may be performed during the attack, or the procedure*

*may be performed after the acute attack has been*

*treated with medical therapy when inflammation and edema*

*have decreased. Gonioscopy determines whether the anterior*

*chamber angle has been opened successfully after the laser iridotomy.*

*Laser iridoplasty may be effective in opening areas of*

*the angle that remain closed after iridotomy, even in the presence*

*of mild to moderate corneal edema. When corneal edema*

*Fig. 21.5 (a) A 60 year-old man with iritis and pupillary block due to*

*posterior synechiae. Anterior segment optical coherence tomography*

*(OCT) before laser iridotomy shows iris bombé, with iris-corneal touch*

*and angle closure. (b) Anterior segment OCT after laser iridotomy*

*(arrow), with flattening of the iris and opening of the anterior chamber*

*Angle. resolves, laser or surgical goniosynechialysis may be performed*

*to treat peripheral anterior synechiae that persist after the*

*acute attack and contribute to chronically elevated IOP.*

*A therapeutic paracentesis can be performed, which may*

*lower the IOP and clear the cornea for laser surgery. It is not*

*advisable to perform a paracentesis if the patient is unable to*

*cooperate or the risk of damage to the iris or lens is high due to*

*severe narrowing of the anterior chamber. In eyes with a component*

*of angle-closure due to the lens, cataract removal may*

*deepen the anterior chamber angle.*

*In addition to laser treatment of the eye that has developed*

*angle-closure glaucoma, the fellow eye should be treated with a*

*prophylactic iridotomy if the anterior chamber angle is narrow.*

*Without prophylactic iridotomy, approximately half of the fellow*

*eyes in acute angle-closure glaucoma patients will develop*

*acute attacks within 5 years.*

*21.6 Rehabilitation and Follow-up*

*At least one IOP measurement should be performed within 30*

*to 120 minutes of laser surgery. A follow-up examination*

*should be performed within a week of laser surgery. If the response*

*to treatment is inadequate, more frequent follow-up visits*

*will be required. An additional follow-up examination*

*should be performed 4 to 8 weeks postoperatively. Topical*

*corticosteroids should be tapered during the postoperative*

*period. Pupillary dilation with postdilation IOP check and gonioscopy*

*determine whether the angle remains open after provocation.*

*Provocative testing with inadequate iridectomy may cause*

*pupillary block angle-closure glaucoma. Angle closure with a patent*

*iridectomy may be due to plateau iris configuration.*

~~~~~CASE 22 Pigmentary Glaucoma~~~~~

*22 Pigmentary Glaucoma*

*Yasemin G. Sozeri, Scott A. Cory, and James C. Robinson*

*Abstract*

*Pigmentary glaucoma is a form of secondary open-angle glaucoma.*

*It most commonly affects young myopic men. The pathophysiology*

*involves an abnormal posterior bowing of the iris,*

*which causes the posterior iris epithelium to chafe against lens*

*zonules and liberate pigment. This pigment makes its way anterior*

*and deposits on to the corneal epithelium (referred to as a*

*Krukenberg spindle) as well as on to angle structures. On gonioscopy,*

*Schwalbe’s line will often appear pigmented, which is*

*then referred to as Sampaolesi’s line, and the trabecular meshwork*

*will appear densely and evenly pigmented. Exercise can*

*induce extra liberation of pigment and cause acute intraocular*

*pressure spikes. Patients will often complain of blurry vision*

*with exercise. Patients with exam findings consistent with pigmentary*

*glaucoma without glaucomatous nerve damage are*

*classified as pigment dispersion syndrome as opposed to pigmentary*

*glaucoma. Treatment strategies for pigmentary glaucoma*

*are similar to other open-angle glaucomas and include*

*medications, laser trabeculoplasty, and incisional surgery*

*including minimally invasive glaucoma surgeries. An additional*

*strategy is laser peripheral iridotomy, which some believe can*

*help reduce iris–zonule chafe and pigment liberation.*

*Keywords: pigmentary glaucoma, iris–zonule chafe, pigment*

*dispersion, Krukenberg’s spindle, Sampaolesi’s line, laser peripheral*

*iridotomy, laser trabeculoplasty*

*22.1 History*

*A 32-year-old myopic man presents for routine eye examination.*

*He currently has no complaints and denies any significant*

*past ocular or medical history. Examination revealed a best corrected*

*visual acuity of 20/20 in each eye and no afferent pupillary*

*defect in either eye. Intraocular pressures (IOPs) by*

*applanation were 28 and 26mm Hg. Slit-lamp examination disclosed*

*vertically oriented pigment deposition on each corneal*

*endothelium and numerous spokelike iris transillumination*

*defects in both eyes (▶Fig. 22.1). Gonioscopy showed fully open*

*angles (360 degrees) in each eye with dense pigmentation of*

*the trabecular meshwork bilaterally. On funduscopic examination,*

*the right optic nerve had a cup-to-disc ratio of approximately*

*0.7 with inferotemporal thinning at the neuroretinal*

*rim. The left eye had a cup-to-disc ratio of 0.55. Retinal examination*

*was normal. Spectral-domain optical coherence tomography*

*(SD-OCT) retinal nerve fiber layer (RNFL) analysis*

*showed moderate thinning of the inferotemporal RNFL in the*

*right eye and mild thinning in the left eye. Automated visual*

*field testing demonstrated a moderate superior arcuate defect*

*in the right eye and an early nasal step in the left eye.*

*Differential Diagnosis—Key Points*

*1. Elevated IOPs with pigment liberation originating from the*

*iris, glaucomatous-appearing optic nerves, and visual field*

*changes in a young myopic man best fits the patient profile*

*of pigmentary glaucoma. Pigmentary glaucoma is generally*

*a disease of the young and affects men approximately twice*

*as often as women. Most experts agree that patients with*

*pigmentary dispersion syndrome or pigmentary glaucoma*

*have abnormal mechanical interaction between the*

*posterior iris epithelium and the lens zonules, leading to the*

*liberation of free pigment derived from the posterior iris*

*epithelium that ultimately blocks aqueous outflow. As*

*aqueous humor makes its way anteriorly, some of the*

*pigment becomes attached to the corneal endothelium.*

*The bulk of the pigment, however, eventually is filtered into*

*the trabecular meshwork. Acute episodes of pigment*

*liberation (such as with exercise) may cause an acute*

*elevation of IOP, while the chronic effect of pigment*

*deposition in the trabecular meshwork leads to sclerosis and*

*eventual decline in function. It is often at this point when*

*persistently elevated IOP progresses to glaucomatous optic*

*nerve damage.*

*2. Although pigmentary glaucoma rarely presents a diagnostic*

*dilemma, the differential diagnosis includes primary openangle*

*glaucoma with excessive pigmentation,*

*pseudoexfoliative glaucoma, uveitis, ocular melanosis, and*

*intraocular melanoma. A thorough and complete ocular*

*examination is important to differentiate accurately*

*between these various conditions.*

*3. Important to the diagnosis of pigmentary glaucoma is the*

*gonioscopic examination of the trabecular meshwork.*

*Pigmentary deposition in the trabecular meshwork due to*

*pigmentary dispersion is often dense and evenly dispersed*

*throughout the entire angle. In contrast, pigmentation that*

*is pseudoexfoliative in origin is often less evenly distributed*

*and may show dense areas of pigmentation with relatively*

*spared areas interspersed throughout. Both*

*pseudoexfoliative and pigmentary glaucoma may show*

*pigmentation of Schwalbe’s line, known as Sampaolesi’s*

*line. The key difference between these two diagnoses can*

*easily be made based on careful examination of the*

*pupillary border and anterior lens capsules.*

*Pseudoexfoliative material is deposited on the pupillary*

*border and anterior lens capsule, which is not characteristic*

*of pigmentary glaucoma.*

*22.2 Test Interpretation*

*The initial examination of the optic nerve is perhaps the most*

*critical first step in establishing whether or not a patient has*

*glaucomatous nerve damage by the traditional methods of*

*grading, documenting, and observing the optic disc. Cup-todisc*

*asymmetry, superficial nerve hemorrhages, and focal or*

*progressive rim thinning are all useful in evaluating the severity*

*of glaucoma. As such, baseline and sometimes serial optic nerve*

*photos should be taken for future reference. Automated perimetry*

*is an important diagnostic tool for evaluating the severity*

*and progression of measurable field loss in all forms of glaucoma.*

*Automated perimetry is based on projecting various levels*

*of light or color stimuli into the patient’s field of vision and*

*estimating that field based on patient responses. Automated*

*perimetry has allowed accurate and reproducible field analysis,*

*which is critical for the long-term management of patients with*

*glaucoma. Patients with pigmentary glaucoma tend to show*

*glaucomatous field defects similar to patients with primary*

*open-angle glaucoma. Most defects manifest as a diffuse*

*decrease in sensitivity located in the peripheral field. SD-OCT*

*has also proven to be a valuable test in evaluating, monitoring,*

*and treating glaucoma. SD-OCT RNFL thickness analysis quantifies*

*and qualifies glaucomatous RNFL thinning to a specific*

*quadrant(s) and/or clock hour(s) compared to the normative*

*database. RNFL thinning can be correlated with optic nerve*

*head changes as well as visual field defects. RNFL thickness*

*analysis becomes less reliable at measuring progressive thinning*

*as the RNFL thickness decreases to 50 μm or less and thus*

*is less useful in patients with severe disease. SD-OCT optic*

*nerve head analysis provides objective measurements of the*

*disc area, neural retinal rim area, cup-to-disc ratio, vertical cup,*

*and cup area and compares these parameters to the patient’s*

*fellow eye for symmetry as well as to the normative database.*

*Lastly, SD-OCT provides a ganglion cell analysis which measures*

*the ganglion cell layer thickness at the macula and compares it*

*to the fellow eye and the normative database for thinning.*

*Along with monitoring IOP, serial optic nerve examinations,*

*automated perimetry, and SD-OCT are useful in management of*

*all forms of glaucoma including pigmentary glaucoma. At a minimum,*

*adjunctive tests such as visual field testing and SD-OCT*

*should be performed at least annually, and may often need to be*

*repeated more frequently depending on the severity of a*

*patient’s particular disease course. It should be noted that optic*

*nerve changes and SD-OCT-detected RNFL thinning can precede*

*perimetry-detected visual field defects and lead to earlier detection*

*of disease. This can be especially useful in distinguishing pigment*

*dispersion syndrome from early pigmentary glaucoma.*

*22.3 Diagnosis*

*Right eye: Moderate-stage pigmentary glaucoma with superior*

*arcuate defect.*

*Left eye: Moderate-stage pigmentary glaucoma with early*

*nasal step defect.*

*22.4 Medical Management*

*Historically, pigmentary glaucoma was managed through the*

*use of miotics (i.e., pilocarpine), which normalized IOP by minimizing*

*the interaction of the iris and lens and thus limited the*

*liberation of iris pigment. The obvious limitation of all miotic*

*treatments is that their side effects are often poorly tolerated in*

*the age group of patients primarily afflicted by pigmentary*

*glaucoma. Extended release miotic therapy may decrease the*

*degree of myopic shift and may be better tolerated. In the event*

*that miotic therapy is intolerable or insufficient in controlling*

*IOP, other topical agents should be initiated. IOP-lowering*

*agents such as prostaglandin analogs, beta-blockers, carbonic*

*anhydrase inhibitors, and alpha-adrenergic agonists are all*

*appropriate. A desirable initial pressure reduction in IOP should*

*be in the range of 20 to 30%. If despite this reduction there is*

*continued visual field loss, then a multiagent regimen should*

*be employed.When medical management fails to limit progression,*

*or is not tolerated or is impractical, surgical alternatives*

*should be considered.*

*22.5 Surgical Management*

*Laser peripheral iridotomy (LPI) is a treatment option that aims*

*to directly alter the cause of pigment liberation. In pigmentary*

*glaucoma, the origin of pigment liberation is felt to be due to an*

*abnormal interaction between the pigment epithelium of the*

*iris and the lens zonules, also known as a reverse pupillary*

*block. Placement of an iridotomy is believed to decrease the*

*potential for iris/lens interaction and thus treat the primary*

*cause of the disease process. Unfortunately, the efficacy of LPI*

*has yet to be adequately studied. Argon laser trabeculoplasty*

*(ALT) is often very effective in patients with a more heavily pigmented*

*trabecular meshwork, making it ideal as an initial treatment*

*for patients with pigmentary glaucoma. ALT is a relatively*

*low-risk procedure that may often provide years of effective*

*pressure reduction. Initial treatment with ALT should be*

*monocular, consist of a 180-degree treatment trial, and utilize*

*the lowest effective power. If this initial treatment results in adequate*

*pressure reduction, the other eye should be considered*

*for treatment. Treatment of only one-half of the trabecular*

*Fig. 22.1 Extensive transillumination defects in pigmentary glaucoma.*

*meshwork is often sufficient and reserves the option for future*

*treatment. Selective laser trabeculoplasty is an alternative to*

*ALT that has been shown to be an effective tool in lowering IOP*

*in patients with open-angle glaucoma. It should be used with*

*caution in patients with heavily pigmented trabecular meshwork,*

*such as patients with pigmentary glaucoma, as there is*

*some evidence that suggests it could lead to an IOP spike in*

*these patients. Similar to other forms of glaucoma, if disease*

*progression continues despite aggressive pharmacologic and*

*laser therapy, incisional surgery should be considered. Depending*

*on patient risk factors, disease severity, and surgeon preference,*

*considerations may include traditional trabeculectomy,*

*Ex-Press glaucoma mini-shunt, or glaucoma drainage implants.*

*The role of more recently developed minimally invasive surgical*

*options such as iStent trabecular microbypass, gonioscopyassisted*

*transluminal trabeculotomy, and endocyclophotocoagulation*

*in the treatment of pigmentary glaucoma has not yet*

*been well studied.*

*22.6 Rehabilitation and Follow-up*

*As with all forms of glaucoma, pigmentary glaucoma requires a*

*patient-specific approach. Follow-up for pigmentary glaucoma*

*should be based on the effectiveness of treatment, the stability*

*of the disease process, overall severity of disease, and patient*

*reliability.*

~~~~~CASE 23 Neovascular Glaucoma~~~~~

*23 Neovascular Glaucoma*

*Daniel Y. Choi and Stephen A. Lin*

*Abstract*

*Neovascular glaucoma is a secondary angle-closure glaucoma.*

*Diagnosis is made through a combination of the clinical history*

*and findings on examination. Management typically consists of*

*therapy to promptly lower intraocular pressure to a reasonable*

*range. Glaucoma filtering surgery may be required to*

*adequately control the intraocular pressure. A full examination*

*to identify and treat the underlying etiology for neovascularization*

*is required. Ultimately, the treatment for neovascular glaucoma*

*should be customized to the patient’s individual*

*situation. As always, proper monitoring and prevention of neovascularization*

*in high-risk patients is of utmost importance.*

*Keywords: neovascular glaucoma, glaucoma, angle-closure glaucoma,*

*ocular hypertension, neovascularization*

*23.1 Clinical History*

*A 72-year-old man presents to the emergency department*

*complaining of “a bad headache on the right side of my head.”*

*He also notes extreme redness and light sensitivity of the right*

*eye and feels “sick to my stomach.” His symptoms have developed*

*quickly over half a day. Fearing that this may be more than*

*“pink eye,” the emergency department physician requests that*

*an ophthalmologist evaluate the patient.*

*Past medical history is remarkable for hypertension, diabetes,*

*and arteriosclerosis. A review of systems is positive for nausea*

*and one episode of vomiting. The patient had experienced an*

*abrupt, painless, severe decline in vision in the right eye approximately*

*3 months earlier. He was diagnosed at that time with an*

*ischemic central retinal vein occlusion by his ophthalmologist.*

*Examination of the right eye reveals a visual acuity of hand*

*motions. Slit-lamp examination shows severe corneal edema*

*and conjunctival injection. A limited view of the anterior chamber*

*reveals a small hyphema with cell and flare. The right iris*

*does not appear to be bowed anteriorly, is minimally reactive to*

*light, and exhibits fine and irregular branching vessels on its surface*

*(▶Fig. 23.1). A gonioscopic view of the drainage angle in the*

*right eye is obscured by corneal edema. The drainage angle is*

*wide open in the left eye. Only a dull red reflex can be appreciated*

*on ophthalmoscopy of the right eye. The right fundus is not*

*visible due to corneal edema and the left fundus is notable only*

*for severe hypertensive retinopathy. B-scan ultrasonography*

*shows an attached retina without any significant findings. The*

*optic disc appears normal in the left eye. Intraocular pressure*

*(IOP) is 67mm Hg in the right eye and 19mm Hg in the left.*

*23.2 Differential Diagnosis—Key*

*Points*

*The differential diagnosis in this case centers on the two key*

*examination findings of elevated IOP and iris neovascularization.*

*It includes neovascular glaucoma (NVG), acute angle-closure*

*glaucoma, Fuchs’ heterochromic iridocyclitis, acute iridocyclitis,*

*angle recession glaucoma, and traumatic hyphema with elevated*

*IOP.*

*23.2.1 Acute, Severe IOP Elevation*

*An acute pressure elevation is often accompanied by corneal*

*edema with a characteristic “steamy” appearance and conjunctival*

*congestion. Patients complain of extreme pain and blurry*

*vision accompanied by headache and sometimes nausea and*

*vomiting. Corneal edema results in patient complaints of “colored*

*halos around lights.” In contrast, a chronic gradual elevation*

*of IOP typically is associated with a relatively quiet eye*

*with minimal symptoms.*

*When approaching the patient with an acute IOP elevation,*

*gonioscopy and the slit-lamp examination to determine if the*

*angle is open or closed is a key step to narrowing down the differential.*

*If the angle is closed, then the diagnosis of acute angle closure*

*may be further subdivided into primary and secondary angle*

*closure. Patients with primary acute angle closure classically*

*present with pupillary block with a nonresponsive middilated*

*pupil and iris bombé. These patients have baseline narrow iridocorneal*

*angles that predispose them to developing pupillary*

*block. Predisposed patients are often hyperopic with shallow*

*anterior chambers. Gonioscopic examination of the asymptomatic*

*fellow eye will often reveal angle narrowing. Secondary*

*acute angle closure may result from mechanical closure due to*

*an anterior “pulling mechanism” (e.g., NVG), a posterior “pushing*

*mechanism” (e.g., choroidal detachment or aqueous misdirection),*

*and a pupillary block mechanism (e.g., secluded pupil*

*or silicone oil).*

*Fig. 23.1 Fine, irregular blood vessels growing over the anterior iris*

*surface are characteristic of iris neovascularization. Growth often*

*begins at the pupillary margin and may extend peripherally, where*

*involvement of the drainage angle can lead to closure and elevated*

*IOP.*

*If the angle is open, the underlying cause of an acute IOP elevation*

*is likely a secondary open angle glaucoma (inflammatory,*

*traumatic, etc.) as primary open angle glaucoma typically*

*presents with a chronic insidious IOP elevation.*

*In this clinical vignette, the presence of neovascularization*

*with an elevated IOP makes NVG the most likely diagnosis. The*

*lack of iris bombé and the absence of a narrow angle in the*

*fellow eye make the diagnosis of a primary angle-closure glaucoma*

*with pupillary block unlikely. Furthermore, neovascularization*

*and hyphema are not encountered in acute angle closure*

*due to pupillary block. This patient had no history of trauma to*

*suggest angle recession or a traumatic hyphema as the underlying*

*primary etiology of the increased IOP. Although iridocyclitis*

*can cause increased IOP, iridocyclitis rarely presents with true*

*iris neovascularization and hyphema. Additionally, the history*

*of a prior vein occlusion makes a primary inflammatory etiology*

*a distant second to NVG.*

*23.2.2 Iris Neovascularization*

*Neovascularization, whether anterior or posterior, is usually*

*associated with an underlying ocular ischemic process that*

*results in the release of vascular endothelial growth factor*

*(VEGF) within the eye. Diabetic retinopathy and retinal vein*

*occlusions each account for approximately one-third of cases of*

*iris neovascularization. Other causes of iris neovascularization*

*include retinal artery occlusion, carotid occlusive disease, sickle*

*cell retinopathy, chronic uveitis, intraocular tumor, and chronic*

*retinal detachment.*

*Iris neovascularization usually begins with fine capillary tufts*

*at the iris margin, which progress toward the iris root and*

*chamber angle. Unlike iris vessels, which are uniform and radial*

*in nature, these new vessels are irregular in caliber and direction.*

*A fine fibrovascular membrane may be associated with*

*these vessels and may lead to angle closure and ectropion*

*uveae. Bleeding from neovascular growth is not uncommon and*

*may lead to hyphema.*

*NVG is a secondary angle-closure glaucoma that is characterized*

*by neovascularization of anterior segment structures that*

*ultimately leads to angle closure, poor outflow facility, and*

*eventual glaucomatous optic nerve damage. Iris neovascularization*

*is invariably present prior to the invasion of the trabecular*

*meshwork by fibrovascular membranes and ultimately permanent*

*angle closure. Early iris neovascularization is easily overlooked*

*on examination unless an effort is made to carefully*

*scan the iris surface and trabecular meshwork. Any patient with*

*risk factors for neovascularization should be thoroughly evaluated*

*and monitored for both posterior and anterior neovascularization.*

*Early detection, frequent monitoring, and prompt*

*intervention may prevent the severe complications associated*

*with extremely high IOP.*

*In this case, the history is extremely important. Previous*

*vision loss and a history of a prior central retinal vein occlusion*

*provide the reason for both the increased IOP (NVG) and also*

*the underlying etiology for the neovascularization. The exam*

*findings of iris and trabecular meshwork neovascularization*

*with an elevated IOP are virtually pathognomonic for NVG.*

*Despite this, it is always important to complete a full dilated*

*fundoscopic examination of both eyes to rule out alternative*

*etiologies for the neovascularization and the elevated IOP. If the*

*view to the posterior pole is compromised due to corneal*

*edema, a B-scan ultrasound should be obtained to rule out any*

*significant posterior pathology.*

*23.3 Diagnosis*

*Acute ocular hypertension secondary to NVG.*

*23.4 Medical Management*

*All efforts should be made to lower IOP quickly. In general, most*

*patients with an acutely elevated IOP due to NVG require oral*

*carbonic anhydrase inhibitors to lower IOP to a relatively safe*

*range. Topical aqueous suppressants including beta-blockers,*

*alpha-2 agonists, and additional carbonic anhydrase inhibitors*

*often should be administered. Cholinergic agents and possibly*

*prostaglandin analogs provide a theoretical risk of further*

*breakdown of the blood–aqueous barrier and their use is*

*debated. Prostaglandin analogs, however, enhance uveoscleral*

*outflow, which may play a more important role if the drainage*

*angle is closed. Care should always be taken when using oral*

*carbonic anhydrase inhibitors, especially in patients with renal*

*dysfunction and/or in African American patients due to the possibility*

*of an underlying sickle cell disorder. Hyperosmotic*

*agents should be used with care, especially in diabetics, in the*

*elderly, and in patients with congestive heart failure. The role of*

*hyperosmotic agents may be limited, as osmotic gradients are*

*weaker in the inflamed eye. Furthermore, oral agents may be*

*difficult to administer in the setting of emesis.*

*Inflammation and pain may be managed with topical prednisolone*

*and cycloplegics. Nausea and vomiting should be treated*

*with medications delivered through a sublingual or other nonoral*

*route.*

*Once the eye is stable, panretinal photocoagulation of the*

*ischemic retina should be considered if there is a sufficient*

*view of the posterior segment. In the acute state, an intravitreal*

*injection (IVI) of an anti-VEGF agent should be considered once*

*an intraocular tumor, retinal detachment, and/or significant*

*retinal traction is ruled out. This injection will rapidly control*

*the intraocular neovascular drive allowing for possible regression*

*of fibrovascular membranes from the trabecular meshwork.*

*Additionally, if filtering surgery is required to control the*

*IOP, a prior IVI of an anti-VEGF agent may decrease intraoperative*

*and postoperative bleeding. An anterior chamber paracentesis*

*may be required prior to and after the IVI, given the*

*baseline elevated IOP in NVG patients.*

*23.5 Surgical Management*

*Medical management alone is frequently inadequate for controlling*

*the IOP in patients with NVG. Ideally, neovascularization*

*should be inactive and/or an IVI of an anti-VEGF agent*

*should administered prior to filtering surgery. Intraoperative*

*bleeding is common when there is active neovascularization,*

*and the prognosis for successful long-term control with a single*

*surgery is often guarded. In general, first-line filtering surgery*

*for NVG involves an aqueous shunting device (such as the Baerveldt*

*(Johnson and Johnson Vision) and Ahmed (New World*

*Medical) implants). If a nonvalved implant is used, venting tube*

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*incisions and/or immediate postoperative IOP-lowering medications*

*will be required to adequately control the IOP while the*

*capsule matures and the tube is tied off. Although trabeculectomy*

*is another option in NVG, given the significantly high failure*

*rate, it is rarely used acutely but remains an option after the*

*neovascularization is completely controlled.*

*NVG in blind eyes may be managed more conservatively with*

*elimination of pain as the main goal. Cyclodestructive procedures*

*with the diode, neodymium:yttrium-aluminum-garnet*

*(Nd:YAG) laser, or cryotherapy can alleviate pain associated*

*with elevated pressure. Topical cycloplegics and steroid drops*

*may also be of use. Retrobulbar alcohol or enucleation is usually*

*reserved for refractory cases.*

~~~~~CASE 24 Inflammatory Glaucoma~~~~~

*24 Inflammatory Glaucoma*

*Robert Kule and Anne L. Coleman*

*Abstract*

*Intraocular inflammation or uveitis may cause a significant*

*increase in intraocular pressure, which can lead to glaucomatous*

*optic neuropathy. The elevation in intraocular pressure*

*may result from various mechanisms, including reduced trabecular*

*meshwork outflow and peripheral anterior synechiae*

*formation. Identifying the underlying etiology of the inflammation*

*is important in order to manage the disease effectively.*

*Accurate diagnosis may be achieved with a thorough history,*

*complete eye examination, and secondary testing, such as serologic*

*workup and body imaging. Treatment of inflammatory*

*glaucoma is achieved using topical and oral ocular hypertensive*

*drugs, as well as surgical intervention, such as filtering surgery*

*and implantation of glaucoma drainage devices. If the uveitis is*

*active, treatment of the underlying systemic disease and control*

*of the inflammation are essential.*

*Keywords: glaucoma, inflammation, uveitis, corticosteroid,*

*herpes simplex, peripheral anterior synechiae, secondary openangle*

*glaucoma, secondary closed-angle glaucoma*

*24.1 History*

*A 38-year-old Caucasian man presented with a 2-day history of*

*blurry vision, photophobia, tearing, and pain involving his left*

*eye. His ocular history is notable for one episode of herpes simplex*

*keratitis involving the left eye, which occurred 12 months*

*ago and which resolved after treatment with trifluridine eye*

*drops.*

*Examination showed vision of 20/20 in the right eye and 20/*

*60 in the left eye, which improved to 20/40 with pinhole. Intraocular*

*pressures (IOP) were 12 and 46mm Hg, respectively.*

*Slit-lamp examination of the right eye was unremarkable. The*

*left cornea revealed fine, stellate keratic precipitates (KPs) scattered*

*in a diffuse pattern. The anterior chamber was deep centrally*

*and peripherally, with 2 + cells and aqueous flare. Patchy*

*atrophy of the iris pupillary sphincter was noted on transillumination*

*(▶Fig. 24.1). No iris nodules, heterochromia, or posterior*

*synechiae were observed. The lens was clear. Gonioscopy*

*demonstrated angles open to the ciliary band in both eyes*

*with moderate pigmentation of the trabecular meshwork and*

*prominent iris processes but no peripheral anterior synechiae*

*(PAS). On funduscopic exam, the vitreous appeared clear, and*

*optic discs were symmetric with healthy rims.*

*Differential Diagnosis—Key Points*

*1. IOP can be elevated, stable, or reduced in response to*

*inflammation. The main cause of IOP rise associated with*

*uveitis, where the majority of eyes have open angles, is*

*thought to be increased resistance to aqueous outflow.*

*Several mechanisms have been proposed, including*

*obstruction of the trabecular meshwork by inflammatory*

*precipitates, swelling of the trabecular lamellae and*

*endothelium, and alteration of aqueous dynamics by the*

*breakdown in the blood–aqueous barrier. Less commonly,*

*angle closure can result from pupillary block, PAS, or*

*forward rotation of the ciliary body.*

*2. Large, “mutton-fat” KPs are found in granulomatous forms*

*of uveitis, such as sarcoidosis and sympathetic ophthalmia.*

*Fine, fibrillar KPs in a stellate pattern, as described in this*

*case, are associated with herpetic or Fuchs’ heterochromic*

*uveitis.*

*3. Iris atrophy is characteristic of herpetic inflammation.*

*Segmental atrophy due to occlusive vasculitis of the iris*

*stromal vessels occurs with herpes zoster, whereas patchy*

*atrophy around the pupillary sphincter is seen in herpes*

*simplex.*

*4. The risk of developing herpes simplex iridocyclitis increases*

*with recurrent episodes of keratitis, especially stromal*

*keratitis. Herpetic uveitis can occur, however, in the absence*

*of noticeable keratitis. The risk of associated glaucoma in*

*cases of herpes simplex uveitis is estimated at 28 to 40%.*

*5. Many conditions can produce intraocular inflammation and*

*elevated IOP (see the following list). The differential*

*diagnosis in this case includes Fuchs’ heterochromic*

*iridocyclitis (typically unilateral, rarely bilateral, insidious*

*onset, rarely symptomatic for ocular irritation, cataract*

*formation, heterochromia), HLA-B27-associated uveitis*

*(asymmetrically bilateral, arthritic conditions, synechiae*

*formation), and glaucomatocyclitic crisis (unilateral,*

*minimal inflammation, diagnosis of exclusion).*

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*24.1.1 Inflammatory Conditions*

*Associated with Glaucoma*

*1. Anterior uveitis:*

*a) HLA-B27-positive uveitis (Reiter’s, ankylosing spondylitis,*

*etc.).*

*b) Juvenile rheumatoid arthritis.*

*c) Fuchs’ heterochromic iridocyclitis.*

*d) Lens-induced uveitis.*

*e) Herpetic keratouveitis (simplex and zoster).*

*f) Posner–Schlossman syndrome.*

*2. Intermediate uveitis (pars planitis).*

*3. Panuveitis:*

*a) Sarcoidosis.*

*b) Toxoplasmosis.*

*c) Syphilitic uveitis.*

*d) Behçet’s syndrome.*

*e) Sympathetic ophthalmia.*

*f) Vogt–Koyanagi–Harada syndrome.*

*4. Masquerade syndrome (intraocular neoplasm).*

*24.2 Test Interpretation*

*A detailed history and review of system is essential in*

*approaching the patient with inflammatory glaucoma. Key*

*points include onset and duration of symptoms, unilateral or*

*bilateral involvement, race, age, prior ocular conditions, risk*

*factors for immune suppression or sexually transmitted diseases,*

*and history of travel or trauma. A family history of rheumatological*

*or ocular disease is especially important, as is a*

*review of systems for arthritic, dermatological, or pulmonary*

*symptoms.*

*Slit-lamp examination of the cornea may reveal epithelial or*

*stromal scarring caused by herpetic or syphilitic keratitis,*

*epithelial edema suggesting an acute rise in IOP, and KPs, which*

*may differentiate granulomatous from nongranulomatous*

*inflammation. The iris should be carefully evaluated for the*

*presence of nodules (seen in sarcoidosis), heterochromia (classic*

*for Fuchs’ iridocyclitis), and posterior synechiae formation*

*(which can cause acute angle closure from pupillary block). An*

*anterior chamber reaction consisting of cells and aqueous flare*

*is the hallmark of anterior uveitis. Glaucomatocyclitis crisis*

*(Posner–Schlossman syndrome) typically presents with mild,*

*recurrent, unilateral inflammation, whereas severe bilateral*

*reactions with hypopyon formation can be seen in Behçet’s disease*

*and HLA-B27-related uveitis. Masquerade syndromes from*

*an intraocular neoplasm may also present as apparent severe*

*inflammation.*

*Careful visualization of the angle, by means of gonioscopy, is*

*critical in the evaluation of all patients with elevated IOP. The*

*configuration of the angle should be noted, and anatomically*

*narrow angles that may be predisposed to closure must be*

*identified. Heavy pigmentation of the trabecular meshwork can*

*be seen in pseudoexfoliation, pigmentary dispersion syndromes,*

*and uveitis. In the last case, the pigment is usually*

*heaviest in the inferior angle, overlying the pocket formed by*

*the iris root and scleral spur. The formation of PAS is an important*

*feature of chronic inflammation, and PAS can lead to elevated*

*IOP and secondary angle closure. PAS can be*

*distinguished from normal iris processes by two features: (1)*

*PAS appear more solid or sheetlike, and (2) PAS obliterate the*

*angle recess. Iris processes tend to be open and lacy, follow the*

*normal curve of the angle, and reveal normal angle structures*

*in the open spaces between processes. Neovascular vessels in*

*the angle, which differ from normal iris vessels in that they*

*extend anteriorly over the scleral spur to reach the trabecular*

*meshwork, can be seen in Fuchs’ iridocyclitis. In the case of an*

*apparently closed angle, a small lens (such as the Zeiss gonioscopy*

*lens) should be used to indent the central cornea. This*

*maneuver (indentation gonioscopy) helps differentiate between*

*an appositionally closed angle that opens with aqueous pressure*

*and an angle that is permanently closed by PAS.*

*Dilated funduscopic examination is essential in determining*

*whether inflammation involves the posterior segment. The*

*collection of white cellular aggregates in the vitreous (“snowballs”)*

*or inferior pars plana (“snowbank”) suggests intermediate*

*uveitis. Inflammatory changes of the retina, retinal vessels,*

*or choroid, with concomitant iridocyclitis, suggest conditions*

*that can cause panuveitis, such as sarcoidosis, toxoplasmosis,*

*sympathetic ophthalmia, or Vogt–Koyanagi–Harada syndrome.*

*Detailed attention should be paid to the optic nerve to look for*

*glaucomatous changes such as asymmetry, excavation, notching,*

*disc hemorrhage, or nerve fiber layer defects.*

*Based on the history and physical exam, diagnostic laboratory*

*testing may be helpful. Special effort should be aimed at*

*identifying infectious etiologies that can be treated with antibiotics.*

*Commonly ordered tests include RPR/FTA-ABS to look for*

*syphilis, serum or aqueous titers for toxoplasmosis, and skin*

*PPD (purified protein derivative) or QuantiFERON-TB Gold test*

*for tuberculosis. HLA (human leukocyte antigen) haplotype*

*testing is helpful for suspected HLA-B27 uveitis and Behçet’s*

*disease. ANA (antinuclear antibody) testing is frequently positive*

*in juvenile rheumatoid arthritis. Herpetic keratouveitis can*

*usually be identified by the clinical picture alone.*

*Fig. 24.1 Transillumination of this eye makes it easy to see the patchy*

*iris atrophy associated with herpetic uveitis. (The image is provided*

*courtesy of Drs. Gary N. Holland and Thomas H. Pettit, Los Angeles,*

*CA.)*

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*24.3 Diagnosis*

*Herpes simplex anterior uveitis.*

*Secondary open angle glaucoma (inflammatory glaucoma).*

*24.4 Medical Management*

*The medical management of inflammatory glaucoma should*

*generally be directed at two main objectives: controlling*

*inflammation and reducing IOP.*

*Corticosteroids constitute the mainstay of therapy for most*

*causes of ocular inflammation. Topical administration is preferred*

*for anterior uveitis, and commonly used agents include*

*prednisolone 1% and dexamethasone 0.1%. Initial dosing may*

*require frequent, every-hour treatment, which can then be*

*tapered based on the clinical response. A newer generation of*

*steroids, such as rimexolone and loteprednol, is reported to be*

*less likely to cause a steroid-induced rise in IOP and may be*

*considered for patients on chronic therapy. Nonsteroidal antiinflammatory*

*agents such as flurbiprofen, ketorolac, and diclofenac*

*can also help control ocular inflammation. In severe cases*

*or those with associated extraocular involvement, systemic*

*therapy with immunosuppressive medications such as methotrexate*

*or azathioprine may be necessary.*

*Aqueous suppressants are generally considered the drugs of*

*choice for control of elevated IOP in inflammatory glaucoma.*

*Topical agents in this category include beta-adrenergic antagonists,*

*such as timolol and levobunolol, and the carbonic anhydrase*

*inhibitors, dorzolamide and brinzolamide. Adrenergic*

*agonists, such as apraclonidine and dipivefrin, may provide*

*additional pressure lowering. Miotics are not usually used in*

*the inflamed eye, as they aggravate the breakdown of the*

*blood–aqueous barrier and potentiate the formation of posterior*

*synechiae. Latanoprost and other prostaglandin analogs*

*(PGAs) have classically been avoided due to possible risks of*

*exacerbating the uveitis, causing cystoid macular edema (CME),*

*and reactivating herpes simplex keratouveitis; however, recent*

*evidence suggests that these complications are rare, and PGAs*

*may be used in patients with uveitic glaucoma, particularly*

*when the IOP is not controlled with aqueous suppressants*

*alone. Uveitis caused by infectious agents, such as syphilis or*

*toxoplasmosis, must be treated with appropriate antibiotics.*

*Topical trifluridine is effective against herpes simplex keratitis*

*with epithelial involvement and for prophylaxis against recurrence*

*of epithelial disease in patients on topical steroids. Topical*

*antivirals penetrate poorly into posterior stroma and anterior*

*chamber, however, and oral acyclovir has been reported to be*

*helpful against herpetic keratouveitis, both in the acute setting*

*and for prophylactic maintenance therapy.*

*Cycloplegic agents, including atropine or cyclopentolate, can*

*aid in relieving pain from ciliary muscle spasm, in preventing*

*formation of posterior synechiae, and in stabilizing the aqueous–*

*blood barrier.*

*24.5 Surgical Management*

*In general, glaucoma surgery should be deferred, if possible,*

*until active inflammation has been brought under control.*

*Surgery is indicated if, despite maximal medical therapy, the*

*IOP remains dangerously elevated, or glaucomatous visual field*

*defects and disc changes develop.*

*Laser peripheral iridotomy should be performed for acute*

*angle closure due to pupillary block, which may be caused by*

*posterior synechiae. The main complication is transient anterior*

*chamber inflammation and increased IOP, which may be ameliorated*

*by premedication with steroids and apraclonidine. If*

*laser iridotomy is unsuccessful, a surgical iridectomy may be*

*required. Laser peripheral iridotomy should be avoided, however,*

*in narrow angle patients with near-360-degree posterior*

*synechiae, as the shunting of aqueous through the iridotomy*

*may cause seclusio pupillae, precipitating iris bombé.*

*Laser trabeculoplasty is ineffective and contraindicated in*

*eyes with active inflammation. The risk of an acute rise in IOP is*

*greatly increased, as is formation of PAS leading to secondary*

*angle closure.*

*For inflammatory glaucoma with open angle, or chronic angle*

*closure, a trabeculectomy can be performed to lower IOP. The*

*use of an antimetabolite such as 5-fluorouracil or mitomycin C*

*significantly improves success rates. The risk of bleb failure is*

*higher in younger patients and those with uncontrolled inflammation.*

*Surgery to place an aqueous drainage device, such as*

*an Ahmed valve or Molteno implant, has also been shown to be*

*effective. Laser cyclophotocoagulation may be associated with*

*an intense inflammatory response postoperatively and should*

*be used with caution.*

*24.6 Rehabilitation and Follow-up*

*Frequent follow-up is essential for patients with uveitic glaucoma,*

*as many of these conditions have a waxing and waning*

*course. Attention must be paid to the presence of inflammation,*

*and steroids should be used to control inflammation*

*despite the risk of steroid-induced pressure elevation. Problems*

*associated with chronic intraocular inflammation, such*

*as band keratopathy and CME, should be actively sought and*

*treated.*

*In addition to monitoring IOP, optic nerve examination and*

*visual field testing are required to detect the development or*

*progression of glaucoma. In addition, the angle should be*

*closely evaluated with gonioscopy at each visit to look for evidence*

*of neovascularization or PAS formation, which may lead*

*to secondary angle closure. The development of glaucomatous*

*damage often occurs well after the initial presentation of acute*

*inflammation, and one should remain vigilant for glaucoma*

*even after the apparent resolution of uveitis.*

~~~~~CASE 25 Primary Congenital Glaucoma~~~~~

*25 Primary Congenital Glaucoma*

*Elena Bitrian and Alana L. Grajewski*

*Abstract*

*This chapter reviews the clinical findings, differential diagnosis*

*and unique challenges in the treatment of Primary Congenital*

*Glaucoma.*

*Keywords: glaucoma, pediatric, childhood, congenital, goniotomy,*

*trabeculotomy, drainage device*

*25.1 History*

*A 3-month-old female infant was referred after her mother noted*

*“cloudy eyes and tearing” for 3 to 4 weeks. The child was the*

*product of a full-term uneventful pregnancy and delivery with no*

*use of forceps. There was no known family history of glaucoma*

*and she had a 3-year-old brother without any ocular problems.*

*On examination in the office, the child was photophobic and*

*was more comfortable in dim illumination. Both eyes had a diffuse*

*corneal haze, the right more than the left. Estimated corneal*

*diameters measured in the office were 12mm in her right*

*eye and 11mm in her left eye (▶Fig. 25.1). Intraocular pressure*

*(IOP) measurements were taken with iCare while the infant*

*nursed on a bottle, and were 45 and 36mm Hg for the right and*

*left eyes, respectively.*

*Differential Diagnosis—Key Points*

*1. Cloudy corneas, tearing, and photophobia with high IOPs*

*are highly suggestive of childhood glaucoma. In this*

*particular clinical presentation, primary congenital*

*glaucoma (PCG) is the most likely diagnosis. However, other*

*ocular conditions that can present with a “cloudy cornea”*

*cannot be excluded until an examination under anesthesia is*

*performed.*

*PCG is the most common nonsyndromic glaucoma in*

*childhood, and it usually presents within the first 2 years of life.*

*Generally, the younger the presentation, the more serious the*

*disorder and the more guarded the prognosis. It is most often*

*bilateral (75% of the cases), but unilateral and asymmetric*

*cases are seen, such as with this particular infant. Males are*

*slightly more commonly affected than females. PCG is usually*

*inherited in an autosomal recessive manner, and in 10 to 40%*

*of cases, there is a reported family history of glaucoma. It is*

*more common in consanguineous populations and there are*

*families with multiple siblings with glaucoma from birth.*

*The most common clinical presentation includes corneal*

*enlargement with clouding, epiphora, and photophobia, all of*

*which were present in this child. These symptoms are*

*secondary to ocular abnormalities caused by elevated IOP.*

*2. Other causes of corneal haze or opacity include birth*

*trauma (forceps), sclerocornea, congenital hereditary*

*endothelial dystrophy, posterior polymorphous dystrophy,*

*numerous metabolic diseases, uveitis, and various forms of*

*anterior segment dysgenesis such as Peter’s anomaly. Each*

*of these has certain unique characteristics that help*

*distinguish it from primary infantile glaucoma.*

*3. Glaucoma in children is characterized by elevated IOP and*

*characteristic optic nerve cupping. In addition, ocular*

*enlargement (buphthalmos) is often seen. Ocular*

*enlargement secondary to childhood glaucoma should not*

*be confused with megalocornea or increased axial length*

*seen in myopia, and those two entities do not have elevated*

*IOP and corneal edema.*

*4. Nasolacrimal duct obstruction is the most common cause of*

*epiphora in this age group. Photophobia, corneal haze, and*

*corneal enlargement are not associated with this problem. A*

*mucopurulent discharge is often present and tends to*

*respond quickly to standard treatment.*

*5. Ocular tumors in infancy can also mimic childhood*

*glaucoma. Some ocular tumors may be associated with a*

*secondary elevated IOP that can produce some of the same*

*signs and symptoms of PCG. As the treatment is distinctly*

*different, it is imperative that this be considered in each*

*child in whom the view to the posterior segment is*

*obscured. Intraoperative ultrasound at the time of the initial*

*examination under anesthesia is, in this circumstance,*

*essential.*

*6. Finally, elevated IOP can also be associated with various*

*systemic syndromes such as Sturge–Weber, Rubinstein–*

*Taybi, and Lowe’s syndromes, rubella, and trisomy 13.*

*25.2 Test Interpretation*

*The testing for primary infantile glaucoma can be thought of as*

*those examinations with or without anesthesia. An office*

*examination is typically without anesthesia. Very young infants*

*can often be pacified with a bottle for obtaining an initial pressure*

*measurement in the office. The ICare is the preferred*

*method to check IOP in clinic since it does not require anesthetic*

*eye drops for pressure care and there is minimal contact*

*with the corneal surface for the reading.*

*A full examination under anesthesia is usually performed initially*

*in the operating room and requires general anesthesia*

*with laryngeal mask or endotracheal intubation. Brief examinations*

*can be safely performed under anesthesia supervision*

*without intubation using an inhalational anesthetic by mask*

*with an oral airway. The examination under anesthesia consists*

*of pressure measurement, corneal diameter measurements,*

*ultrasonography (axial length and biomicroscopy if needed),*

*anterior segment examination, and gonioscopy. The dilated*

*fundus examination with optic disc photos can be done if surgery*

*is not planned. If surgery is planned, the pupils are not*

*dilated.*

*Glaucoma*

*80*

*25.3 Diagnosis*

*The diagnosis of PCG depends on several factors, with IOP*

*measurement being only one. Anesthetic agents as well as facial*

*compression from the mask can influence IOP measurements.*

*Because of this, it is best to obtain two sets of measurements:*

*the first under light anesthesia as soon as the child is quiet, and*

*the second measurement once the airway is secured. Any consistent*

*method to measure IOP is acceptable. In the operating*

*room, the most common method to check IOP is Tonopen, as*

*well as hand-held applanation instruments (Perkins). The normal*

*IOP in infants is slightly lower than that found in adults.*

*This is because the ciliary body does not reach the capacity for*

*full aqueous production until several months after birth. Asymmetric*

*IOPs are often helpful in distinguishing bilateral from*

*unilateral or asymmetric cases.*

*Normal neonatal corneal diameters are 10 to 10.5mm horizontally*

*and increase 0.5 to 1.0mm over the first year. Any corneal*

*diameter ≥ 11.5mm in a newborn is almost certainly*

*pathologic. With respect to ocular enlargement, measurement*

*of axial length by A-scan ultrasonography is extremely useful*

*for diagnosis and follow-up. A child younger than 3 years can*

*suffer stretching of the tissues due to elevated IOP. This stretching*

*can produce Descemet’s breaks (also known as Haab’s*

*striae) and increased axial length. After 3 years of age, elevated*

*IOP does not cause those changes. On occasions, the anterior*

*segment examination can be limited by corneal edema and*

*opacity. Nevertheless, one should record the corneal breaks in*

*Descemet’s membrane as these become useful for comparison*

*in follow-up (▶Fig. 25.2). On gonioscopy, the iris appears*

*stretched with thinning of the anterior stroma and a high flat*

*insertion into the trabecular meshwork (▶Fig. 25.3). If surgery*

*is not planned, dilated retina examination and optic disc stereo*

*photographs are performed. Stereoscopic disc photographs are*

*clinically one of the most useful tools for long-term follow-up.*

*25.4 Medical Management*

*PCG is a surgical disease. Medications can be used in the preoperative*

*period to minimize any further damage from elevated*

*IOP and to decrease the corneal edema. Medical treatment prior*

*to surgery facilitates a better examination of the anterior and*

*posterior segments and often allows to perform angle surgery*

*through an ab interno approach. Topical glaucoma agents that*

*can be used include carbonic anhydrase inhibitors (brimonidine*

*and dorzolamide) and selective beta-blockers. Beta-blockers*

*must be used with caution in children and usually 0.25% dose is*

*used on younger children. The use of topical alpha-2 agonist in*

*small children is associated with profound sedative effects. In*

*addition, these agents prolong the effect of anesthesia and these*

*are contraindicated in infants. Oral acetazolamide can be*

*administered in a syrup suspension of acetazolamide at 5 to*

*10mg per kg every 6 to 8 hours.*

*Fig. 25.2 Horizontal break in Descemet’s membrane, Haab’s striae,*

*right eye.*

*Fig. 25.3 Gonioscopy demonstrates the high flat insertion with*

*peripheral anterior stromal thinning typical of primary congenital*

*glaucoma.*

*Fig. 25.1 Examination under anesthesia. Both corneas are enlarged,*

*the right more than the left. The left cornea demonstrates a moderate*

*central corneal haze; the right cornea has a more subtle epithelial*

*edema seen best with the microscope.*

*Primary Congenital Glaucoma*

*81*

*25.5 Surgical Management*

*Prompt surgery is essential in most cases of childhood glaucoma.*

*Damage from elevated IOP is more likely the longer IOP*

*remains elevated and the higher the IOP is. In the case we presented,*

*with the presumptive diagnosis of PCG made at the time*

*of the office examination, the child should be placed on medication*

*(topical or oral carbonic anhydrase inhibitor) until the*

*pediatrician and anesthesiologist give clearance for general*

*anesthesia. In order to minimize the time until treatment as*

*well as limit exposure to anesthesia, surgery should be planned*

*for the same time as the initial full examination under anesthesia*

*if the diagnosis is confirmed. For this reason, the initial*

*examination should be performed by a surgeon familiar with*

*angle surgery for childhood glaucoma. The surgical procedure*

*of choice for PCG is angle surgery, either goniotomy or trabeculotomy.*

*Both procedures have high success and low complication*

*rates. These procedures work equally well. The preferred*

*approach is to treat the angle of 360 degrees with either of*

*these methods before moving on to other surgery. The success*

*rate of this procedure is between 80 and 90% with initial angle*

*surgery, thus making the need for a second procedure rare. If*

*IOP remains uncontrolled following 360 degrees of surgical*

*treatment of the angle, without other factors complicating the*

*clinical picture (e.g., hyphema or anterior chamber inflammation),*

*the temporary use of topical medications can be tried.*

*After a sufficient time from surgery and if medical therapy is*

*not adequate, a glaucoma drainage device such as a Baerveldt*

*shunt is placed. This style of drainage device is preferred in*

*infants as its low contour better conforms to the globe and so it*

*is less likely to displace the globe. There have been reports of*

*success with trabeculectomy; however, these rarely function*

*without the use of an antimetabolite. Mitomycin C enhances*

*the success rate of filtering surgery in children. Given the longterm*

*risks of a mitomycin bleb in a child, however, traditional*

*angle surgery and/or a drainage implant is preferred. Cyclodestructive*

*procedures are reserved for those cases that fail filtration*

*procedures.*

*25.6 Rehabilitation and Follow-up*

*After completion of a full examination under anesthesia and*

*angle surgery, the child should be placed on topical cycloplegics*

*and steroids for 1 to 2 weeks. A second examination under*

*anesthesia is performed at 8 to 10 weeks postoperatively. All*

*measurements are repeated. If the IOP is acceptable, the baby is*

*dilated for disc photography and fundus examination. Followup*

*examinations under anesthesia can be performed about*

*every 2 to 3 months, until it is certain that the IOP is stable or*

*the child is able to be examined in clinic. At that point, examinations*

*can be every third to fourth month and then reduced to*

*every 6 months, when the patient is stable. By the age of 3 or 4*

*years, the child can generally be examined in the office.*

~~~~~CASE 26 Ocular Hypotony~~~~~

*26 Ocular Hypotony*

*Thomas W. Samuelson*

*Abstract*

*Ocular hypotony is a relatively common adverse event following*

*filtration surgery. Hypotony can present at any time postoperatively,*

*ranging from the immediate postoperative period to*

*many years later. The causes of hypotony following filtration*

*surgery are numerous and varied. The workup of this condition*

*should be systematic utilizing history to ensure proper adherence*

*to pharmacologic therapy including discontinuation of*

*aqueous suppressants, the Seidel test to assess for wound leaks,*

*fundoscopy to assess for choroidal effusion, and gonioscopy to*

*rule out cyclodialysis cleft formation. Once the cause of hypotony*

*has been identified, appropriate treatment is initiated.*

*Common treatment modalities include observation, discontinuation*

*of all aqueous suppressants, cycloplegia, and treatment of*

*wound leaks as needed utilizing direct closure with sutures*

*when necessary. In cases of anterior chamber shallowing, reformation*

*with viscoelastic material may be warranted. In cases of*

*primary overfiltration, use of a bandage contact lens to tamponade*

*the filtration site, autologous blood patches, and/or bleb*

*compression sutures may be useful. Finally, when more conservative*

*measures fail, returning to the operating room to place*

*additional scleral flap sutures may be necessary.*

*Keywords: glaucoma, low pressure, overfiltration, choroidal effusion,*

*maculopathy*

*26.1 History*

*A 45-year-old woman was referred for surgical management of*

*inflammatory glaucoma in her aphakic right eye. Her left eye*

*had had only light perception since birth due to persistent*

*hyperplastic primary vitreous.*

*The preoperative visual acuity with aphakic correction was*

*20/20. The intraocular pressure (IOP) was 40mm Hg on maximum*

*medical therapy including oral agents. Central corneal*

*thickness was 535 μm in each eye. There was 1+ cell and flare*

*in the anterior chamber (AC) with scattered, fine, keratic precipitates.*

*There was vitreous at the pupillary plane. The optic disc*

*was markedly excavated with a cup-to-disc ratio of 0.9 and a*

*notch inferiorly. The visual field had a superior altitudinal defect.*

*A trabeculectomy with mitomycin C and subtotal vitrectomy*

*was performed without incident. Postoperatively, the visual*

*acuity remained 20/20. The IOP was well controlled in the range*

*of 9 to 12mm Hg for the first postoperative year. However, 1*

*year after surgery, the patient presented with a complaint of*

*worsening vision.*

*The visual acuity was 20/60. An increase in hyperopic correction*

*of + 1.50 diopters improved the visual acuity to 20/20. The*

*bleb was highly elevated, avascular, and cystic. The remainder*

*of the examination was unchanged from baseline with the*

*exception of moderate chorioretinal folds involving the posterior*

*pole and macula. The IOP was 3mm Hg.*

*Differential Diagnosis—Key Points*

*This patient has hypotony with maculopathy. The differential*

*diagnosis of hypotony in this case includes several disorders.*

*1. Primary overfiltration. This disorder is most common in the*

*early postoperative period following trabeculectomy when*

*the eye is still recovering from chronic pharmacologic*

*aqueous suppression and the conjunctiva has yet to*

*contract in the region of the filter. Hypotony related to*

*overfiltration is a diagnosis of exclusion. Primary*

*overfiltration implies that the basic problem relates to*

*excessive outflow rather than to an abnormally low*

*production of aqueous. Clinically, the bleb is generally*

*exuberant and highly elevated. Primary overfiltration must*

*be distinguished from secondary overfiltration that may*

*result from a wound leak or cyclodialysis cleft. These*

*conditions are discussed below.*

*2. Underproduction (hyposecretion) of aqueous.*

*Hyposecretion of aqueous is an important cause of ocular*

*hypotony. Hyposecretion may occur when aqueous*

*suppressants are not discontinued following filtration*

*surgery. Pharmacologic hyposecretion of aqueous is*

*diagnosed by obtaining the appropriate history.*

*Hyposecretion may also occur in response to inflammation.*

*Clinically, there may be significant flare in the AC due to*

*decreased clearance of proteins and altered blood–aqueous*

*barrier. The bleb is generally lower and more vascularized in*

*such eyes. Hyposecretion may also result from ciliary*

*detachment or ocular ischemia; these conditions are*

*addressed below.*

*3. Bleb leak. A bleb leak can result in hypotony and may*

*occur at any time following glaucoma filtration surgery.*

*A Seidel test is mandatory in any postsurgical patient*

*with hypotony. The entire bleb and incision line should*

*be painted with fluorescein; the leak is apparent where*

*the dye is displaced. In general, a bleb leak will result in*

*a lower bleb. However, bleb morphology may be variable*

*in eyes with leaks and should not be relied on for the*

*diagnosis. The diagnosis and management of bleb leaks*

*are discussed in Case 28.*

*4. Cyclodialysis cleft. A cyclodialysis cleft is a relatively*

*uncommon condition that may result in profound hypotony.*

*It is most common following cataract surgery utilizing a*

*scleral tunnel incision. However, a cleft may also occur*

*following glaucoma filtration surgery when the block*

*excision is too posterior and the ciliary body is disinserted*

*from the scleral spur. Additionally, a cleft may also occur*

*following trauma. Hypotony results from increased outflow*

*facility as aqueous is diverted from the AC into the*

*suprachoroidal space. The diagnosis is made by careful*

*gonioscopy. If the AC is too shallow to visualize the angle,*

*viscoelastic material may be injected to deepen the AC to*

*improve visualization.*

*Ocular Hypotony*

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*5. Retinal detachment. Retinal detachment may cause*

*hypotony by increasing uveal scleral outflow or by*

*decreasing aqueous production. The diagnosis is made by*

*fundus examination or by ultrasound in the event that*

*media opacity precludes a view of the posterior pole.*

*6. Choroidal effusion. This is not typically a primary cause of*

*hypotony but rather a result of hypotony. However, the*

*presence of fluid in the suprachoroidal space may result in*

*ciliary detachment that in turn may decrease aqueous*

*production, which may exacerbate hypotony. The diagnosis*

*of choroidal effusion is made by indirect biomicroscopy and*

*identification of smooth, dome-shaped, lobular elevation of*

*the retina. Characteristically, the AC is shallow.*

*7. Ocular ischemia. Ocular ischemia–related hypotony results*

*from decreased aqueous production due to underperfusion*

*of the ciliary body. Associated findings may include rubeosis*

*iridis, low-grade AC reaction, and scattered blot*

*hemorrhages in the retina. Carotid artery blood flow studies*

*or fluorescein angiography will provide the definitive*

*diagnosis.*

*8. Occult globe perforation. This disorder is a rare cause of*

*ocular hypotony. Most commonly, globe perforation occurs*

*during retrobulbar injection or during placement of the*

*rectus traction suture used to stabilize the globe during*

*surgery. The diagnosis is made by fundus examination.*

*26.2 Test Interpretation*

*The slit-lamp and fundus examination generally provide the*

*necessary information to correctly identify the etiology of ocular*

*hypotony (▶Table 26.1). Once the visual acuity and IOP are*

*measured, the bleb is examined carefully. The elevation, vascularity,*

*and extent of the bleb should be noted (▶Fig. 26.1). The*

*presence or absence of microcyst formation within the bleb*

*should be noted. Examination of the bleb should include a*

*Seidel test to rule out a bleb leak. A Seidel test is best accomplished*

*by using a moistened strip of fluorescein and directly*

*painting the bleb and incision line. A wound leak is identified*

*by detecting a stream of bright green aqueous using cobalt blue*

*light at the slit lamp (▶Fig. 26.2). It is important to realize that*

*an intermittent leak may not be apparent if hypotony is profound*

*and there is no flow gradient. In such cases, gentle pressure*

*may be applied to the globe under direct visualization at*

*the slit lamp. The increased pressure gradient may reveal an*

*occult leak.*

*Slit-lamp biomicroscopy is used to document the AC depth.*

*The AC may be shallow or of normal depth. A shallow AC is a*

*nonspecific sign and, unlike the bleb appearance, does not help*

*discern the etiology of the low IOP. Finally, the presence of*

*intraocular inflammation should be noted. This inflammation is*

*a nonspecific sign, but pronounced AC flare may be a sign of*

*decreased aqueous production.*

*Fig. 26.1 Typical appearance of an overfiltering bleb in a patient with*

*hypotony.*

*Fig. 26.2 Positive Seidel’s test in a patient with hypotony.*

*Table 26.1 Differential diagnosis of postoperative hypotony*

*Diagnosis Test results/exam featuresa*

*Overfiltration Seidel (–)*

*Bleb high on exam*

*Bleb leak Seidel (+)*

*Bleb variable—generally low*

*Decreased production—*

*pharmacologic*

*History of aqueous suppression therapy*

*Seidel (–)*

*Bleb low*

*Decreased production—*

*nonpharmacologic*

*Seidel (–)*

*Increased Inflammation, increased flare*

*fundus exam/ultrasound*

*R/O retinal detachment*

*Ciliary detachment*

*Choroidal effusions*

*Bleb low*

*Cyclodialysis cleft Gonioscopy confirms presence of cleft*

*bleb low*

*Retinal detachment Fundus exam/ultrasound*

*Ocular ischemia Peripheral retinal hemorrhage*

*Angle neovascularization*

*Carotid studies*

*Globe perforation Fundus exam detects perforation or*

*vitreous hemorrhage*

*aA Seidel test is mandatory on every patient with hypotony.*

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*The fundus examination will rule out retinal detachment, an*

*uncommon but important cause of low IOP. Additionally, fundus*

*examination may document the presence of choroidal effusion.*

*Occasionally, a very anterior or annular choroidal effusion*

*may be occult and not visible on standard fundus exam with*

*indirect biomicroscopy. Such cases may be detected by ultrasound*

*biomicroscopy. Finally, the macula should be examined*

*for striae, which may result from hypotony. The macular striae*

*characteristic of hypotonous maculopathy do not typically have*

*an exudative component. Fluorescein angiography is generally*

*not helpful. Finally, the fundus exam may reveal a swollen or*

*hyperemic optic disc, another nonspecific sign of hypotony.*

*Gonioscopy is useful to rule out a cyclodialysis cleft or excessively*

*large sclerostomy site. Additionally, gonioscopy is necessary*

*to rule out angle neovascularization in cases of ocular ischemia.*

*Refraction is useful in cases of reduced visual acuity associated*

*with hypotony. Relative myopia may result from shallowing*

*of the AC and forward displacement of the lens or*

*intraocular lens. Conversely, relative hyperopia may result*

*when profound hypotony causes contraction of the globe and*

*decreased axial length. An axial length measurement may confirm*

*reduced axial length relative to baseline values or compared*

*to the fellow eye. Reduced axial length is a common*

*finding in patients with hypotonous maculopathy (▶Fig. 26.3).*

*In general, choroidal effusions are more common in elderly*

*patients with rigid sclera, while globe contraction is more common*

*in younger patients with less rigid sclera.*

*The patient in this case discussion had hypotony associated*

*with a large, avascular, Seidel-negative bleb. Slit-lamp examination*

*found the eye to be quiet and noninflamed. Gonioscopy*

*excluded a cyclodialysis cleft. The axial length was 0.75mm*

*shorter and refraction 1.5 diopters more hyperopic than baseline*

*readings. Maculopathy was detected by fundus exam. There was*

*no retinal or choroidal detachment. Finally, a careful patient history*

*confirmed that the patient was not taking any topical or*

*systemic medications that could suppress aqueous production.*

*26.3 Diagnosis*

*Hypotony due to primary overfiltration.*

*26.4 Medical Management*

*For mild hypotony early in the postoperative period, pharmacologic*

*treatment may stabilize the eye until the overfiltration*

*spontaneously resolves. Cycloplegic agents may help deepen*

*the AC and stabilize the blood–aqueous barrier. While aqueous*

*suppressants are often administered to treat bleb leaks, they*

*are not helpful in cases of hypotony related to overfiltration.*

*Topical corticosteroids may quiet the eye and maximize aqueous*

*production. However, they may also make the bleb thinner*

*and less vascular, preventing bleb contraction. As such, the benefit*

*of topical corticosteroids on aqueous production must be*

*weighed against the potential negative effect on an overfiltering*

*bleb.*

*26.5 Surgical Management*

*When hypotony is profound and persistent, surgical intervention*

*may be necessary. Several procedures have been advocated*

*to treat overfiltration including compression shells or sutures,*

*inflammation-inciting measures such as trichloroacetic acid,*

*autologous blood patch (▶Fig. 26.4), and bleb remodeling with*

*Nd:YAG laser. As a rule, mild cases may respond to these measures.*

*However, more profound and protracted hypotony often*

*requires surgical revision such as resuturing of the scleral flap*

*with either transconjunctival scleral flap sutures or bleb revision*

*performed by dissection down to bare sclera and directly*

*resuturing the scleral flap (▶Fig. 26.5, ▶Fig. 26.6). Mattress*

*sutures have also been described to compress the bleb externally*

*(▶Fig. 26.7).*

*Fig. 26.3 Typical fundus appearance of a hypotonous eye with disc*

*swelling and chorioretinal folds.*

*Fig. 26.4 Mild cases of overfiltration hypotony may be successfully*

*managed with an autologous blood patch.*

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*26.6 Rehabilitation and Follow-up*

*Cycloplegic agents and conservative observation failed to*

*reverse the hypotony. An autologous blood patch also failed.*

*The patient was then taken to the operating room where two*

*additional sutures were placed in the scleral flap (▶Fig. 26.6).*

*The bleb was not excised. The patient responded well with*

*increased IOP into the 20 s. The axial length, refraction, and visual*

*acuity returned to normal. One month postrevision, suture*

*lysis was performed resulting in IOP of 13mm Hg. Six years*

*later, the IOP has remained in the low teens with no recurrent*

*hypotony.*

~~~~~CASE 27 PosttrabeculectomyWound Leak~~~~~

*27 PosttrabeculectomyWound Leak*

*Xuan Thanh Le-Nguyen and Robert M. Feldman*

*Abstract*

*This chapter discusses the initial evaluation, diagnosis, and*

*treatment options for bleb leaks associated with hypotony after*

*trabeculectomy.*

*Keywords: hypotony, trabeculectomy, treatment of hypotony,*

*bleb leaks, glaucoma*

*27.1 History*

*A 59-year-old woman with advanced primary open-angle glaucoma*

*underwent a limbus-based trabeculectomy with intraoperative*

*application of mitomycin C in the right eye. The*

*scleral flap was closed with two 10–0 nylon sutures. Tenon’s*

*capsule was closed with a running locking 8–0 dissolvable*

*suture (Vicryl, Ethicon, Inc., Somerville, NJ), and the conjunctiva*

*was closed with a running, nonlocking 8–0 dissolvable suture.*

*Five months postoperatively, the patient presented for*

*examination because of a dramatic decrease in vision in the*

*right eye. On examination, the best-corrected visual acuity was*

*20/100 in the right eye and 20/30 in the left eye. The anterior*

*chamber of the right eye was very shallow, and the intraocular*

*pressure (IOP) was 2mm Hg (▶Fig. 27.1).*

*Differential Diagnosis—Key Points*

*The causes of postoperative shallow anterior chamber and low*

*IOP can be divided into two major groups depending on the*

*timing of the complication.*

*1. Early postoperative (less than 4 weeks). Early*

*postoperative shallowing of the anterior chamber*

*associated with low IOP may be due to overfiltration,*

*reduced aqueous production, wound leak, or choroidal*

*effusion or hemorrhage (▶Fig. 27.2).*

*a) Bleb overfiltration occurs when there is an excessive*

*outflow of aqueous. Early postoperative cases may be*

*due to intraoperative surgical limitations and*

*imprecision, such as a large ostium with a small flap, the*

*presence of an ostium in close relation to the edge of the*

*scleral flap, and loose sutures. Ultimately, excessive flow*

*is due to a relative lack of resistance to aqueous outflow.*

*The incidence of early postoperative shallowing and*

*hypotony might be reduced by tighter scleral flap sutures*

*with sequential suture release by argon laser suture lysis*

*or releasable suture techniques. Overfiltration is initially*

*managed by external tamponade. However, surgical*

*correction to tighten the scleral flap may be required.*

*Usually, this problem will correct itself within 2 weeks of*

*surgery if there are no intervening complications.*

*b) Causes of postoperative aqueous hyposecretion include*

*the postoperative use of topical aqueous suppressants or*

*systemic carbonic anhydrase inhibitors, excessive*

*postoperative use of topical phenylephrine, and*

*detachment of the ciliary body. Cyclodialysis clefts may*

*lead to hypotony initially by increased outflow, which*

*may continue or be superimposed by choroidal effusions*

*and decreased aqueous production.*

*c) A wound leak is one of the most common causes of early*

*shallowing of the anterior chamber with hypotony. A*

*Seidel test is necessary to localize the leak (▶Fig. 27.3).*

*Causes include conjunctival buttonholes, wound*

*dehiscence, or a traumatized thin filtering bleb. The*

*management of wound leak depends on the character*

*and location of the filtering bleb. Initial treatment may be*

*a pressure patch with aqueous suppression and*

*withholding of topical corticosteroids until resolved. Use*

*of a Simmons shell or an oversized bandage contact lens*

*may be useful. Definitive therapy is surgical closure.*

*d) Choroidal effusion is a common complication following*

*filtering surgery and usually associated with hypotony.*

*The effusion is usually transient, and the management is*

*mainly topical or systemic corticosteroids combined with*

*cycloplegics. Systemic corticosteroids should be reserved*

*for cases of “kissing” choroidals. Surgical drainage is*

*indicated if there is persistent shallowing of the anterior*

*chamber, corneal decompensation, or synechial*

*formation. These will generally resolve with conservative*

*treatment by 2 weeks, after which drainage and*

*reformation of the anterior chamber should be*

*considered.*

*2. Late Postoperative (Greater than 4 Weeks). The most*

*common causes of late postoperative anterior chamber*

*shallowing with low IOP are chronic hypotony and late bleb*

*leaks.*

*a) Chronic hypotony (IOP less than 5mm Hg) might be a*

*manifestation of overfiltration, aqueous hyposecretion,*

*cyclodialysis cleft, undetected retinal detachment, or*

*bleb leaks. Postoperative chronic hypotony is more*

*common after trabeculectomy with antifibrotics (5-*

*fluorouracil or mitomycin C) as compared to*

*trabeculectomy alone.1,2,3 The most common sequela is*

*hypotony maculopathy, which is more common in young*

*males and in high myopes.4,5 Clinical manifestations of*

*hypotony include choroidal and retinal folds, optic disc*

*swelling, and engorgement and tortuosity of the retinal*

*vasculature.*

*The management of chronic hypotony is mainly directed*

*at eliminating the underlying cause. The goal is to decrease*

*excessive aqueous outflow and eliminate the choroidal*

*effusion. Aqueous suppression should be*

*discontinued, including stopping beta-blockers in the*

*other eye as a crossover effect exists.6 Large overfiltering*

*blebs can be reduced in size by placement of compression*

*sutures, cryotherapy, argon or Nd:YAG laser, or injection*

*of autologous blood. Oddly enough, needle revision*

*can be successful in reshaping blebs and reducing hypotony.*

*If the previous measures fail, more invasive surgical*

*bleb revision, including resuturing the scleral flap, might*

*be required.*

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*b) Late bleb leak is a well-documented complication of*

*filtering surgery with antimetabolite usage and may*

*develop months or years after the initial surgery.2,7 This*

*condition is more common with cystic, thin-walled,*

*avascular blebs. In contrast to early leaks, late bleb leaks*

*carry a high risk of developing infections, such as blebitis*

*or endophthalmitis.5 Chronic hypotony maculopathy can*

*also occur and may result in permanent reduction of*

*central vision. Typically, stopping a late leak is not*

*adequate in the long term as it will likely recur. Some*

*form of bleb recovering or resurfacing is required to treat*

*late bleb leaks definitively.*

*27.2 Test Interpretation*

*The clinical examination should include characterization of bleb*

*appearance and assessment of the leak. A moistened sterile fluorescein*

*strip should be applied to the bleb under cobalt blue*

*slit-lamp illumination. A leak is defined as a spontaneous focalpoint*

*source of aqueous leakage from an area of interrupted*

*conjunctival tissue. Anterior chamber depth should also be*

*assessed (▶Fig. 27.3 and ▶Table 27.1).*

*27.3 Diagnosis*

*Late bleb leak.*

*27.4 Medical Management*

*With the advent of antimetabolites, the success rates of glaucoma*

*filtering procedures have drastically improved.2 However,*

*the improved pressure-lowering effect has increased postoperative*

*complications including bleb leaks (both early and late),*

*hypotony, and hypotony-induced maculopathy.1 Although*

*many treatment options have been proposed, successful closure*

*of bleb leaks following trabeculectomy remains difficult, and*

*the best method of repair is controversial.*

*If left untreated, hypotony with a flat anterior chamber can*

*have many complications such as cataract, corneal decompensation,*

*synechiae, choroidal effusions, or macular edema.4,8*

*Management of bleb leaks is challenging. Typically, initial*

*treatment is aqueous suppression and observation (with or without*

*a bandage contact lens). Suppression of aqueous production*

*slows the flow through the leak, allowing epithelial proliferation*

*and healing with closure of the defect. This is often inadequate*

*as a long-term solution, as these leaks may spontaneously*

*resolve and reappear elsewhere within the ischemic bleb.*

*Other techniques include the following.*

*27.4.1 Autologous Blood Injections*

*Autologous blood has been used in the medical field for many*

*established applications including its use as a “patch”; examples*

*include closure of spinal tap leaks or pulmonary air leaks.*

*Fig. 27.2 Management flow chart for*

*posttrabeculectomy wound leak.*

*Fig. 27.1 Slit-lamp photograph of the right eye demonstrating a low*

*filtering bleb.*

*Glaucoma*

*88*

*Autologous blood can be injected into the bleb or into the surrounding*

*subconjunctival tissue. The procedure can be performed*

*with topical anesthesia at the slit lamp. The underlying*

*hypothesis is that whole blood contains factors, blood cells, and*

*other proteins that may initially cause obstruction of flow.*

*Some of these components may also contribute to fibroblastic*

*transformation to replace inactivated Tenon’s capsule fibroblasts.*

*Complications of the procedure include hyphema, bleb*

*perforation, very high IOPs, and infection. This procedure is*

*often ineffective, and multiple injections might be necessary.9*

*27.4.2 Argon Laser*

*The mechanism behind how argon laser closes a conjunctival*

*leak is not entirely understood. It is thought that there may be a*

*mechanical effect caused by the shrinking of the conjunctiva*

*(possibly bringing the ends of a tear together) or a thermal*

*effect characterized by the coagulation of epithelial cells to form*

*a seal over the break. The application of laser may also cause a*

*release of inflammatory products that can promote healing.*

*Unfortunately, this technique is plagued with complications*

*such as fenestration and pitting of the conjunctiva, corneal stromal*

*opacities, and need for retreatment.10*

*27.4.3 Continuous-Wave Nd:YAG Laser*

*This laser is not readily available to most surgeons and is*

*expensive. Disadvantages include iatrogenic bleb leaks, pupillary*

*retraction toward the bleb, pigmentation precipitation by*

*the laser that can affect future laser treatment, and pupil flattening*

*or peaking. The mechanism by which Nd:YAG laser*

*remodels filtering blebs is not readily explained, and the longterm*

*results have been disappointing.11*

*27.5 Surgical Management*

*Various surgical approaches to repair leaking blebs have been*

*described. The decision on which approach to use will depend*

*on the cause of the leak (bleb cyst structure, weak overlying*

*conjunctiva, thin sclera, and/or melted sclera, etc.). These*

*approaches include excision of the bleb with advancement of*

*adjacent conjunctiva, revision of the bleb with autologous conjunctival*

*graft, patch material over the ostium/sclera (materials*

*include clear cornea, amniotic membrane, or scleral patch*

*grafts), Tenon’s capsule pedicle plugs, glue, and rotational conjunctival-*

*Tenon’s flap grafts.12,13,14,15 A technique of free conjunctival*

*patching over ischemic blebs has been reported to*

*have excellent results.14*

*27.6 Rehabilitation and Follow-up*

*Once the leak is closed, the patients are to be followed closely*

*for recurrent leaks if an ischemic bleb remains. If definitive surgical*

*intervention was successful, the bleb will no longer be*

*ischemic, and the risk of recurrence will be low.*

~~~~~CASE 28 Failing Filtering Bleb~~~~~

*28 Failing Filtering Bleb*

*Xuan Thanh Le-Nguyen and Robert M. Feldman*

*Abstract*

*This chapter reviews the clinical findings, differential diagnosis,*

*and treatment for a failed filtering bleb.*

*Keywords: failed bleb, flat bleb, surgical management of failed*

*blebs, glaucoma*

*28.1 History*

*A 53-year-old African American woman with advanced primary*

*open-angle glaucoma and a target intraocular pressure (IOP) of*

*15mm Hg underwent a limbus-based trabeculectomy with intraoperative*

*application of mitomycin C in the right eye. At the*

*1-year postoperative visit, the IOP was at target, and a moderately*

*elevated diffuse ischemic bleb was present with microcysts.*

*Three months later, the patient presented with an IOP of*

*28mm Hg. The anterior chamber was deep; the filtering bleb,*

*however, was almost flat (▶Fig. 28.1).*

*28.2 Differential Diagnosis—Key*

*Points*

*Modern techniques for performing trabeculectomy have led to*

*very high success rates.1 However, late failure can occur, and*

*the surgeon must be prepared to manage these cases.*

*Elevated IOP in the setting of a deep anterior chamber in the*

*postfiltration eye may be classified based on the appearance of*

*the filtering bleb and the timing of the elevated IOP.When associated*

*with a high bleb, the most likely cause is an encapsulated*

*filtering bleb (Tenon’s capsule cyst), which typically does not*

*occur as late as this case. When associated with a low bleb, the*

*most likely causes are tight scleral flap sutures, occlusion of the*

*sclerostomy site potentiating filtration failure, or fibrosis within*

*the bleb.*

*Risk factors for filtration failure include young age, race,*

*inflammatory conditions such as uveitis, a history of prior failed*

*filtering procedure or other conjunctival procedure, neovascular*

*glaucoma, and aphakia. Older patients typically have a less*

*robust propensity toward scar formation than younger patients.*

*One also has to consider that iatrogenic surgical techniques,*

*such as excessive cautery, failure to adequately control hemorrhage,*

*or excessive intraocular manipulation, may also lead to*

*failure of the filtering bleb.2,3*

*28.2.1 Elevated IOP Associated with*

*High Bleb*

*Encapsulated Filtering Bleb (Tenon’s Cyst)*

*(Early)*

*The most common cause of filtering surgery failure is encapsulation*

*of the filtration bleb, typically causing failure during the*

*first 6 weeks after surgery. Clinically, the encapsulated bleb*

*appears as an elevated, dome-shaped structure at the site of the*

*filtration bleb. Histopathologically, the cyst consists of dense*

*subconjunctival connective tissue, few cells, and no cellular lining.*

*The aqueous becomes entrapped within the cystlike cavity*

*of hypertrophied Tenon’s capsule.4,5,6*

*Many encapsulated blebs will eventually resolve spontaneously*

*without intervention. However, digital compression can*

*be applied to encourage filtration, and topical anti-inflammatory*

*agents might be used to inhibit further fibrosis. If conservative*

*treatment fails to reduce IOP, surgical intervention might*

*be indicated (see below).*

*28.2.2 Elevated IOP Associated with*

*Low Bleb (Early)*

*Tight Scleral Flap Sutures*

*In the early postoperative period, elevated IOP in the setting of*

*a low bleb can indicate that the scleral flap sutures are too tight.*

*While in the operating room, each surgeon has his or her own*

*technique on how to titrate the tightness of the knots as well as*

*the placement and number of sutures to try to control bleb formation.*

*Postoperatively, however, the management is often done*

*using an argon laser or releasing releasable sutures if placed. A*

*suture lysis lens can be used on a topically anesthetized eye to*

*lyse sutures per surgeon preference. The procedure should be followed*

*by a gentle digital ocular massage to facilitate the egress*

*of aqueous if necessary. One suture at a time should be cut, and*

*the procedure should not be done during the first 3 postoperative*

*weeks to avoid overfiltration and hypotony. Unfortunately, the*

*procedure may be associated with hypotony due to excessive*

*flow, conjunctival burns, or buttonholes.*

*Occlusion of the Sclerostomy Site*

*In the early postoperative period, the internal sclerostomy*

*may become obstructed (tissue incarceration), causing elevation*

*of IOP. Although this is uncommon, incarceration can be*

*ruled out by gonioscopy. Possible causes of obstruction include*

*Fig. 28.1 Slit-lamp photograph demonstrating a flat filtering bleb.*

*Glaucoma*

*90*

*incompletely excised Descemet’s membrane, iris, ciliary body,*

*lens capsule, vitreous, or coagulated blood. Late in the postoperative*

*period, progressive growth of the fibroblasts might lead*

*to membrane proliferation over the internal ostium.*

*Episcleral Fibrosis (Late)*

*A bleb may be inadequate due to fibrosis at the scleral flap,*

*which occurs from the episclera. It also can be due to loculations*

*within the bleb or a “ring of steel” limiting outward extension*

*of the bleb and limited filtration. A bleb may appear*

*“perfect” but still have inadequate filtration.*

*28.3 Test Interpretation*

*A filtering bleb can be evaluated at the slit-lamp exam. It should*

*be evaluated for height, vascularity, microcysts, localization*

*(focal vs. diffuse), and the presence of encapsulation or a “ring*

*of steel.” Gonioscopic examination is an integral part of assessing*

*the patency of the internal ostium. The failing bleb is typically*

*low to flat and heavily vascularized.*

*Other methods can also be used to assess the trabeculectomy*

*if needed. Ultrasound biomicroscopy can be useful to evaluate*

*the ostomy and flap. Newer imaging modalities, such as anterior*

*segment optical coherence tomography, can give the clinician*

*important information about bleb morphology that would*

*affect the management course.7*

*28.4 Diagnosis*

*Late filtration failure.*

*28.5 Medical Management*

*When evaluating a patient with the above presentation, high*

*IOP after filtering surgery with a deep anterior chamber, the*

*clinician should follow a logical approach as outlined in*

*▶Fig. 28.2. Medical management alone is limited to cases of*

*encapsulation and cases where the filter cannot be salvaged*

*surgically.*

*28.6 Surgical Management*

*Surgical management generally consists of needle revision, but*

*more aggressive revision may be required to salvage a failing*

*bleb7,8 (▶Fig. 28.2).*

*28.7 Rehabilitation and Follow-up*

*Once the IOP is controlled, patients are to be followed closely*

*for any signs of recurrent failure. IOP-lowering medication*

*might be necessary to maintain low IOP, even if surgical revision*

*was successful.*

*Fig. 28.2 Management flow chart for a failing*

*filtering bleb.*

~~~~~CASE 29 Flat Anterior Chamber~~~~~

*29 Flat Anterior Chamber*

*Martha Motuz Leen*

*Abstract*

*Aqueous misdirection is a secondary angle-closure glaucoma.*

*Diagnosis is suspected when a flat (or very shallow) central and*

*peripheral anterior chamber is observed, and other causes of*

*flat anterior chamber have been ruled out. This rare condition*

*typically occurs in eyes with short axial lengths that are predisposed*

*to angle-closure glaucoma and have undergone prior*

*laser or incisional surgery. Also known as “ciliary block” or*

*“malignant” glaucoma, treatment consists of initially reversing*

*the aqueous misdirection medically, followed by surgical intervention*

*if necessary.*

*Keywords: aqueous misdirection, ciliary block, malignant glaucoma,*

*angle-closure glaucoma, secondary glaucoma, flat anterior*

*chamber, shallow anterior chamber*

*29.1 Clinical History*

*A 53-year-old woman with a history of bilateral chronic angleclosure*

*glaucoma presented with a shallow anterior chamber in*

*the right eye 1 day after a mitomycin trabeculectomy.*

*Examination revealed a visual acuity of 20/400 in the right*

*eye and 20/40 in the left eye. Intraocular pressures (IOPs) were*

*34mm Hg in the right eye and 12mm Hg in the left eye. Slitlamp*

*examination of the right eye showed a moderately elevated*

*filtration bleb that was negative for Seidel’s testing. The*

*anterior chamber was shallow with iridocorneal contact*

*extending from the periphery to within 1mm of the pupillary*

*margin. Central shallowing was also present with a posterior*

*chamber intraocular lens located 0.5mm posterior to the corneal*

*endothelium. Anterior chamber cells were graded 3 + . A*

*surgical iridectomy was confirmed to be patent since ciliary*

*processes were easily visible. Slit-lamp examination of the left*

*eye showed a filtration bleb, deep anterior chamber, patent surgical*

*iridectomy, and pseudophakia.*

*Fundus examination demonstrated a poor view with an*

*excellent red reflex in the right eye and moderate glaucomatous*

*cupping with an otherwise unremarkable retina in the left eye.*

*B-scan ultrasonography of the right eye revealed a flat retina*

*and absence of choroidal effusions.*

*Differential Diagnosis—Key Points*

*1. Shallowing or flattening of the anterior chamber after*

*filtration surgery is common, especially in the early*

*postoperative setting. It is useful to identify those clinical*

*features that are typical of each of the potential causes of*

*shallowing (▶Table 29.1). For instance, if the IOP is low,*

*overfiltration or choroidal effusions are suspected. If the IOP*

*is normal or high, pupillary block, choroidal hemorrhage,*

*and aqueous misdirection are considerations. It is also*

*useful to classify whether shallowing of the anterior*

*chamber involves the periphery only or both central and*

*peripheral areas (▶Fig. 29.1a, b). Using bleb height as a*

*criterion for differentiating diagnoses is not as helpful, since*

*the bleb may be either high or low with each of these*

*entities. In addition to these features, the response to a*

*surgical confirmatory intervention, an iridectomy, can point*

*to the correct diagnosis.*

*2. Overfiltration is the most common cause of shallow anterior*

*chamber after filtration surgery. In the early postoperative*

*period, overfiltration may occur through a large bleb or*

*loose scleral flap with little resistance to outflow, a*

*conjunctival buttonhole, a conjunctival wound leak, or a*

*cyclodialysis cleft. In the later postoperative period,*

*overfiltration may occur by transudation or leak from a bleb*

*that is avascular and very thin, especially if antimetabolites*

*were used. Chronic overfiltration itself without hypotony is*

*not expected to shallow the anterior chamber as the*

*hydrostatic pressure in the anterior chamber and vitreous*

*cavity equalize. However, when overfiltration is associated*

*with a low IOP, the ciliary body and choroid tend to become*

*diffusely edematous. This results in an anterior rotation of*

*the ciliary body, leading to shallowing of the anterior*

*chamber centrally and peripherally in phakic and*

*pseudophakic eyes. A patent iridectomy is identified.*

*Choroidal effusions are not present on fundus examination,*

*but overfiltration is often a precursor for their development.*

*3. A choroidal effusion is an accumulation of serous fluid in the*

*suprachoroidal space, most commonly in eyes that are*

*severely hypotonous in the early postoperative period.*

*Although the suprachoroidal space may be considered one*

*continuous area, firm connections of the choroid to the*

*sclera at the vortex veins and optic nerve head lead to a*

*lobulated appearance of choroidal effusions. This results in*

*an anterior rotation of the ciliary body with shallowing of*

*the anterior chamber both centrally and peripherally in*

*phakic and pseudophakic eyes. The presence of this fluid*

*contributes to a vicious cycle of reduced aqueous*

*production and possibly enhanced uveoscleral outflow, in*

*turn aggravating hypotony and the tendency for more*

*choroidal effusion. Overfiltration is often identified as the*

*initial cause of hypotony. A patent iridectomy is present.*

*Smooth light-brown or tan choroidal elevations are seen on*

*funduscopy. In some cases, choroidal effusions are very low*

*and cannot easily be discerned without ultrasonography. In*

*severe cases, surgical drainage of straw-colored*

*suprachoroidal fluid reverses the cycle.*

*4. Pupillary block occurs when there is apposition of the iris to*

*the lens in phakic or pseudophakic eyes, or to the anterior*

*vitreous face in aphakic eyes. The aqueous is unable to flow*

*anteriorly and accumulates just beneath the iris, causing a*

*convex bowing of the iris (iris bombé). Peripheral anterior*

*chamber shallowing results in appositional closure of the*

*angle. It is important to recognize that the central chamber*

*tends not to be as shallow. The IOP may be normal initially*

*and then progressively elevated. A patent iridectomy is not*

*present. Although creation of an iridectomy is a routine part*

*of most glaucoma filtration surgery, a complete opening*

*Flat Anterior Chamber*

*93*

*may not always be present, with underlying iris pigment*

*epithelium still intact or iris incarceration into the sclerotomy.*

*The iridectomy may also become obstructed with ciliary*

*processes, blood, or vitreous, or become bound down by*

*synechiae in an inflamed eye. If the surgical wound was*

*dissected too posteriorly, ciliary body tissue rather than iris*

*may have been excised. The anterior chamber will readily*

*deepen after an iridotomy is created. If there is any doubt*

*about its patency, another iris opening should be created.*

*5. A choroidal hemorrhage is an accumulation of blood that*

*occurs in the suprachoroidal space in either the early or the*

*late postoperative period, usually acutely and in association*

*with severe pain. The ciliary body rotates anteriorly,*

*shallowing the anterior chamber peripherally and centrally*

*in phakic and pseudophakic eyes. Since the choroidal*

*circulation is not subject to autoregulation, hypertensive*

*patients with fragile vessels may be unable to accommodate*

*the increased choroidal blood flow when the IOP is lowered,*

*increasing the risk of choroidal hemorrhage. Aphakic eyes*

*may also be at higher risk. Unlike choroidal effusions, the IOP*

*tends to be normal or high. A patent iridectomy is present.*

*Smooth dark-brown or red choroidal elevations are seen on*

*funduscopy, sometimes requiring ultrasonography for*

*confirmation when small in size. In severe cases, surgical*

*drainage of red or dark-brown suprachoroidal fluid is required.*

*6. Aqueous misdirection occurs when aqueous is unable to*

*flow anteriorly past a relative block at the junction of the*

*ciliary processes, lens equator (when present), and anterior*

*vitreous face. Subsequently, aqueous is diverted posteriorly*

*within or adjacent to the vitreous body (▶Fig. 29.2). As the*

*aqueous accumulates, the vitreous is displaced forward,*

*causing anterior ciliary body rotation and shallowing of the*

*anterior chamber peripherally and centrally. This can lead to*

*a vicious cycle as the aqueous volume continues to increase*

*in the space behind the vitreous, the permeability of the*

*compressed vitreous body decreases further, and the*

*apposition of the anterior hyaloid face with the ciliary*

*processes and lens equator worsens. The IOP may be*

*normal initially and become progressively elevated as the*

*cycle continues. The presence of a patent iridectomy must*

*be confirmed, and choroidal elevations are generally not*

*present. Aqueous misdirection can occur in the early*

*postoperative period or later when cycloplegics are*

*discontinued. It most commonly occurs after surgery on*

*phakic eyes with chronic angle-closure glaucoma. Terms*

*that have been used synonymously with aqueous*

*misdirection include ciliary block and malignant glaucoma.*

*A wide spectrum of presentations is possible with each of*

*these diagnoses, and more than one can occasionally occur as*

*a sequence of events. For example, an eye with chronic angleclosure*

*glaucoma may have developed a wound leak resulting*

*in hypotony with initial choroidal edema, then progressing to a*

*small anterior choroidal effusion. As the ciliary body rotates*

*forward and the anterior chamber shallows, greater apposition*

*occurs between the anterior hyaloid, ciliary processes, and lens*

*equator. This leads to misdirection of aqueous posteriorly with*

*progressive shallowing of the anterior chamber and elevation*

*of the IOP. Therefore, presence of a choroidal effusion does not*

*entirely eliminate the possibility of aqueous misdirection. In*

*this example, drainage of the choroidal effusion alone might*

*result in reversal of aqueous misdirection.*

*29.2 Test Interpretation*

*Slit-lamp examination of anterior chamber depth may reveal*

*shallowing in the periphery only with an iris bombé configuration,*

*features that would be suggestive of a pupillary block*

*mechanism. If the anterior chamber is shallow both centrally*

*and peripherally, choroidal thickening, choroidal effusion, choroidal*

*hemorrhage, or aqueous misdirection would be more*

*likely.*

*The bleb is inspected and checked for pinpoint leaks and for*

*slow transudation, especially if the tissue is very thin. A Seidel*

*test can be performed to identify an area of leakage or transudation*

*by painting a bleb or incision site with a fluorescein strip*

*and viewing the area with a cobalt blue light. Although a pinpoint*

*leak can usually be seen immediately, delineation of an*

*area of bleb transudation may require several seconds of observation.*

*If present, overfiltration with choroidal thickening, or*

*choroidal effusion, is suspected.*

*Determination should be made if an iridectomy exists and*

*is patent. Even with a previously patent iridectomy, it may*

*become blocked with iris, vitreous, or blood or become*

*bound down to the underlying lens. If a patent iridectomy is*

*confirmed, pupillary block can be ruled out, but not the other*

*entities. If ciliary processes are seen through a patent iridectomy*

*and appear to be anteriorly rotated, or in apposition*

*against the vitreous, aqueous misdirection is suspected. If there*

*is any question of the patency of the iridectomy, it should be*

*opened or a new iridotomy created with laser. If shallowing*

*readily reverses as a result, a diagnosis of pupillary block is*

*made.*

*Table 29.1 Causes of shallow anterior chamber*

*Diagnosis Shallowing IOP Relief with iridectomy Common features*

*Overfiltration Peripheral only, or central*

*and peripheral*

*Low No Bleb leak often present*

*Choroidal effusion Central and peripheral Low No Light-brown choroidals*

*Pupillary block Peripheral only Normal or high Yes Iris bombé*

*Choroidal hemorrhage Central and peripheral Normal or high No Dark-brown choroidals;*

*acute pain*

*Aqueous misdirection Central and peripheral Normal or high No History of chronic angleclosure*

*glaucoma*

*Glaucoma*

*94*

*If the iridectomy is patent, the pupil should be dilated. When*

*choroidals are larger, they are easily identified on fundus*

*examination, appearing smooth and dome-shaped and varying*

*from one to four in number. The convex choroidals may occasionally*

*be extensive enough that they meet in the midvitreous,*

*often referred to as “kissing” choroidals. Serous choroidal effusions*

*tend to have a tan or light-brown appearance, whereas*

*choroidal hemorrhages tend to have a dark-brown or red*

*appearance. If choroidals are not seen, careful evaluation of the*

*vitreous may suggest optically empty pockets indicative of fluid*

*accumulation typical of aqueous misdirection.*

*A small pupil may prohibit adequate visualization of the posterior*

*pole. In such cases, conventional B-scan ultrasonography*

*is useful to identify choroidal elevation or choroidal thickening.*

*Ultrasound can also help differentiate between a serous choroidal*

*effusion that is echolucent and choroidal hemorrhage that*

*is echogenic. Ultrasound can be used to inspect the vitreous for*

*pockets of fluid that may be seen with aqueous misdirection.*

*Sometimes, a choroidal edema that is very anterior can be too*

*subtle to identify despite funduscopy with a large pupil or conventional*

*B-scan ultrasonography. In this instance, high-frequency*

*ultrasound biomicroscopy can prove useful to better*

*visualize the anterior choroidal edema, as well as to identify the*

*ciliary block that is characteristic of aqueous misdirection.*

*29.3 Diagnosis*

*In the case study described, a patent peripheral iridectomy is*

*present with central as well as peripheral shallowing and there*

*is no iris bombé. These features exclude pupillary block as a*

*mechanism. There is no bleb leak or wound leak and the eye is*

*Fig. 29.1 (a) normal anterior chamber depth*

*should be distinguished from (b) which shows*

*peripheral shallowing alone characteristic of iris*

*bombe commonly seen with pupillary block and*

*(c) where the anterior chamber is more uniformly*

*shallow despite a patent iridectomy. The*

*configuration illustrated in (c) may be seen with*

*overfiltration, serous choroidal effusion, choroidal*

*hemorrhage or aqueous misdirection. (Adapted*

*from Skuta GL. The angle closure glaucomas. In:*

*Kaufman PL, Mittag TW, assoc eds. Glaucoma.*

*Vol. 7. In: Podos SM, Yanoff M, eds. Textbook of*

*Ophthalmology. Philadelphia, PA: Mosby-Year*

*Book; 1994:8–23.)*

*Fig. 29.2 Aqueous misdirection in a phakic eye. Apposition of*

*anteriorly rotated ciliary processes, lens, and anterior hyaloid (arrows)*

*predisposes to posterior misdirection of aqueous (A) into the vitreous*

*cavity. The lens and iris become progressively displaced anteriorly,*

*closing the angle, and increasing the IOP. (Adapted from Skuta GL. The*

*angle closure glaucomas. In: Kaufman PL, Mittag TW, assoc eds.*

*Glaucoma. Vol. 7. In: Podos SM, Yanoff M, eds. Textbook of*

*Ophthalmology. Philadelphia, PA: Mosby-Year Book; 1994:8–21.)*

*Flat Anterior Chamber*

*95*

*not hypotonous, making overfiltration less likely. Funduscopy*

*and ultrasound demonstrate no choroidal elevation, excluding*

*serous choroidal effusion or choroidal hemorrhage. The ciliary*

*processes are noted to be easily visible through the iridectomy.*

*The diagnosis is aqueous misdirection in the right eye.*

*29.4 Medical Management*

*The first line of therapy for aqueous misdirection is medical*

*management. A cycloplegic–mydriatic combination of atropine*

*1% and phenylephrine 2.5% is instilled four times a day to maximally*

*rotate the ciliary body and lens posteriorly, attempting*

*to break the ciliary block. Topical aqueous suppressants as well*

*as an oral carbonic anhydrase inhibitor are used to reduce*

*aqueous production and slow down fluid collection within the*

*vitreous body. An oral or intravenous osmotic agent can be considered*

*to actually reduce the volume of aqueous in the vitreous*

*cavity in an effort to break the cycle of fluid accumulation.*

*Miotics are to be avoided since instillation results in an anterior*

*rotation of the ciliary body, exacerbating the ciliary block.*

*Prompt recognition and treatment of aqueous misdirection can*

*abort the process earlier in its course.*

*29.5 Surgical Management*

*If the aqueous misdirection is not corrected medically and the*

*condition continues to worsen, then vitreous disruption by*

*laser treatment or surgery may be attempted. Neodymium:YAG*

*laser disruption of anterior hyaloid face and posterior capsule*

*through the pupil, when accessible in pseudophakic and*

*aphakic eyes, or through an iridectomy, can be performed to*

*allow trapped pockets of fluid to move anteriorly with more*

*ease. Argon laser shrinkage of the ciliary processes through a*

*peripheral iridectomy can also be attempted to break the apposition*

*between the ciliary processes and lens or vitreous.*

*If there is lenticular–cornea contact and the IOP is not yet elevated,*

*intracameral viscoelastic injection may have a therapeutic*

*effect by deepening the anterior chamber, rotating the*

*ciliary body posteriorly, and temporarily reversing the vicious*

*cycle of misdirected aqueous. Even a small amount of viscoelastic*

*injection can rapidly raise the IOP and should therefore be*

*performed with careful monitoring.*

*If laser modalities are ineffective, then a core pars plana*

*vitrectomy with reformation of the anterior chamber is recommended.*

*Surgical disruption of the vitreous helps to reestablish*

*anterior flow of trapped aqueous as well as to prevent*

*the recurrence of the cycle by eliminating the potential for*

*intact vitreous gel to act as a diaphragm across the globe. In*

*pseudophakic and aphakic eyes, the vitrectomy is extended*

*anteriorly to remove anterior hyaloid, lens zonules, or capsule*

*in the vicinity of the iridectomy. In phakic eyes, anterior*

*removal is more challenging since the integrity of the lens must*

*be maintained. For this reason, recurrence of aqueous misdirection*

*after vitrectomy in phakic eyes may be more common due*

*to less complete removal of anterior hyaloid. It is useful to place*

*a sclerotomy within reach of the iridectomy to facilitate*

*removal of the vitreous in its vicinity.*

*29.6 Rehabilitation and Follow-up*

*Cycloplegia, such as with atropine 1% daily, may need to be*

*maintained indefinitely. In cases where the aqueous misdirection*

*is broken pharmacologically or with laser treatment, recurrence*

*can occur when cycloplegia is discontinued, even months*

*later. Instillation of miotics can trigger a recurrence by rotating*

*the ciliary body and lens anteriorly, starting the cycle of misdirection.*

*If a vitrectomy was required for reversal of aqueous misdirection,*

*cycloplegia can often be stopped, though caution*

*should be exercised in phakic eyes, which may be at higher risk*

*of recurrence. In the fellow eye, prophylactic laser iridotomy,*

*avoidance of miotics, and anticipation of possible aqueous misdirection*

*with any future surgery are recommended protective*

*measures.*

~~~~~CASE 30 Persistent Choroidal Detachment~~~~~

*30 Persistent Choroidal Detachment*

*Donald L. Budenz*

*Abstract*

*Choroidal effusions are not uncommon after glaucoma filtration*

*surgery. They are present in up to 30% of cases immediately*

*postoperatively in carefully controlled studies in which investigators*

*look for them. They are often confused with retinal*

*detachments or suprachoroidal hemorrhages but are easily distinguishable*

*on careful clinical exam or ultrasound. They are*

*usually benign but may precede suprachoroidal hemorrhages*

*and block the visual axis. Conservative management usually*

*results in resolution. Surgical management is not difficult for*

*the anterior segment surgeon to perform and is recommended*

*when vision is affected for a prolonged period.*

*Keywords: choroidal effusion, glaucoma surgery, complications,*

*management*

*30.1 History*

*An 80-year-old woman with a 20-year history of glaucoma presented*

*for consultation 8 months following combined cataract*

*extraction, intraocular lens implant, and trabeculectomy with*

*mitomycin C in the right eye. She complained of a “shadow”*

*since her surgery, which was blocking her temporal vision. This*

*was so debilitating that she almost ran over a small boy with*

*her car.*

*The visual acuity was 20/30 in the affected eye and the intraocular*

*pressure (IOP) was 7mm Hg. A large, ischemic filtering*

*bleb was present with a negative Seidel’s test. The cornea was*

*clear, the anterior chamber deep and quiet, and the cup-to-disc*

*ratio was 0.8. The peripheral fundus was not visible due to a*

*small and fibrotic pupil. A B-scan ultrasound was performed,*

*which showed 360-degree ciliochoroidal detachments with*

*serous fluid inside the detachments. There was a large nasal*

*choroidal detachment that measured 8mm (▶Fig. 30.1). There*

*was no retinal detachment overlying the choroidal detachment.*

*Differential Diagnosis—Key Points*

*1. Most patients with persistent choroidal effusions are*

*asymptomatic. They present with a low or low-normal IOP*

*as the only presenting sign. Vision may be reduced if the*

*pressure is very low, causing corneal, retinal, or choroidal*

*folds. Also, if the effusions are large, they may block the*

*visual axis, causing profound visual loss.*

*2. The differential diagnosis of low IOP after filtering surgery*

*includes overfiltration, filtering bleb leak, retinal*

*detachment, cyclodialysis cleft, iridocyclitis, and choroidal*

*effusion. Overfiltration is a diagnosis of exclusion and*

*typically presents with a large and/or ischemic filtering bleb,*

*which has no leak by Seidel’s testing. The posterior pole*

*may have choroidal effusions, which are due to the low*

*pressure from overfiltration. Late bleb leaks may also cause*

*low IOP and choroidal detachments and are diagnosed by*

*demonstrating a positive Seidel’s test. Occasionally, a*

*provocative Seidel’s test, using gentle pressure on the*

*globe, may reveal an occult leak. Serous retinal*

*detachments are a rare postoperative complication of*

*filtering surgery but should always be excluded as a possible*

*cause of hypotony in any patient. Retinal detachment may*

*be diagnosed on fundus examination and/or ultrasound*

*(▶Fig. 30.2). A cyclodialysis cleft may result from surgical*

*trauma and this should be ruled out on gonioscopy. This*

*may be occult and difficult to diagnose without the aid of*

*high-resolution ultrasound (ultrasound biomicroscopy).*

*Iridocyclitis may cause hypotony and typically presents in*

*uveitics or following tapering of topical steroid medications.*

*3. Suprachoroidal hemorrhage (▶Fig. 30.3) may cause*

*choroidal detachment, but the IOP is generally high and the*

*patient usually has considerable pain associated with this.*

*4. Choroidal effusions have a bullous appearance, similar to*

*retinal detachment and choroidal hemorrhage. Unlike those*

*conditions, the bullous detachments of serous choroidal*

*effusions have the normal orange fundus appearance, rather*

*than being translucent (retinal detachment) or dark red/*

*brown (suprachoroidal hemorrhage). Both serous and*

*hemorrhagic choroidal detachments typically have four*

*bullous lobes, one in each quadrant. This is because the*

*choroid is firmly attached to the exit site of the four vortex*

*veins, as well as being attached to the optic nerve*

*posteriorly and scleral spur anteriorly. Transillumination with*

*a muscle light may help distinguish serous from*

*hemorrhagic choroidal detachments; hemorrhagic*

*detachments will block the transillumination better than*

*serous detachments. When in doubt, standard B-scan*

*echography is the definitive way to differentiate these three*

*entities (see Test Interpretation below).*

*5. Annular ciliochoroidal detachment is an underdiagnosed*

*condition in which the anterior-most choroid becomes*

*separated from the sclera. The fundus typically appears*

*normal. and diagnosis is made by ultrasound biomicroscopy*

*or conventional resolution ultrasound performed through a*

*water bath. These patients may have a closed anterior*

*chamber angle on gonioscopy due to forward rotation of*

*the ciliary body. In this circumstance, the IOP may be*

*normal or elevated.*

*6. Choroidal effusions are common after glaucoma filtration*

*surgery due to surgically induced hypotony. Low IOP results*

*in the leakage of protein-rich serum from the choroidal*

*vasculature into the suprachoroidal space. The ciliary body*

*often becomes detached and intraocular inflammation may*

*result. These factors may decrease aqueous production,*

*contributing to hypotony. Alternatively, choroidal effusion*

*may promote increased uveoscleral aqueous outflow,*

*contributing to hypotony. The condition can be viewed as a*

*pathologic cycle, whereby profound hypotony leads to*

*ciliochoroidal effusion, which in turn causes hypotony.*

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*Fig. 30.1 Serous choroidal effusions. (a) The typical appearance of serous choroidal effusion. Smooth, orange, bullous detachments are seen. (b) The*

*typical B-scan echographic appearance of serous choroidal detachments. The wall is generally thicker and smoother than that seen in a retinal*

*detachment. The inside of the detachment is echographically clear due to the serous nature of the interior, unlike hemorrhagic choroidal detachment.*

*(▶Fig. 30.1a is provided courtesy of Albert M. Maguire, MD, Philadelphia, PA. ▶Fig. 30.1b is provided courtesy of Sarah Keene, Philadelphia, PA.)*

*Fig. 30.2 Retinal detachment. (a) The clinical appearance of a retinal detachment. The surface is bullous but more translucent and lacks the typical*

*orange color of the retinal pigment epithelium usually seen in a choroidal effusion. (b) B-scan ultrasound of a retinal detachment. The wall is generally*

*thinner and the surface is less regular than that seen in choroidal detachment. (▶Fig. 30.2a is provided courtesy of Albert M. Maguire, MD,*

*Philadelphia, PA. ▶Fig. 30.2b is provided courtesy of Randall Hughes, Miami, FL.)*

*Fig. 30.3 Hemorrhagic choroidal detachment. (a) Photograph of a hemorrhagic choroidal detachment. The color, ranging from dark-red to brown, is*

*diagnostic of this entity. (b) The B-scan ultrasound shows the echographically dense cavity of suprachoroidal blood, easily distinguished from a serous*

*detachment of the retina or choroid. (▶Fig. 30.3a is provided courtesy of Albert M. Maguire, MD, Philadelphia, PA. ▶Fig. 30.3b is provided courtesy of*

*Sarah Keene, Philadelphia, PA.)*

*Glaucoma*

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*30.2 Test Interpretation*

*In serous choroidal effusion, B-scan ultrasound reveals an echographically*

*clear space between the detached choroid and the*

*sclera, distinguishing this from choroidal hemorrhage. Additionally,*

*the choroid is thicker than the retina, which helps distinguish*

*choroidal effusion from retinal detachment. The*

*clinical and echographic appearance of choroidal effusion, retinal*

*detachment, and choroidal hemorrhage are shown in*

*▶Fig. 30.1, ▶Fig. 30.2, and ▶Fig. 30.3.*

*30.3 Diagnosis*

*Right eye: Persistent serous choroidal detachment.*

*30.4 Medical Management*

*Observation usually results in complete resolution of ciliochoroidal*

*effusions without sequelae. Elevation of IOP may hasten*

*the spontaneous drainage of the serous fluid by driving proteins*

*out through the sclera. The water component of the fluid*

*may drain via the sclera as well, or perhaps gets reabsorbed into*

*the choroidal capillary system. Discontinuation of systemic carbonic*

*anhydrase inhibitors and topical aqueous suppressants in*

*the affected eye may aid in this resolution. Discontinuation of*

*topical beta-blocker in the contralateral eye is also recommended,*

*since this may contribute to reduced aqueous production*

*in the affected eye.*

*The benefit of topical steroid and cycloplegic therapy has not*

*been well established, but there is little to argue against trying*

*this treatment. We do not use systemic steroids, as advocated*

*by some, because their effectiveness has not been established*

*and the potential risk of systemic side effects outweighs the*

*potential benefit. Oral carbonic anhydrase inhibitors have been*

*used with varied success. We believe these drugs more likely*

*potentiate the problem, although dramatic resolution of choroidal*

*effusions has been reported following initiation of oral acetazolamide.*

*30.5 Surgical Management*

*The indications for drainage of serous choroidal effusions*

*include lenticulocorneal touch, nonresolving effusions blocking*

*the visual axis, hypotony causing corneal or retinal folds, failing*

*filtering bleb due to poor aqueous production, overlying serous*

*retinal detachment, or serous choroidal detachment accompanying*

*a bleb leak. The presence of “kissing” choroidal detachments*

*(▶Fig. 30.4) is not necessarily an indication for immediate intervention*

*as there seem to be no particular sequelae that accompany*

*apposition of the retinal surfaces. However, insofar as these*

*are accompanied by profound visual loss due to blocking of the*

*visual axis, we prefer to drain them if they do not resolve in*

*short order. The anxiety related to the visual loss associated with*

*choroidal detachments that block the visual axis is substantial,*

*and drainage of choroidal effusions is a simple and effective procedure*

*with very few potential complications.*

*The technique for drainage of choroidal effusions is illustrated*

*in ▶Fig. 30.5. A paracentesis is made through the temporal*

*peripheral cornea and the anterior chamber is reformed with*

*balanced salt solution (BSS) or a viscoelastic if it is shallow. An*

*anterior chamber maintainer, which is attached to a BSS infusion*

*line, is inserted. This obviates the need to constantly reform the*

*anterior chamber as the choroidal space is drained. A radial conjunctival*

*incision is made in the inferotemporal or inferonasal*

*quadrant, extending 3 to 4mm posterior to the corneoscleral*

*limbus. Inferior locations are chosen to permit continued drainage*

*of fluid from superior choroidal detachments via gravity*

*postoperatively. A 2- to 3-mm radial sclerostomy is then*

*Fig. 30.4 Kissing choroidal detachments. In severe cases, the serous*

*detachments of the choroid may be so elevated that the contralateral*

*retinal surfaces become apposed centrally. These have been termed*

*“kissing” choroidals. While visually debilitating, kissing choroidal*

*detachments have the same excellent prognosis as nonkissing*

*detachments. The B-scan echographic appearance is shown in this*

*figure. Fig. 30.5 Drainage of choroidal effusions. See text for description of*

*technique.*

*Persistent Choroidal Detachment*

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*fashioned using a supersharp blade until the suprachoroidal*

*space is entered. The location of this incision need only be just*

*posterior to the limbus since the choroid is detached up to the*

*scleral spur. While making the sclerostomy incision, it is helpful*

*for the surgeon and assistant to retract each side of the incision*

*as the cut-down is made to aid in visualization. The critical point*

*comes when the incision reaches the level of the suprachoroidal*

*space and straw-colored serous fluid gushes out. The incision is*

*opened to an adequate length to allow a sclerostomy punch to fit*

*into it on either side. A single punch is then performed on each*

*side of the incision to allow continued drainage of the choroidal*

*fluid postoperatively. Also, leaving the sclera open may prevent*

*reformation of choroidal effusions if the postoperative IOP*

*remains low, since the pressure in the suprachoroidal space will*

*be equivalent to atmospheric pressure. The conjunctival incision*

*is then closed with an absorbable suture and the same procedure*

*performed in the contralateral inferior quadrant. The anterior*

*maintainer is removed and a suture is oftentimes needed to close*

*the paracentesis track. If a filtering bleb leak or cyclodialysis is*

*present, these may be addressed at this time. Subconjunctival*

*injections of antibiotics and steroids are employed.*

*30.6 Rehabilitation and Follow-up*

*The patient is examined 1 day postoperatively and placed on a*

*brief course of a topical steroid, antibiotic, and cycloplegic agent*

*(if phakic). Persistent effusion and/or drainage may be noted,*

*but complete resolution of the serous effusion is usually*

*prompt. Visual recovery is generally dramatic if the choroidal*

*effusion involved the visual axis.*

~~~~~CASE 31 Nonproliferative Diabetic Retinopathy~~~~~

*31 Nonproliferative Diabetic Retinopathy*

*Thalmon R. Campagnoli and William E. Smiddy*

*Abstract*

*The staging of nonproliferative diabetic retinopathy remains an*

*important tool for directing follow-up regimens and estimating*

*prognosis. Until recently, maximal systemic glucose control was*

*the only treatment option, and that was generally considered to*

*be for prevention of progression to more severe stages, especially*

*proliferative retinopathy. The Early Treatment Diabetic*

*Retinopathy Study (ETDRS) recommended consideration of*

*panretinal laser before the appearance of proliferative retinopathy.*

*Association with macular edema is still the most important*

*determinant of treatment, but recent studies of the DRCR*

*Network have demonstrated improvement in the degree of*

*nonproliferative retinopathy, and might be a more important*

*treatment goal in the future.*

*Keywords: diabetes, nonproliferative retinopathy, microaneurysms,*

*laser*

*31.1 History*

*A 53-year-old man with a 10-year history of type II diabetes*

*mellitus presented with a 2-month history of blurred vision*

*OU. Medical history is positive for hypertension, peripheral*

*neuropathy, and a history of hepatitis C. Best corrected visual*

*acuity was 20/20 OU. Slit-lamp examination was unremarkable.*

*The intraocular pressure was 11mm Hg in the right eye and*

*12mm Hg in the left eye. Funduscopic examination on the right*

*showed a normal disc, no macular edema, macular lipid, or*

*neovascularization. Intraretinal hemorrhages in two quadrants*

*and a mild degree in the other two quadrants were present in*

*both eyes. There was a cotton-wool spot superior to the right*

*macula (▶Fig. 31.1). Fluorescein angiography demonstrated*

*microaneurysms with mild perifoveal capillary dropout, but no*

*neovascularization (▶Fig. 31.2).*

*Differential Diagnosis—Key Points*

*1. It is estimated that over 25 million Americans aged 20 years*

*or older have diabetes mellitus. The Los Angeles Latino Eye*

*Study (LALES) found a prevalence of 56% of diabetic*

*retinopathy in individuals with 5 to 9 years of diabetes*

*duration. A previous study had shown a 78% prevalence of*

*diabetic retinopathy after a 10-year duration of systemic*

*disease. The 14-year follow-up study of the Wisconsin Eye*

*Survey of Diabetic Retinopathy (WESDR) demonstrated a*

*96% incidence of developing new retinopathy, an 86%*

*progression rate, and 26% incidence of diabetic macular*

*edema.*

*2. It is common that diabetic patients present with blurred*

*vision that they attribute to refractive problems rather than*

*complications from diabetic retinopathy. This may delay the*

*correct diagnosis and treatment.*

*3. Microaneurysms and intraretinal hemorrhages may be*

*clinical findings in other retinal vascular conditions such as*

*branch and central retinal vein occlusion, radiation*

*retinopathy, perifoveal retinal telangiectasia, and Eales’*

*disease. Usually, the medical history yields evidence of the*

*diabetic condition, but screening for diabetes should be*

*performed in patients with the ophthalmoscopic features of*

*diabetic retinopathy. The more generalized distribution in*

*diabetes usually distinguishes nonproliferative diabetic*

*retinopathy (NPDR) from cases of branch retinal vein*

*occlusion, which have a segmental distribution;*

*predominance of venular changes and unilateral*

*presentation also increase the likelihood of branch or central*

*vein occlusion diagnosis.*

*31.2 Test Interpretation*

*The most important aspect of evaluating diabetic retinopathy is*

*the clinical examination. The most important examination tool*

*is magnified observation of the macula and posterior pole—*

*accomplished most effectively with a fundus contact lens.*

*Fundus photography may increase the sensitivity of assessing*

*NPDR severity and differentiate it from early proliferative diabetic*

*retinopathy. Formal grading of the level of retinopathy*

*was determined from photographs in the Early Treatment Diabetic*

*Retinopathy Study (ETDRS). While detailed grading may*

*not be clinically necessary, photographic slides may guide follow-*

*up schedules or treatment. Fluorescein angiography may*

*define surprisingly large areas of ischemia, which, when perifoveal,*

*may explain decreased vision. Eyes with large areas of*

*nonperfusion may indicate a poorer prognosis. Early neovascular*

*complexes are easily recognized by fluorescein leakage.*

*Electrophysiologic studies are not part of a standard evaluation,*

*but have been shown to demonstrate early and characteristic*

*changes with increased degrees of ischemia.*

*Fig. 31.1 Normal funduscopic appearance of the right eye with a*

*normal disc. There is no macular edema or macular lipid. Temporal*

*through the macula can be seen a moderate number of intraretinal*

*hemorrhages with microaneurysms.*

*Retina*

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*The use of spectral-domain optical coherence tomography*

*(SD-OCT) is not recommended for minimal diabetic retinopathy*

*screening. SD-OCT is commonly indicated in diabetic retinopathy*

*to help in detecting the cause of unexplained visual acuity*

*loss, identify areas of vitreomacular interface abnormalities,*

*ensure presence or absence of macular edema, and assess other*

*possibly associated macular diseases (e.g., age-related macular*

*degeneration).*

*31.3 Diagnosis*

*Moderately severe nonproliferative diabetic retinopathy, OU.*

*31.4 Medical Management*

*Numerous studies including the Diabetes Complications Control*

*Trial, the United Kingdom Prospective Diabetes Study, the*

*ETDRS, and the WESDR have identified baseline clinical characteristics*

*associated with a more rapid or a higher rate of progression*

*of retinopathy. These consistently include severity of*

*baseline retinopathy, duration of disease, and degree of glycemic*

*control. Some studies have shown that accompanying systemic*

*features such as hypertension and hypercholesterolemia*

*may also increase the risk of progression. Perhaps, more importantly,*

*some of these studies have also shown that control of*

*blood glucose and hypertension may lower these risks. Doxycycline,*

*a substance known to carry retinal anti-inflammatory*

*and neuroprotective effects, has been used in attempts to*

*induce regression or reduce progression of mild and moderate*

*NPDR, but no success was achieved. A study evaluating eyes*

*treated for diabetic macular edema suggested decreased progression*

*of retinopathy after intravitreal steroid or anti–vascular*

*endothelial growth factor injection; however, the optimal*

*control of medical conditions continues to be of major importance*

*in eyes diagnosed with diabetic retinopathy.*

*The ETDRS has demonstrated efficacy in instituting laser*

*treatment even before proliferative diabetic retinopathy develops.*

*Type II diabetics show a larger treatment benefit compared*

*to type I patients. The threshold for considering scatter laser*

*treatment is the presence of severe NPDR. This patient’s right*

*eye approaches that threshold. The “4–2-1” rule has been*

*developed to assist the clinician in making this determination*

*by simplifying the definition of severe NPDR into a clinically*

*useful algorithm. The definition of severe NPDR includes four*

*quadrants of microaneurysms and intraretinal hemorrhages*

*equal to or greater than standard photograph 2A (▶Fig. 31.3),*

*two quadrants of venous beading equal to or exceeding the*

*degree present in standard photograph 6A (▶Fig. 31.4), and*

*one quadrant of intraretinal microvascular abnormality equal*

*to or exceeding the degree present in standard photograph 8A*

*(▶Fig. 31.5). When two or three of these features are present,*

*“very severe NPDR” is defined, which carries a 50% risk of*

*Fig. 31.2 Angiographic appearance of the left eye showing somewhat*

*more microaneurysms than were apparent from clinical examination.*

*Notice the foveal vascular zone with a somewhat irregular distribution.*

*Notice small areas of capillary nonperfusion one disc diameter inferior*

*and superior to the foveal vascular zone and also temporal to the*

*macula.*

*Fig. 31.3 ETDRS standard photograph 2A, the standard for*

*microaneurysms.*

*Fig. 31.4 ETDRS standard photograph 6A, the standard for venous*

*beading.*

*Nonproliferative Diabetic Retinopathy*

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*developing high-risk characteristics (severe proliferative diabetic*

*retinopathy and its incumbent risk of visual loss) within 1*

*year. This risk is diminished by approximately 50% with laser*

*treatment.*

*31.5 Rehabilitation and Follow-up*

*Patients with diabetic retinopathy require careful follow-up*

*examinations with a frequency dependent on the severity of*

*the retinopathy. An annual examination is recommended for*

*patients with minimal or absent NPDR. An examination is recommended*

*every 6 to 12 months for patients with mild to moderate*

*(more than microaneurysms only, but less than severe*

*NPDR) nonproliferative disease if there is no macular edema, but*

*every 4 to 6 months if there is nonclinically significant edema*

*present, and 1 to 2 months if clinical significant macular edema*

*(see Chapter 32, Diabetic Macular Edema) is present. Patients*

*with severe or very severe NPDR should be reexamined every 2*

*to 4 months.*

~~~~~CASE 32 Diabetic Macular Edema~~~~~

*32 Diabetic Macular Edema*

*Thalmon R. Campagnoli and William E. Smiddy*

*Abstract*

*Treatment of diabetic macular edema has been transformed*

*during the past decade with the advent of anti-vascular endothelial*

*growth factor therapy. While laser has not been totally*

*removed from the treatment armamentarium, it plays a small*

*role in current therapy algorithms. There are specific associated*

*features such as proliferative disease, initial visual acuity, and*

*systemic control that can influence the treatment approach.*

*Indications for treatment have changed little, but optical coherence*

*tomography imaging studies now play the dominant role*

*in diagnosing and monitoring treatment, with diminishing*

*roles for fluorescein angiography. Surgical management of diabetic*

*macular edema remains controversial, and probably*

*should best be considered in cases with demonstrable preretinal*

*traction.*

*Keywords: diabetes, retinopathy, macula, edema, intravitreal injection,*

*laser*

*32.1 History*

*This 58-year-old man with a 20-year history of type I diabetes,*

*recent-onset hypertension, and chronic hypercholesterolemia*

*sought consultation because of blurred vision of several weeks’*

*duration.*

*Examination disclosed best corrected visual acuity of 20/30*

*in each eye. There was no afferent pupillary defect. Slit-lamp*

*examination showed only trace nuclear lens opacity. Tensions*

*were 20 in each eye.*

*Funduscopic examination showed moderate microaneurysms*

*scattered about all quadrants of both eyes. In the right eye,*

*there was clinically significant diabetic macular edema with a*

*circinate lipid ring surrounding the center of the macula*

*(▶Fig. 32.1). No neovascular changes were seen. In the left eye,*

*in addition to the microaneurysms and macular edema, there*

*was early neovascularization at the disc (NVD) (▶Fig. 32.2). Fluorescein*

*angiography demonstrated macular leakage OU and*

*NVD in the left eye (▶Fig. 32.3). Optical coherence tomography*

*(OCT) confirmed macular edema OU.*

*Fig. 32.1 Funduscopic appearance of right eye demonstrating the*

*diabetic macular edema temporal to fovea. This approaches the center*

*and accounts for visual loss.*

*Fig. 32.2 Appearance of left eye is similar to right with lipid and*

*macular thickening temporal to macula. Early NVD is present at the*

*inferior part of the disc.*

*Fig. 32.3 Fluorescein angiogram shows macular edema leakage, but*

*also confirms the NVD as evidenced by late leakage.*

*Diabetic Macular Edema*

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*The patient underwent bilateral macular edema treatment*

*with intravitreal anti-vascular endothelial growth factor (anti-*

*VEGF) injection in OU. He was scheduled for follow-up examination*

*in 1 month to reevaluate the early neovascularization of*

*the disc in OS and repeat anti-VEGF therapy for persistent macular*

*edema in OU. The patient returned for a third office visit 1*

*month after the second anti-VEGF treatment, when a decision*

*for a third anti-VEGF injection and focal laser treatment in OD*

*was made in virtue of unresolved edema. OS demonstrated 20/*

*20 visual acuity and normal macular contours on OCT, and no*

*further treatment was recommended at the time.*

*Differential Diagnosis—Key Points*

*1. The patient meets the criteria for clinically significant*

*macular edema in each eye. The Early Treatment Diabetic*

*Retinopathy Study (ETDRS) defines clinically significant*

*diabetic macular edema as macular thickening within 500*

*μm of the center, lipid within 500 μm of the center*

*associated with macular thickening that may be present*

*greater than 500 μm of the center, and macular thickening*

*of 1 disc area, any portion of which is within 1 disc diameter*

*of the center of the fovea. It is imperative to evaluate the*

*involvement or noninvolvement of the macular 1-mm*

*center by the diabetic macular edema (DME), given that the*

*risk of visual loss and the need for treatment are greater*

*when the center is involved.*

*2. Visual acuity is not part of the definition of clinically*

*significant macular edema, and is of less importance*

*compared to the clinical examination in deciding whether or*

*not to recommend treatment. When the visual acuity is in*

*the 20/20 range, treatment with laser may be*

*recommended if there is clinically significant diabetic*

*macular edema not involving the macular center. In case*

*the macular center is involved, anti-VEGF therapy is*

*advocated as a better initial treatment strategy. In selected*

*cases, treatment may be deferred provided close follow-up*

*examination may be obtained, but usually the presence of*

*center-involving clinically significant macular edema (CSME)*

*implies need for immediate treatment.*

*3. This patient presented with possible early proliferative*

*disease in the left eye. It is generally believed that panretinal*

*photocoagulation (PRP) may exacerbate macular edema.*

*This was a leading cause of what was termed “early*

*persistent visual loss” following PRP in the Diabetic*

*Retinopathy Study (DRS). Accordingly, it was recommended*

*that macular edema be treated first with prompt attention*

*to PRP following laser treatment. For patients with high-risk*

*characteristics as defined by the DRS (which this patient did*

*not yet have), PRP and macular edema treatments were*

*usually offered simultaneously or within a couple of weeks.*

*The introduction of anti-VEGF therapy for CSME minimized the*

*concerns regarding the occurrence of “early persistent visual*

*loss” phenomena, considering the action of inflammatory*

*molecules released after PRP is commonly suppressed by the*

*anti-VEGF effect. For patients with severe nonproliferative*

*disease or early proliferative changes, PRP is considered, but*

*this may be deferred once it is not uncommon to notice*

*retinopathy stabilization and regression of early proliferation*

*after anti-VEGF therapy for DME; careful follow-up is crucial in*

*allowing assessment of further treatment need.*

*4. Optimal control of systemic conditions is important in*

*optimizing the natural course and even the response to*

*treatment. Patients with hypercholesterolemia or systemic*

*hypertension tend to respond poorer to treatment.*

*Accordingly, medical consultation for optimal treatment of*

*the systemic condition is recommended before reevaluating*

*for macular edema treatment.*

*5. In a patient with diabetes and at least moderate retinopathy*

*and macular thickening, the diagnosis is hardly*

*questionable. However, hypertensive retinopathy and*

*cystoid macular edema following cataract surgery, or*

*radiation retinopathy, are two entities which may mimic the*

*appearance in this patient.*

*32.2 Diagnosis*

*Clinically significant diabetic macular edema, center-involving*

*(ci-CSME) OU.*

*Early proliferative diabetic retinopathy, OS.*

*32.3 Test Interpretation*

*The clinical examination forms the basis for diagnosis and is the*

*primary factor in deciding if treatment is recommended for*

*patients with diabetic macular edema. Fluorescein angiography*

*may be useful by defining degrees of nonperfusion (and therefore*

*assigning the cause of visual loss to an entity other than*

*macular edema) and in localizing areas of maximal microaneurysm*

*leakage, which may be helpful in guiding treatment. In some*

*cases, stereoscopic fundus photography may also be of value in*

*confirming the presence or absence of macular thickening. These*

*modalities have been largely supplanted by spectral domain OCT*

*(SD-OCT). SD-OCT provides superior quantitative and qualitative*

*assessment of retinal thickening areas, and has especial reproducibility,*

*allowing precise change(s) detection.*

*32.4 Medical Management*

*Medical treatment therapies are necessary to maximize treatment*

*of hypercholesterolemia or systemic hypertension. Optimal*

*control of blood sugar is a long-term goal to be pursued,*

*but is rarely valuable in effecting the short-term improvements*

*in retinopathy.*

*32.5 Surgical Management*

*Anti-VEGF therapy with bevacizumab, ranibizumab, or aflibercept*

*has mostly replaced laser treatment in DME, and is the*

*first-line therapy for center-involving DME. Intravitreal corticosteroids*

*are considered a good alternative for poor-responsive,*

*pseudophakic eyes with no history of elevated intraocular pressure.*

*A sequence of three intravitreal injections with the same*

*initial drug within 4- to 6-week intervals is usually necessary*

*before considering other therapies.*

*Retina*

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*Laser treatment was previously established by the ETDRS as*

*the cornerstone treatment for diabetic macular edema; nowadays,*

*its benefit is that it might avoid long-term injection-based*

*therapy. The treatment technique involves the use of 50- or 100-*

*μm spot sizes, with 0.1- to 0.2-second burn durations (generally,*

*the argon laser treatment is used). The burn-intensity end point*

*is some whitening of the retina, but not as intense as for PRP.*

*The ETDRS technique involved direct treatment of microaneurysms,*

*but allowed for a grid treatment of the thickened area.*

*Many utilize a modified grid treatment whereby the initial treatment*

*is aimed at obvious microaneurysms, with a filling in of*

*the thickened area which yields, effectively, a grid treatment.*

*The ETDRS modified grid treatment has been widely adopted*

*by retina specialists in association with anti-VEGF therapy. Multiple*

*recent trials demonstrated better results when anti-VEGF*

*drugs are combined to laser therapy for center-involving CSME.*

*In cases of non–center involving CSME, laser monotherapy following*

*the ETDRS technique (modified or not modified) is still*

*the best option.*

*Rare patients will present with macular edema that appears*

*to be due to traction induced by a taut, thickened posterior hyaloid.*

*Such cases are easily identified preoperatively by SD-OCT,*

*but may respond only to surgical removal of the thickened posterior*

*hyaloid.*

*32.6 Rehabilitation and Follow-up*

*Generally, after patients are treated for diabetic macular edema*

*with an anti-VEGF agent with or without focal laser, they are*

*followed up in 4 to 6 weeks. If there is clinical evidence of persistent*

*visual loss attributable to remnant or recurrent edema,*

*then the patient is retreated in this time frame. A sequence of*

*anti-VEGF intravitreal injections is sometimes needed for the*

*complete edema regression and best visual acuity achievement.*

*Switching to another anti-VEGF drug might be beneficial for*

*patients with persistent edema, especially if poor response is*

*noticed after three consecutive attempts with the same drug in*

*4- to 6-weeks intervals. Intravitreal corticosteroids are a good*

*alternative in some cases, and it might offer greater benefit in*

*eyes with severe edema. Repeated laser treatment can also be*

*considered 3 to 6 months following initial treatment. Care is*

*taken not to overtreat in patients who have had multiple treatments,*

*since it may not be possible to eliminate the macular*

*thickening and recover the vision despite successive anti-VEGF/*

*corticosteroids and laser therapy, and after a point those treatments*

*may become visually counterproductive.*

~~~~~CASE 33 Proliferative Diabetic Retinopathy~~~~~

*33 Proliferative Diabetic Retinopathy*

*Thalmon R. Campagnoli and William E. Smiddy*

*Abstract*

*Proliferative diabetic retinopathy might be encountered less*

*frequently, or be diagnosed at an earlier stage, currently but*

*remains an important and moderately common cause of visual*

*loss in a diabetic patient. The dichotomy of high-risk versus*

*non-high-risk characteristics is probably only important as an*

*impetus for urgency, but not determination of treatment in*

*current practice. The mainstay of treatment is probably still*

*panretinal laser photocoagulation, but intravitreal injection of*

*anti-vascular endothelial growth factor (anti-VEGF) agents is*

*playing a larger role currently, as evidenced by recent results of*

*Protocol S from the DRCR Network. Anti-VEGF injections are*

*especially important when there is concurrent macular edema,*

*and are also unequivocally valuable in the setting of vitreous*

*hemorrhage severe enough to prevent laser application. Diagnostic*

*modalities are generally unnecessary, but fluorescein*

*angiography can still be helpful for the diagnosis of early proliferative*

*disease.*

*Keywords: diabetes, retinopathy, proliferative, neovascularization,*

*laser, photocoagulation, intravitreal injections, anti-VEGF*

*treatment*

*33.1 History*

*A 50-year-old man with a 5-year history of type II diabetes mellitus*

*presented for a second opinion from an ophthalmologist*

*regarding the possibility of diabetic retinopathy. The patient*

*was asymptomatic upon initial presentation.*

*His examination showed vision of 20/20 in each eye. Pressures*

*were 12 and 13mm Hg, in the right and left eyes, respectively.*

*Slit-lamp examination was unremarkable. The lens was*

*perfectly clear. On funduscopic examination of the right eye,*

*there was a mild degree of hard exudates scattered about the*

*posterior pole, but there was no definite macular thickening.*

*Questionable neovascularization elsewhere was seen at the distal*

*portion of both temporal arcades. Most prominent, however,*

*was definite neovascularization at the disc that was in excess of*

*one disc area in extent (▶Fig. 33.1). In the left eye, there were*

*intraretinal hemorrhages with microaneurysms in all four*

*quadrants, but this exceeded the standard photograph 2A for*

*hemorrhages in only two quadrants (▶Fig. 33.2).*

*33.2 Risk Factors for Severe Visual*

*Loss in Diabetic Retinopathy Study*

*1. Any neovascularization.*

*2. Neovascularization at the disc (as compared to*

*neovascularization elsewhere).*

*3. Severe neovascularization:*

*a) Neovascularization within one disc diameter of the optic*

*disc exceeding one-quarter to one-third disc area in size—*

*DRS standard photograph 10A.*

*b) Neovascularization elsewhere exceeding one-half disc*

*area in extent.*

*4. Vitreous hemorrhage.*

*Differential Diagnosis—Key Points*

*1. In the setting of a patient with diabetes mellitus with*

*bilateral retinopathy, it is quite clear that the diagnosis is*

*diabetic retinopathy. Of principal importance is*

*understanding the staging of each eye so that proper*

*treatment recommendations may be determined. The*

*classification of diabetic retinopathy is simplified to*

*“nonproliferative” diabetic retinopathy and “proliferative”*

*diabetic retinopathy. This classification system is based on*

*the findings of numerous multicentered studies of natural*

*history and responses to treatment. The right eye has*

*proliferative diabetic retinopathy (PDR), whereas the left eye*

*has nonproliferative diabetic retinopathy.*

*PDR is defined by the presence of neovascularization and/or*

*vitreous hemorrhage (presumed neovascularization), and is*

*typically subdivided into early (non-high-risk) PDR or high-risk*

*PDR. The Diabetic Retinopathy Study (DRS) identified four*

*high-risk features and defined as high-risk eyes the ones*

*containing three or four of these features (see list below).*

*2. Other causes of retinal neovascularization should also be*

*considered in the differential diagnosis, but given this*

*medical history they are extremely unlikely.*

*Neovascularization due to branch retinal vein occlusion*

*usually does not produce neovascularization directly at the*

*disc and thus would most commonly be in the differential*

*diagnosis of neovascularization elsewhere. However, the*

*appearance of collateral vessels at the disc as sometimes*

*occurs after branch or central retinal vein occlusion may*

*mimic neovascular vessels at the disc. These are more*

*characteristically of larger caliber (“loopy”) and are*

*nonprogressive. Unlike neovascularization, collateral vessels*

*pose no threat of vitreous hemorrhage. Other causes of*

*neovascularization typically share the ischemic state and*

*may be seen in uveitis, in various forms of occult vasculitis,*

*Eales’ disease, proliferative sickle retinopathy, and radiation*

*retinopathy.*

*3. Other causes of nonproliferative retinopathy mimicking the*

*findings in this patient’s left eye include radiation*

*retinopathy and hypertensive retinopathy.*

*4. Diabetic retinopathy, particularly proliferative phases, may*

*occur asymptomatically. It is for this reason that many*

*patients commonly go undiagnosed until more severe*

*complications have ensued (i.e., vitreous hemorrhage or*

*tractional retinal detachment). Thus, a careful, complete,*

*dilated funduscopic examination with some form of highmagnification*

*fundoscopy should be performed on a regular*

*basis.*

*Retina*

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*33.3 Test Interpretation*

*Usually, the staging of retinopathy, either proliferative or nonproliferative,*

*is achieved by clinical examination. While the*

*direct ophthalmoscope may be suitable for the purposes of*

*staging the condition, slit-lamp biomicroscopy with a precorneal*

*lens is more accurate. The use of the 60- or 90-diopter lens*

*gives an inverted, indirect image; however, it typically sacrifices*

*some degree of stereopsis and, accordingly, some sensitivity.*

*The contact lens evaluation allows optimal stereoscopic evaluation,*

*but may be limited by media opacities in many patients.*

*Fluorescein angiography is usually not a diagnostic modality.*

*However, in questionable vascular lesions, the fluorescein*

*angiogram may demonstrate leakage from neovascular vessels,*

*whereas other vascular malformations such as intraretinal*

*microvascular abnormalities may not show leakage. Another*

*use of fluorescein angiogram is for detection of retinal nonperfused*

*areas and treatment guidance which might prompt*

*treatment even before PDR is manifest in selected cases. A clinically*

*useful tool is to obtain high-quality stereoscopic fundus*

*photographs in all fields. Examination of these photographs is*

*the most sensitive means of evaluating the fine details of the*

*fundus vasculature. Strictly speaking, neovascularization is typically*

*seen as fine vessel outgrowth from the venous side of the*

*circulation, which most characteristically leads to slightly elevated*

*vascular frond. This is in contrast to the intraretinal*

*microvascular abnormalities which are within the retina and,*

*therefore, flat.*

*Spectral-domain optical coherence tomography is especially*

*useful in order to noninvasively demonstrate and quantify associated*

*macular edema and/or vitreomacular traction leading to*

*decreased vision in PDR eyes (▶Fig. 33.3), and also assess other*

*possible vision-threatening macular diseases.*

*33.4 Diagnosis*

*Right eye: Proliferative diabetic retinopathy with high-risk*

*characteristics.*

*Left eye: Moderately severe nonproliferative diabetic retinopathy.*

*33.5 Medical Management*

*The DRS defined a poor prognosis for patients with neovascularization,*

*and especially for those with high-risk characteristics*

*as defined by eyes containing three or four of the characteristics*

*as listed in section 33.2 Risk Factors for Severe Visual Loss in*

*Diabetic Retinopathy Study.1 The mainstay of treatment for PDR*

*is panretinal laser photocoagulation (PRP). PRP is typically performed*

*under topical anesthesia with the use of a pan-fundus*

*contact lens and is at least minimally uncomfortable, or using a*

*laser indirect delivery system. A significant proportion of*

*patients will require retrobulbar anesthesia because of pain*

*incurred with laser treatment. Commonly, PRP is delivered in*

*two or more sessions to avoid either severe pain or choroidal*

*Fig. 33.1 Examination of the right disc showed neovascularization*

*involving over one disc area, extending beyond the temporal and*

*superior margins of the disc. Stereoscopic view showed this clearly to*

*be elevated over the retinal surface. No vitreous hemorrhage was*

*present.*

*Fig. 33.2 The left eye showed a moderate number of microaneurysms*

*and intraretinal hemorrhages with occasional hard exudates. No*

*intraretinal microvascular abnormalities or venous beading were noted.*

*A moderate degree of hemorrhage was noted only in two quadrants.*

*Fig. 33.3 Standard photograph 10A from the Diabetic Retinopathy*

*Study showing neovascularization involving one-third to one-half of the*

*disc area.*

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*detachment from excessive treatment. Usually, a relatively*

*short burn duration (0.1 second or less) is the best way to minimize*

*patient discomfort. Spot size ranging from 200 to 500 μm*

*is usually utilized. A total of approximately 1,500 laser spots are*

*aimed for, but probably more important is the area of retina*

*lesioned by the laser. That is, fewer spots are necessary when*

*larger spot sizes are used. Usually, a 1- to 2-week interval*

*between laser sessions is recommended, but this is accelerated*

*with more severe neovascularization.*

*Complications of panretinal photocoagulation include an*

*almost universal finding of some degree of pain in the immediate*

*posttreatment period, which usually responds to over-the-counter*

*analgesics. Vitreous hemorrhage may occur following laser*

*photocoagulation; it is unclear whether that is the coincidence*

*or whether it is due to laser-induced remodeling of the neovascular*

*complexes during initial stages of regression. Most patients*

*will recognize diminished illumination in an eye undergoing the*

*procedure, most distinctly noticed as a decrease in night vision.*

*Although peripheral visual field loss has been documented, it is*

*not usually clinically significant. Exacerbation of preexisting*

*(even nonclinically significant) diabetic macular edema may follow*

*PRP. For this reason, treatment of diabetic macular edema*

*with focal photocoagulation and/or anti-VEGF therapy is recommended*

*either before or at least during PRP treatment. The DRS*

*documented a 20% incidence of early persistent visual loss (≥ 2*

*lines) following PRP, mostly due to this phenomenon.*

*The Early Treatment Diabetic Retinopathy Study2 and, to a*

*lesser degree, DRS1 defined potential efficacy for patients even*

*before proliferative retinopathy ensues. This is discussed in a*

*previous chapter.*

*The results of the DRS showed that for patients with high-risk*

*characteristics the rate of severe visual loss (5/200) after 2 years*

*decreased from 27 to 10%. Long-term follow-up studies have*

*documented the relative stability of eyes following an initially*

*successful response to panretinal photocoagulation. While a*

*treatment benefit was seen in the DRS for early proliferative*

*cases, the magnitude of the response was not sufficient to support*

*a strong treatment recommendation. Nevertheless, consideration*

*could be given to laser treatment in these cases.*

*Recently, adjunctive anti-VEGF therapy has been reported to*

*be beneficial for PDR, especially when accompanying vitreous*

*hemorrhage limits amenability to treatment. This is also potentially*

*useful in the PDR eye that is associated with macular*

*edema. Another role for anti-VEGF treatment is an eye with*

*aggressive neovascularization for which surgical intervention*

*has been recommended, to mitigate intraoperative bleeding. Its*

*role in the treatment of very severe NPDR and early PDR without*

*macular edema is currently under investigation.*

*33.6 Surgical Management*

*The indications and surgical treatment of patients with severe*

*complications of diabetic retinopathy are beyond the scope of*

*this chapter. Patients with vitreous hemorrhage or fibrovascular*

*proliferation leading to traction that threatens the macula (with*

*or without detachment) are considered for vitrectomy. Typically,*

*earlier vitrectomy is considered for patients with vitreous*

*hemorrhage and type I diabetes. Patients with type II diabetes*

*are commonly observed for spontaneous improvement of vitreous*

*hemorrhage. The results of vitrectomy are best for patients*

*with vitreous hemorrhage and worse for patients with severe*

*degrees of traction or retinal detachment.*

*33.7 Rehabilitation and Follow-up*

*After completion of a course of PRP, the patient should be*

*observed within a few weeks. If the retinopathy progresses,*

*vitrectomy must be considered. If the retinopathy regresses*

*completely, then a conservative, observational follow-up regimen*

*may be pursued, contingent upon the stability of the retinopathy*

*and visual acuity. Follow-up PRP and/or anti-VEGF*

*therapy is considered when there are multiple recurrent vitreous*

*hemorrhages or when the regression of the neovascularization*

*is incomplete, particularly when the morphology of the*

*neovascularization is feathery, with fine caliber vessels.*

~~~~~CASE 34 Retinal Arterial Occlusion~~~~~

*34 Retinal Arterial Occlusion*

*Amir Mohsenin and William E. Smiddy*

*Abstract*

*Retinal arterial occlusion, whether it be branch or central, is the*

*characteristic cause of sudden, mostly irreversible loss of vision.*

*It is most important as a potential warning signal of systemic*

*vascular disease, and referral for a systemic medical workup*

*has long been the recommended consequence of the diagnosis.*

*Atherosclerosis is the most common medical association, but a*

*more thorough evaluation for carotid plaque or arrhythmias*

*would be the suggested focus for the internist’s workup. The*

*classic finding of a Hollenhorst plaque and retinal whitening*

*appearing within hours of the loss of vision with fading during*

*the following week remain the classic presentation. Optical*

*coherence tomography imaging of later cases can demonstrate*

*the inner retinal atrophy that follows from the ischemic injury.*

*Keywords: retina, vascular occlusion, thrombus, ischemia, cholesterol*

*34.1 History*

*A 69-year-old woman presented 4 weeks after sudden visual*

*loss in the right eye. Medical history included a 6-year history*

*of systemic hypertension and a 1-year history of diabetes mellitus.*

*Examination showed visual acuity of 20/30 and 20/25 in*

*the right and left eyes, respectively. There was no afferent*

*pupillary defect. Intraocular pressures were 16mm Hg in each*

*eye. Slit-lamp examination was remarkable only for early*

*nuclear sclerosis of the lens in both eyes. On funduscopic*

*examination of the right eye, the inferotemporal retinal artery*

*appeared sclerotic and attenuated with a glistening yellow cholesterol*

*embolus (Hollenhorst’s plaque) at its proximal part*

*(▶Fig. 34.1). There was an area of superficial retinal whitening,*

*most prominent in the posterior pole along the distribution of*

*the obstructed artery. Funduscopic examination of the left eye*

*was normal.*

*Fluorescein angiography demonstrated a corresponding filling*

*defect in the inferior branch retinal artery distribution*

*(▶Fig. 34.2).*

*34.2 Test Interpretation*

*Diagnosis of most cases of acute retinal artery occlusion (CRAO*

*or BRAO) may be achieved by clinical examination of the fundus*

*with the indirect ophthalmoscope or slit-lamp biomicroscopy.*

*Acute occlusions are more obvious due to the characteristic*

*edema.*

*Intravenous fluorescein angiography may be useful in showing*

*the details of the abnormal circulation of central or branch*

*artery occlusion. The principal abnormality is delayed appearance*

*of the dye in the arterial circulation. Cilioretinal artery*

*sparing may be demonstrable. Late staining of the optic nerve*

*head may also occur. The filling of the retinal arteries is often*

*abnormal, with the fluorescein partially filling an artery.*

*Venous filling is usually slowed, and occasionally the dye will*

*not progress beyond laminar flow. Leakage of the dye from the*

*vessel wall is not normally seen except at the site where an*

*embolus lodges within a retinal artery. Delayed choroidal filling*

*occurs in about 10% of CRAO cases and suggests ophthalmic*

*artery occlusion. The occlusion frequently recanalizes within a*

*few weeks of obstruction and, accordingly, the angiogram may*

*show only subtle changes in more chronic cases.*

*Visual field testing may also be helpful in making a diagnosis*

*in nonacute cases of BRAO. The characteristic finding is a*

*Differential Diagnosis—Key Points*

*1. The hallmarks of arterial occlusion are sudden, dense loss of*

*vision corresponding to a zone of retinal whitening and*

*arterial attenuation. The retinal whitening is due to edema*

*but is transient; after a few days, it resolves and the*

*diagnosis may be more difficult. The characteristic cherryred*

*spot of central retinal artery occlusion (CRAO) is due to*

*the retinal pigment epithelium and choroidal coloration*

*remaining visible through the central, thin foveola—made*

*more prominent because the thicker, surrounding macular*

*tissues are translucent due to the acute ischemic edema*

*(▶Fig. 34.3).*

*2. Approximately 57% of retinal arterial occlusions involve the*

*central retinal artery, 39% involve the branch retinal artery,*

*and 5% involve the cilioretinal artery.*

*3. Branch retinal artery occlusion (BRAO) results from embolic*

*or thrombotic occlusion of the affected vessel. The*

*temporal retinal arteries are involved in 90% of cases. Three*

*main varieties of emboli include cholesterol emboli arising*

*in the carotid arteries, platelet-fibrin emboli associated with*

*large vessel arteriosclerosis, and calcific emboli arising from*

*diseased cardiac valves. These are not commonly able to be*

*differentiated clinically. Rare causes of emboli include*

*cardiac myxoma, fat emboli from long bone fractures,*

*septic emboli from infective endocarditis, and migraine (in*

*patients younger than 30 years).*

*4. CRAO is often caused by atherosclerosis-related thrombosis*

*occurring at the level of the lamina cribrosa. Other causes*

*include emboli, spasm, and dissecting aneurysm. Emboli are*

*seen in the retinal arterial system in about 20% of eyes with*

*CRAO. Patients with atherosclerotic CRAO are at increased*

*risk of early death from systemic vascular disease.*

*5. Systemic workup of patients with arterial occlusions is*

*usually deferred to the internist, but might include a*

*complete physical examination, carotid evaluation (e.g.,*

*Doppler flow studies or angiography) as indicated,*

*electrocardiogram, and echocardiography. Systemic*

*hypertension (70%) and diabetes (25%) are also commonly*

*associated with retinal arterial occlusions.*

*Retinal Arterial Occlusion*

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*sectoral, or even hemifield, abnormality that has a distinct border*

*respecting the horizontal midline.*

*Electroretinography is not usually necessary, but characteristically*

*reflects inner retinal ischemia by a decrease in B-wave*

*amplitude.*

*34.3 Diagnosis*

*Branch retinal artery occlusion, right eye.*

*34.4 Medical Management*

*The visual prognosis in BRAO is much better than for CRAO;*

*80% of eyes with BRAO eventually improve to 20/40 or better.*

*Possibly, the most important aspect of medical management is*

*diagnosing systemic conditions.*

*No specific ocular therapy has been proven to improve the*

*visual prognosis. Systemic vascular disease may contribute to*

*the arterial occlusion and predispose the patient to avoidable*

*future stroke or heart attack. Indeed, in one study, CRAO*

*patients had twice the mortality rate (56% 9-year survival) of*

*age-matched controls. In acute cases, digital pressure on the*

*globe for 15 seconds, followed by a sudden release, may dislodge*

*or advance an embolus. Lowering the intraocular pressure*

*with intravenous acetazolamide, topical intraocular*

*pressure–lowering drops, or anterior chamber paracentesis, if*

*less than 24 hours old, may also dislodge or advance an embolus.*

*Augsburger and Magargal noted at least a three-line*

*improvement in vision in 35% of eyes at 1 month after the acute*

*event, when paracentesis was performed early. Inhalation of a*

*mixture of 5% carbon dioxide and 95% oxygen (carbogen) or*

*retrobulbar or systemically administered calcium channel*

*blockers to promote vasodilation have been advocated, but the*

*results are generally disappointing.*

*Retinal neovascularization may develop after BRAO, particularly*

*in patients with diabetes mellitus. Iris neovascularization*

*secondary to BRAO is extremely rare, but develops in up to 20%*

*of eyes with CRAO within 12 weeks, especially when also associated*

*with central vein occlusion. Full-scatter panretinal photocoagulation*

*is effective in eradicating the new iris vessels in*

*about two-thirds of cases. Ipsilateral carotid artery stenosis*

*may also be present and be a cause of rubeosis iridis.*

*There is no good evidence that anticoagulation enhances*

*prognosis in an isolated retinal arterial occlusion.*

*Studies using fibrinolytic agents have been reported, but have*

*found limited use, presumably due to the need for prompt*

*treatment, specialized catheterization techniques, or limited*

*visual recovery.*

*34.5 Rehabilitation and Follow-up*

*The most important reason for follow-up examination is to monitor*

*for subsequent neovascularization. Reinforcement of regimens*

*prescribed by the patient’s internist should be provided.*

*Fig. 34.3 Funduscopic appearance of a different patient 3 days after*

*sudden visual loss. Retinal edema indicative of CRAO is apparent, with*

*classic foveal “cherry-red spot” in evidence.*

*Fig. 34.1 Photograph of the right fundus showing inferotemporal*

*branch artery occlusion with prominent Hollenhorst’s plaques.*

*Fig. 34.2 Fluorescein angiogram of the same eye showing limited*

*filling of the inferotemporal retinal artery and its branches. Numerous*

*drusen are also apparent, scattered about the posterior pole.*

*Retina*

*112*

*Rehabilitation efforts are not specific to arterial occlusive disease,*

*and low vision aids as indicated may be sought. Prism*

*glasses for patients with dense hemifield defects have been*

*described, but are of limited general benefit.*

~~~~~CASE 35 Central Retinal Vein Occlusion~~~~~

*35 Central Retinal Vein Occlusion*

*William E. Smiddy*

*Abstract*

*Central retinal vein occlusion presents with a broad spectrum*

*of severity. The most common systemic association in older*

*patients is hypertension or its long-term sequelae, but the classic*

*association with oral contraceptives in younger patients*

*should be remembered. Other hypercoagulability conditions*

*have also been associated. The diagnostic hallmark is intraretinal*

*hemorrhage in all four quadrants, with collateralization at*

*the disc being more prominent a bit later in the course. The*

*degree of induced ischemia is usually the most important*

*determinant of visual acuity, but the secondary macular edema*

*may also play an important role in the visual acuity. Most*

*important is that the macular edema represents a frequently*

*reversible component for which intravitreal anti-vascular endothelial*

*growth factor (anti-VEGF) or corticosteroid injection*

*therapy may target. Similar to macular edema due to diabetic*

*retinopathy, various treatment algorithms have been demonstrated*

*to be beneficial in high proportions of patients. Optical*

*coherence tomography plays a major role in directing the*

*course of treatment. Neovascular glaucoma still occurs, and*

*represents a source of catastrophic ocular demise, but in some*

*cases may be controlled with anti-VEGF treatment in conjunction*

*with panretinal photocoagulation especially if iris neovascularization*

*can be detected early.*

*Keywords: central retinal vein occlusion, retina, venous occlusive*

*disease, intravitreal injections, anti-VEGF, macular edema,*

*neovascularization*

*35.1 History*

*A 45-year-old woman presented with a 3-week history of*

*decreased vision in the right eye. Her only medications were*

*oral contraceptives and did not have hypertension. The vision*

*had gradually diminished during the first week after onset and*

*then stabilized. Examination disclosed best corrected visual*

*acuity of 20/100 OD and 20/20 OS. There was a right afferent*

*pupillary defect. Slit-lamp examination showed no signs of iris*

*neovascularization; the patient was pseudophakic with a clear*

*posterior capsule. Intraocular pressures were 12 and 14mm Hg,*

*respectively. Funduscopic examination on the right showed*

*intraretinal hemorrhage distributed throughout each quadrant*

*with mild disc edema, but no definite collaterals (▶Fig. 35.1).*

*Macular edema was evident over about a disc area at the fovea.*

*The cup-to-disc ratio was 0.3. Examination of the left eye was*

*normal.*

*Fluorescein angiography showed good perfusion in the midperiphery*

*and late dye leakage at the fovea. The optical coherence*

*tomography (OCT) showed marked central macular edema*

*(▶Fig. 35.2).*

*Intravitreal triamcinolone was administered. The macular*

*edema resolved, and remained resolved 3 months later*

*(▶Fig. 35.3) with improvement of vision to 20/30. However, the*

*edema and visual loss recurred at 6 months at which time a*

*second intravitreal triamcinolone was administered with similar*

*resolution, but with recurrence only 3 months later. She has*

*been maintained on intravitreal bevacizumab now about every*

*3 months with a stable OCT and visual acuity of 20/30.*

*Differential Diagnosis—Key Points*

*Acute visual loss typically suggests a vascular event. As in this*

*case, acute visual loss may be followed by continued*

*deterioration. Other abnormalities based on these historical*

*features such as optic neuropathies must be considered but*

*are usually distinguished by clinical examination features.*

*1. The pattern of intraretinal hemorrhages in this case*

*markedly narrowed the differential diagnosis. Extensive*

*intraretinal hemorrhages in all quadrants is a characteristic*

*finding of central retinal vein occlusion (CRVO), and only in*

*cases with less extensive hemorrhage does diagnostic*

*confusion exist. The distribution of intraretinal hemorrhages*

*in all quadrants distinguishes a CRVO from branch or*

*hemiretinal vein occlusion. Diabetic retinopathy or*

*advanced radiation retinopathy with diffuse intraretinal*

*hemorrhage may mimic this entity, but those histories were*

*lacking.*

*2. Confluent, extensive intraretinal hemorrhage may mimic*

*subhyaloid or subretinal hemorrhage. Subretinal and*

*subhyaloid hemorrhages are almost always consolidated*

*rather than scattered, typically in the posterior pole.*

*3. The most common systemic disease associated with CRVO*

*is hypertension. A majority of patients have hypertension,*

*cardiovascular disease, or diabetes. CRVOs are unilateral in*

*at least 95% of cases. This patient was taking oral*

*contraceptives, which have been etiologically implicated as*

*a risk factor for CRVO. Patients with bilateral CRVO more*

*commonly have other systemic medical conditions such as*

*hyperviscosity syndromes (e.g., multiple myeloma,*

*macroglobulinemia, coagulation defects, or polycythemia*

*vera). Systemic defects are found frequently enough in*

*bilateral cases that systemic evaluation is recommended.*

*Systemic evaluation in unilateral cases is usually limited to*

*referral to a general medical doctor for a complete physical*

*examination, especially for younger patients such as in this*

*case. Cessation of the oral contraceptives was*

*recommended. Patients with isolated unilateral CRVOs have*

*such a low incidence of these systemic diseases that the*

*medical workup is left to the discretion of the patient’s*

*ophthalmologist and internist.*

*35.2 Test Interpretation*

*The ophthalmoscopic appearance is typically characteristic and*

*diagnostic. Fluorescein angiography may demonstrate retinal*

*nonperfusion, which may provide prognostic information for*

*the development of neovascular glaucoma. Lower visual acuity*

*Retina*

*114*

*implies a higher risk group for more severe visual loss and*

*poorer response to treatment.*

*Most useful, especially for assessing response to therapy, is*

*OCT.*

*The electroretinogram may yield valuable information—the B*

*wave arises in the inner nuclear layer of the retina (probably*

*the Müller cells), and the A wave arises in the photoreceptors. A*

*decreased B/A wave amplitude measuring less than 1.0 indicates*

*ischemia and an increased risk of neovascular glaucoma.*

*Cases with B/A ratios greater than 1.0 indicate that the ischemic*

*injury has not disproportionally affected the portion of the retina*

*subserved by the retinal versus choroidal circulation.*

*Accordingly, such patients usually do not develop neovascular*

*glaucoma.*

*35.3 Diagnosis*

*CRVO, with secondary macular edema, OD.*

*35.4 Medical Management*

*The first step in the treatment of a patient with CRVO is identification*

*and treatment of systemic disorders in concert with*

*the patient’s primary care physician; in this case, cessation of*

*oral contraceptives was recommended due to its implication as*

*a risk factor for venous thrombosis. Aspirin or other anticoagulants*

*have been shown to decrease the risk of subsequent*

*thrombotic events in systemic thrombotic conditions. This is*

*the rationale behind aspirin therapy (80mg daily) after CRVO.*

*However, it is not infrequent that an incident patient was*

*already taking aspirin or anticoagulants at the time of the vascular*

*event, for other systemic vascular disorders. Thus, anticoagulants*

*do not completely prevent vaso-occlusive disease, and*

*since some side effects may occur, their use should be considered*

*carefully for CRVO.*

*Management of patient with CRVO is in two categories: neovascularization*

*of the anterior segment and macular edema.*

*Neovascularization, as in other retinal vascular disorders, is a*

*response to ischemia. CRVOs have historically been divided into*

*ischemic (complete, nonperfused) versus nonischemic (incomplete,*

*well-perfused, or partial) vein occlusions. Approximately*

*30% of eyes with CRVO are nonperfused, and approximately half*

*of these cases will develop neovascular glaucoma. Typically, the*

*visual acuity is more profoundly diminished in such patients.*

*The Central Vein Occlusion Study (CVOS) evaluate the role of*

*prophylactic PRP in ischemic CRVO, finding that when severe*

*retinal ischemia (at least 5 disc areas of nonperfusion) or rubeosis*

*iridis should be treated with PRP. Eyes with vitreous hemorrhage*

*or other media opacities that prevent laser treatment can*

*Fig. 35.3 Three months after intravitreal triamcinolone injection OD,*

*the OCT shows resolution of the macular edema and visual acuity*

*improvement to 20/30.*

*Fig. 35.1 Fundus photograph OD demonstrating intraretinal*

*hemorrhage in all four quadrants and tortuous vessels. There are no*

*collaterals. The visual acuity is 20/100. Fig. 35.2 The OCT OD marked intraretinal edema, consistent with the*

*visual loss.*

*Central Retinal Vein Occlusion*

*115*

*be considered for cryopexy or vitrectomy, but carry a poor*

*prognosis*

*Macular edema is the more common sight-threatening complication*

*of CRVO that is encountered. The CVOS found grid*

*photocoagulation not to be efficacious in patients with macular*

*edema; although macular edema could be reduced, the visual*

*outcomes were the same in control groups. However, intravitreal*

*triamcinolone and anti-vascular endothelial growth factor*

*agents have been found to be effective in ameliorating vision*

*loss by decreasing macular edema. As with their use in other*

*retinal vascular disorders, an initial period of more frequent*

*injections (perhaps 4–6 weeks) can usually be followed by less*

*frequent injections once the macular edema has resolved.*

*Laser treatment has been used and advocated to create a chorioretinal*

*anastomosis, but its role is not well established. Pilot*

*studies of intravenous or intravitreal fibrinolytic agents have*

*been reported but, also, do not have proven efficacy.*

*35.5 Surgical Management*

*The role for surgical management is currently established only*

*for media opacities preventing photocoagulation or for control*

*of intraocular pressure in eyes with some visual potential. Glaucoma*

*surgery is commonly done in conjunction with laser or*

*retinal cryopexy. The most effective means of controlling the*

*pressure in cases with neovascular glaucoma is placement of a*

*shunt device.*

*35.6 Rehabilitation and Follow-up*

*The CVOS and other studies have found development of*

*rubeotic glaucoma occurs 3 to 6 months after the onset of the*

*CRVO. Thus, the recommended interval for follow-up examinations*

*(if injection therapy is not instituted) is monthly for 6*

*months after diagnosis. After 1 year, the incidence of rubeosis is*

*extremely low unless a previously perfused case converts to a*

*nonperfused case. This transition is usually heralded by a*

*decrease in visual acuity.*

~~~~~CASE 36 Branch Retinal Vein Occlusion~~~~~

*36 Branch Retinal Vein Occlusion*

*William E. Smiddy*

*Abstract*

*Branch retinal vein occlusion has a wide spectrum of involvement,*

*but is usually less severe than central retinal venous*

*occlusive disease. While systemic hypertension is more common*

*in patients with this condition, it is not universal and is*

*more commonly spontaneous and unassociated with systemic*

*diseases. Retinal neovascularization may occur, but is not common.*

*Sectoral scatter laser photocoagulation has been demonstrated*

*long ago to be a useful modality to prevent progressive*

*fibrovascular proliferation and vitreous hemorrhage, and is still*

*an important treatment in such cases. The more common*

*vision-threatening aspect is macular edema. While focal laser*

*has been proven beneficial to prevent additional visual loss, its*

*role has mostly been supplanted by intravitreal therapy with*

*corticosteroids or anti-vascular endothelial growth factor therapy.*

*Treatment protocols have been defined through many clinical*

*trials, but generally parallel those for macular edema due to*

*other etiologies such as central retinal vein occlusion and diabetic*

*macular edema. Similarly, optical coherence tomography*

*monitoring is the mainstay of determining how to modify or to*

*direct ongoing treatment.*

*Keywords: branch retinal vein occlusion, retinal occlusive disease,*

*macular edema, neovascularization, intravitreal injection,*

*anti-VEGF*

*36.1 History*

*A 66-year-old man had a 2-month history of decreased vision*

*OS characterized by a central scotoma that was centered superatemporally.*

*He had a 20-year history of hypertension that he*

*reported was well controlled on medications. The visual acuity*

*was 20/200 at first presentation, OS. A branch retinal vein*

*occlusion (BRVO) was diagnosed.*

*The right eye had previously incurred a central retinal vein*

*occlusion (CRVO) that responded to several injections of several*

*anti-vascular endothelial growth factor (anti-VEGF) agents, as*

*well as a couple of intravitreal triamcinolone injections. The*

*visual acuity OD had improved from 20/400 to 20/80 after resolution*

*of the macular edema.*

*The intraocular pressures were 15mm Hg in each eye. Funduscopic*

*examination OD showed a dry macula with collateral*

*vessels at the optic nerve head. In the left eye, there was an*

*anomalous arterial venous crossing along the inferotemporal*

*arcade with dot-and-blot hemorrhages extending from the*

*midportion of the inferotemporal arcade posteriorly into the*

*macula. There was moderate to marked macular edema*

*(▶Fig. 36.1).*

*Intravitreal bevacizumab was administered without improvement,*

*followed by aflibercept which had a better effect and has*

*been applied for about a year every 6 weeks. The visual acuity*

*has stabilized at 20/70 (▶Fig. 36.2).*

*Differential Diagnosis—Key Points*

*This patient presented initially with intraretinal hemorrhages*

*and macular edema that involved the fovea. Although*

*neovascularization and vitreous hemorrhage were absent,*

*these can be additional features of a BRVO. Intraretinal*

*hemorrhage, macular edema, and retinal neovascularization*

*with or without vitreous hemorrhage have distinct differential*

*diagnoses.*

*1. The most common cause of intraretinal hemorrhage is*

*diabetic retinopathy. Characteristically, this is associated*

*with microaneurysms in a distribution that involves many if*

*not all quadrants and, importantly, usually both eyes,*

*generally to a similar degree. More severe diabetic*

*retinopathy is accompanied by intraretinal microvascular*

*abnormalities, lipid exudates, venous beading, and other*

*signs of ischemia including neovascularization. Less*

*common causes of intraretinal hemorrhage include*

*radiation retinopathy and various forms of uveitis. CRVO is*

*characterized by intraretinal hemorrhages in all quadrants.*

*In this case, the intraretinal hemorrhages were present*

*segmentally in the distribution of the inferotemporal branch*

*retinal vein.*

*2. Retinal neovascularization is a response to ischemia. This,*

*too, is commonly associated with diabetic retinopathy, but*

*may be difficult to distinguish from patients with BRVOs.*

*However, as with intraretinal hemorrhages, other features*

*of diabetic retinopathy are usually more prominent in a*

*more generalized distribution in contrast to the segmental*

*distribution seen with BRVOs. A vitreous hemorrhage may*

*accompany any disease process with retinal*

*neovascularization. Other causes of retinal*

*neovascularization and/or vitreous hemorrhage include the*

*sickle cell retinopathies and various forms of uveitis.*

*3. With chronicity, there may be vascular collateralization,*

*commonly prominent at the nerve head. These collaterals*

*may mimic retinal neovascular vessels. The fluorescein*

*angiogram may be valuable in differentiating between the*

*two entities, as neovascularization classically displays*

*fluorescein leakage.*

*36.2 Test Interpretation*

*Clinical examination is the most important diagnostic test in*

*making the diagnosis. However, ancillary tests include fundus*

*photography, fluorescein angiography, and optical coherence*

*tomography (OCT) may confirm the clinical diagnosis but are*

*most helpful in monitoring and directing therapy. Fundus photography*

*may allow easier detection of diabetic retinopathy*

*and, consequently, earlier detection of neovascularization.*

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*Fluorescein angiography is valuable in assessing the retinal*

*perfusion status. Although this does not direct treatment, it*

*may influence the frequency of follow-up examinations to look*

*for the onset of retinal neovascularization. The fluorescein*

*angiogram may also depict a characteristic segmental pattern*

*of retinal vascular leakage. While this may confirm the presence*

*of the macular edema, it does not necessarily diagnose its cause.*

*Relying solely on clinical examination, the macular edema may*

*be mimicked by zones of nonperfusion or ischemia, causing*

*diagnostic uncertainty; the angiogram usually clarifies this and*

*may disclose unsuspected areas of retinal neovascularization*

*and distinguish neovascularization (which is characterized by*

*dye leakage) from collateral vessels (which do not leak dye).*

*36.3 Diagnosis*

*BRVO with macular edema, OS.*

*36.4 Medical Management*

*Systemic hypertension is a risk factor for the development of a*

*vein occlusion, but it does not appear to be an independent risk*

*factor for the severity of the course once a vein occlusion*

*occurs. However, the ophthalmologist should encourage maximal*

*control of hypertension in all patients. Other risk factors*

*that are less firmly established include patients with diabetes,*

*other cardiovascular disease, glaucoma, increased body mass at*

*age 20, hyperopia, higher serum cholesterol, lower high-density*

*liquid protein levels, a variety of less clinically apparent coagulation*

*disorders, and alcohol consumption. Systemic evaluation*

*for an isolated BRVO is probably only warranted for a younger*

*patient or with bilateral disease, but the ophthalmologist is*

*encouraged to notify the patient’s primary care physician of*

*such an occurrence.*

*The mainstay of medical management was laser photocoagulation*

*for many years, and may still be employed in selected*

*cases. The Branch Vein Occlusion Study (BVOS) studied laser*

*photocoagulation in patients with complications due to BRVO.*

*The most common complication of BRVO is macular edema*

*which may be self-limited with a fair degree and frequency of*

*spontaneous resolution. However, the BVOS established that*

*when the visual acuity is 20/40 or worse for at least 3 months,*

*then a focal grid photocoagulation pattern is recommended in*

*the area of edema; 63% of treated eyes gained two lines or more*

*of vision compared to 36% of untreated control eyes after 3*

*years of follow-up.*

*The BVOS also recommended scatter laser photocoagulation*

*be performed in the quadrant of the vein occlusion when neovascularization*

*ensues. While the exact pathogenesis of retinal*

*vein occlusion is uncertain, occlusion of the vein typically*

*occurs at the crossing point of an artery where the artery and*

*vein share a common adventitial sheath, suggesting a role for*

*endothelial damage due to chronic turbulence of flow. Furthermore,*

*the artery usually passes anterior to the vein, in contrast*

*to a random distribution in unaffected eyes. It has been*

*observed that the neovascularization commonly occurs in front*

*of the vein, rather than from the arteries. It was found that the*

*incidence of vitreous hemorrhages decreased from approximately*

*60% in controls to 30% of laser-treated patients with*

*neovascularization.*

*Fig. 36.1 (a) OCT appearance of the left eye with substantial macular edema distributed inferonasally, but spreading into the center. Vision was 20/*

*200. (b) OCT appearance of the right eye at presentation and (c) after treatment with many intravitreal agents for a central retinal vein occlusion. The*

*marked intraretinal edema has resolved with vision OD of 20/80.*

*Fig. 36.2 OCT appearance 6 months later, OS, after intravitreal*

*bevacizumab and, subsequently, aflibercept that has been required*

*every 6 weeks to maintain regression of the edema. The vision has*

*stabilized at 20/70.*

*Retina*

*118*

*Prophylactic laser treatment in patients with fluorescein*

*angiographically defined retinal capillary nonperfusion (larger*

*than 5 disc diameters in width) was also evaluated by the BVOS,*

*with the conclusion the frequency of neovascularization was*

*too infrequent to be justified.*

*The advent of intravitreal therapy for retinal vascular disease*

*has prompted many controlled clinical trials which have demonstrated*

*that intravitreal triamcinolone as well as the gamut*

*of anti-VEGF agents generally offers better final visual acuity*

*and resolution of macular edema compared to focal laser, and*

*are now the mainstay of treatment of macular edema secondary*

*to BRVO. As with their use in treating other retinal vascular*

*conditions, the frequency of treatment can often be*

*extended after initial control of the edema.*

*Anticoagulant treatment has not been shown to be beneficial*

*in the prevention or management of BRVO. However, as with*

*the treatment of other nonocular vaso-occlusive disorders,*

*aspirin therapy is often prescribed.*

*36.5 Surgical Management*

*The role of vitrectomy in eyes with BRVO is limited to nonclearing*

*vitreous hemorrhage or tractional and/or rhegmatogenous*

*macular detachment from fibrovascular proliferation in more*

*severe cases. In some cases, an epiretinal membrane may occur.*

*Usually, an epiretinal membrane induces minimal visual loss,*

*but if the vision decreases below about 20/60, vitrectomy with*

*membrane peeling may be considered. Surgical decompression*

*of the common adventitial sheath at the block site should still*

*be considered experimental.*

*36.6 Rehabilitation and Follow-up*

*Patients presenting with BRVO and vision better than 20/32*

*should be followed every 3 to 6 months initially, as laser and*

*intravitreal drug trials usually studied patients with at least this*

*degree of visual loss. Treatment is generally recommended for*

*patients presenting macular edema causing visual loss at and*

*below these visual acuity levels.*

*While there are various treatment frequency regimens*

*studied by clinical trials, generally the clinician institutes intravitreal*

*therapy initially (perhaps every 4–6 weeks), followed by*

*less frequent injections depending on the clinical response.*

*Studies comparing the results of the various agents have not*

*been published for BRVO patients. Switching to other agents is*

*considered if there is inadequate response after a course of initial*

*treatment.*

*Segmental scatter photocoagulation to the affected zones is*

*recommended if retinal neovascularization is detected. Vitrectomy*

*is an option for nonclearing vitreous hemorrhage or for*

*progressive fibrovascular proliferation causing visually important*

*traction retinal detachment. Some have advocated optic*

*nerve sheath decompression or lysis of the common adventitial*

*sheath at the occlusion site in selected cases.*

~~~~~CASE 37 Nonexudative Age-Related Macular Degeneration~~~~~

*37 Nonexudative Age-Related Macular Degeneration*

*John Edward Legarreta*

*Abstract*

*The hallmark of nonexudative (or atrophic) age-related macular*

*degeneration (AMD) is drusen, which frequently coexists with a*

*variable degree of atrophy of the retinal pigment epithelium*

*(RPE) in the macula. The size of the drusen and degree of atrophy*

*are generally related to degree of visual loss, and form the*

*basis for consideration of the efficacy of preventative vitamin*

*therapy. Nonexudative maculopathy is distinguished from exudative*

*AMD by the lack of exudation on imaging studies such as*

*fluorescein angiography or optical coherence tomography. Fundus*

*autofluorescence might demonstrate more widespread*

*atrophic RPE changes than color photographs or clinical examination*

*suggests, and may be an important parameter for evaluating*

*future therapies directed at atrophic AMD. At the present*

*time, the only established treatment strategy is the prophylactic*

*benefit of vitamin supplementation as defined in the Age-*

*Related Eye Disease Study. Patients with more severe degrees of*

*visual loss may benefit from a low vision evaluation resulting in*

*low vision aids strategically targeted to their needs, but this is*

*generally palliative in extent. A key importance in recognizing*

*the eye with atrophic AMD is to prompt awareness on the part*

*of the patient and monitoring by the physician for the development*

*of exudative AMD.*

*Keywords: drusen, autofluorescence, AREDS, metamorphopsia*

*37.1 History*

*A 68-year-old man presented for follow-up retina evaluation*

*for nonexudative macular degeneration in both eyes. Vision*

*was stable per patient and the patient had no prior history of*

*laser or intravitreal injections. Visual acuity was 20/50 on the*

*right and 20/60 on the left. Pupil examination was normal and*

*intraocular pressures were within normal limits in both eyes.*

*Slit-lamp examination showed mild to moderate nuclear sclerotic*

*lens opacities in both eyes. Funduscopic examination*

*showed cup-to-disc ratios of 0.3 in the right eye and 0.5 in the*

*left eye without glaucomatous atrophy. The macular examination*

*was notable for marked retinal pigment epithelium (RPE)*

*depigmentation with drusen and central macular atrophy in*

*both eyes (▶Fig. 37.1). There was no subretinal or intraretinal*

*fluid, blood, or exudate.*

*Optical coherence tomography (OCT) was performed in both*

*eyes and showed drusen and central RPE atrophy in both eyes*

*(▶Fig. 37.2). There was no evidence of macular fluid. Fundus*

*autofluorescence (FAF) was performed which showed central*

*hypo-autofluorescence in both eyes (▶Fig. 37.3).*

*Observational follow-up was recommended and the patient*

*was instructed to continue to use the Amsler grid daily, to continue*

*AREDS2 vitamin supplementation, and to have a diet with*

*sufficient green, leafy vegetables.*

*Differential Diagnosis—Key Points*

*1. Correlating the degree of visual loss to the*

*ophthalmoscopically evident degree of RPE depigmentary*

*change in patients with bilateral drusen and atrophy may be*

*inaccurate. Confluent, geographic atrophy of the RPE*

*involving the central macula and fovea is associated with*

*visual loss, but there may be a large degree of variability to*

*the vision loss depending on the degree of atrophy of the*

*outer retina. A disparity in the visual acuity from substantial*

*visual loss out of proportion to the degree of pigmentation*

*raises the possibility of occult exudative disease or*

*coexisting diagnoses. Common coexisting disease processes*

*include nuclear sclerotic cataract, vascular occlusive disease,*

*amblyopia, or optic neuropathies. The normal clinical*

*history, pupillary responses, and the normal-appearing optic*

*nerve head seem to rule these out.*

*2. OCT was obtained which ruled out choroidal*

*neovascularization. Typically, with choroidal*

*neovascularization, there is subretinal or intraretinal fluid*

*and/or sub- or intraretinal hemorrhage. These findings were*

*lacking in this case. Additionally, the central macular*

*thickness was thin in both eyes, but the remaining retinal*

*thickness appears to be normal, and it is likely that the*

*photoreceptors are not as atrophic as on the appearance on*

*OCT, which can explain why the patient has better than*

*expected vision given the appearance on clinical exam and*

*imaging.*

*3. Pattern dystrophies, inflammatory-induced changes,*

*trauma-induced RPE changes, or other degenerations such*

*as Stargardt’s or cone dystrophy may mimic atrophic,*

*nonexudative age-related macular degeneration (AMD). The*

*pattern of symmetry or clinical history of onset of visual*

*loss, as well as OCT features, usually allows a distinction*

*between atrophic AMD and these other entities.*

*37.2 Diagnosis*

*Nonexudative age-related macular degeneration, OU.*

*37.3 Test Interpretation*

*OCT has replaced fluorescein angiography as the first-line test*

*for determining whether or not exudative disease is present as*

*well as determining the extent of geographic atrophy. FAF may*

*enhance the assessment of the extent of RPE pigmentary*

*changes in atrophic disease, since the contrast between depigmented*

*RPE and relatively normal RPE may be less obvious*

*ophthalmoscopically, especially in lightly pigmented patients.*

*Retina*

*120*

*Fig. 37.1 Funduscopic appearance of patient with nonexudative AMD in both eyes. No subretinal fluid was detected, but there is moderate to amount*

*of depigmentary changes, drusen, and macular atrophy in both eyes.*

*Fig. 37.2 Optical coherence tomography showed drusen and central RPE atrophy in both eyes. There was no evidence of macular fluid.*

*Nonexudative Age-Related Macular Degeneration*

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*Other testing that might be pertinent in such patients*

*includes tests to rule out other causes of potential visual loss*

*such as a visual field test, color vision, and potential acuity*

*meter testing. Potential acuity meter testing may yield falsely*

*better result in patients with exudative disease.*

*Another test that is sensitive, but not specific, is Amsler grid*

*testing. This is a semi-quantitative way of ascertaining whether*

*the quality of vision is decreased in a manner consistent with*

*an alteration in the RPE or subretinal space. Although it is only*

*a minority of cases in which the Amsler grid test detected transition*

*to exudative disease, it remains a useful tool if applied as*

*a means of monitoring a patient at risk of developing exudative*

*maculopathy.*

*37.4 Medical Management*

*At the current time, individuals with intermediate nonexudative*

*AMD or advanced nonexudative AMD or exudative AMD in*

*the other eye should have dietary supplementation with*

*AREDS2 vitamins. Studies have shown that vitamin supplementation*

*has some benefit in slowing the progression to advanced*

*AMD in about 25% of patients. Additionally, patients are*

*encouraged to avoid tobacco smoking. At the time of this publication,*

*several clinical trials are under way targeting several*

*pathways involving the pathogenesis of nonexudative AMD;*

*however, no treatment has been proven efficacious to date.*

*37.5 Rehabilitation and Follow-up*

*Low vision aids are the primary rehabilitative tools for patients*

*with substantial visual loss. These usually restore a marginal*

*degree of visual function, but may be helpful for specific tasks.*

*The key component in the patient with limited macular function*

*is identifying the most convenient and effective means of*

*providing magnification and delivering light to the subject*

*material. Frequently, patients find that focused light is helpful,*

*whereas bright overhead lights tend to be too diffuse to be of*

*benefit. For distance vision, a variety of telescopic aids are available,*

*but magnification comes at the expense of constricting*

*the visual field. Patients considering low vision evaluation must*

*be counseled candidly as to the limits of potential benefits. Still,*

*low vision aids offer at least a modest degree of satisfaction in a*

*majority of patients.*

*Patients with nonexudative macular degeneration are routinely*

*counseled to use the Amsler grid test for optimal diagnosis*

*of transition to exudative disease. In addition, they are*

*encouraged to evaluate each eye’s perception independently for*

*deviation of straight lines such as those in doorways, light*

*poles, and building edges.*

*Examination every 3 to 12 months is generally recommended*

*by most clinicians, depending on the stability of the exam and*

*testing. It is emphasized to the patient that any changes in visual*

*symptoms, especially increased metamorphopsia, should*

*prompt immediate reevaluation.*

~~~~~CASE 38 Exudative Age-Related Macular Degeneration~~~~~

*38 Exudative Age-Related Macular Degeneration*

*John Edward Legarreta*

*Abstract*

*The definitional features of exudative age-related macular*

*degeneration (AMD) include hemorrhage and exudation of fluid*

*or exudate into the intraretinal, subretinal, and subretinal pigment*

*epithelial (retinal pigment epithelium [RPE]) spaces, in*

*the setting of an eye with other atrophic RPE findings such as*

*drusen. The source of these sight-threatening features is choroidal*

*neovascularization (choroidal neovascular membrane*

*[CNVM]), which may form either under the retina or RPE.*

*Symptoms include loss of central vision and metamorphopsia.*

*Imaging modalities include fluorescein angiography and, more*

*so, optical coherence tomography. The mainstay of treatment*

*has become intravitreal injections of anti-vascular endothelial*

*growth factor agents—bevacizumab, ranibizumab, and aflibercept.*

*There is a variety of strategies for the frequency of application*

*of these agents. These have demonstrated unprecedented*

*efficacy compared to those previously available for quenching*

*the growth of the CNVM, yet still there is a large unmet need*

*for preserving or restoring lost vision. Furthermore, these injections*

*typically require long-term, repetitive therapy. The previous*

*distinction between classic and nonclassic CNVM*

*characteristics is of less therapeutic importance than previously*

*delineated. Other causes of CNVM that might mimic the diagnosis*

*of exudative AMD include the presumed ocular histoplasmosis*

*syndrome, myopic degeneration, and idiopathic CNVM. Each*

*of these is generally treated in a similar fashion.*

*Keywords: choroidal neovascularization, optical coherence tomography,*

*anti-VEGF, intravitreal injection*

*38.1 Case Report*

*An 87-year-old woman presented complaining of decreased*

*vision in her right eye. She had a prior history of nonexudative*

*age-related macular degeneration (AMD) in both eyes.*

*Examination showed vision of 20/40 in the right eye and 20/*

*50 in the left eye. There was no definite afferent pupillary*

*defect. Slit-lamp examination showed the patient to be pseudophakic*

*in both eyes. Intraocular pressures were within normal*

*limits in each eye. Funduscopic examination on the right*

*showed drusen with retinal pigment epithelium (RPE) changes*

*in the macula with new subretinal fluid and pigment epithelial*

*detachment. No hemorrhage was noted. On the left, there were*

*drusen with RPE changes in the macula but no hemorrhage was*

*noted.*

*Optical coherence tomography (OCT) was performed*

*(▶Fig. 38.1), and in the right eye, it showed a pigment epithelial*

*detachment with adjacent subretinal fluid. The left eye showed*

*drusen with no evidence of macular fluid. Fluorescein angiography*

*(FA) (▶Fig. 38.2) was performed, and in the right eye, it*

*showed delayed stippled hyperfluorescence with late leakage,*

*consistent with an occult choroidal neovascular membrane*

*(CNVM). The patient underwent an intravitreal injection of bevacizumab*

*and was instructed to follow up in 4 weeks.*

*Differential Diagnosis—Key Points*

*1. Decreased vision in a patient with nonexudative AMD must*

*always be evaluated for the possible conversion to an*

*exudative process. The presence of macular fluid with or*

*without the presence of hemorrhage is typical of a CNVM*

*and can be confirmed with OCT and/or FA imaging.*

*2. Subretinal hemorrhage is typically a consequence of*

*subretinal choroidal neovascularization. However, in rare*

*instances severe intraretinal hemorrhages from retinal*

*vascular disease, trauma, or a retinal tear may also lead to*

*subretinal hemorrhage. Subretinal hemorrhages may extend*

*substantially, even after initial onset. Usually, with choroidal*

*neovascularization, there is relatively localized hemorrhage,*

*but in rare cases a massive subretinal hemorrhage may*

*affect the entire macula or be even more extensive.*

*3. The differential diagnosis of subretinal hemorrhage and*

*subretinal fluid is, for the most part, the differential*

*diagnosis of subretinal choroidal neovascularization. The*

*most common cause of choroidal neovascularization is*

*AMD. The hallmark of macular degeneration is the RPE*

*changes with drusen. These should be demonstrable either*

*within the same eye or in the fellow eye. The presumed*

*ocular histoplasmosis syndrome is another common cause*

*of choroidal neovascularization, but is usually accompanied*

*by other stigmata such as atrophic “punched-out” choroidal*

*scars (“histo spots”). A third cause of subretinal*

*neovascularization, hemorrhage, and fluid association is*

*myopic degeneration with widespread RPE depigmentary*

*changes or staphyloma formation. A fourth category is socalled*

*idiopathic neovascularization. Other causes are much*

*rarer.*

*38.2 Diagnosis*

*Occult choroidal neovascularization with subretinal fluid and*

*pigment epithelial detachment secondary to a new conversion*

*to exudative AMD in the right eye.*

*38.3 Test Interpretation*

*OCT is the gold standard for determining the presence or*

*absence of macular fluid in the retina, and thus defining the*

*presence or absence of choroidal neovascularization. FA, though*

*no longer the gold standard or primary test in most patients,*

*still has utility in helping define the type choroidal neovascularization*

*and in cases where the clinical presentation and OCT*

*imaging are unable to determine a clear diagnosis. A classic*

*CNVM on FA demonstrates filling in the early frames, with leakage*

*of the membrane in the later frames. Such features are used*

*to define either “classic” or “nonclassic” portions of the membrane.*

*The terms “poorly defined” and “occult choroidal neovascularization”*

*describe membranes that are more extensive*

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*Fig. 38.1 Optical coherence tomography in the right eye showed a pigment epithelial detachment with adjacent subretinal fluid. The left eye showed*

*drusen with no evidence of macular fluid.*

*Fig. 38.2 Fluorescein angiographic appearance in*

*the right eye showed delayed stippled*

*hyperfluorescence with late leakage, consistent*

*with an occult choroidal neovascular membrane.*

*Retina*

*124*

*than the area of apparent dye leakage, as in the example in this*

*case.*

*38.4 Medical Treatment*

*The first established treatment of choroidal neovascularization*

*was thermal laser photocoagulation; photodynamic therapy*

*(commonly called “cold laser”) was an important advance that*

*utilized a photosensitizing agent to target the abnormal vessels.*

*However, the advent of intravitreal antiangiogenic (anti-vascular*

*endothelial growth factor [anti-VEGF]) therapy has surpassed*

*all other treatment modalities and is the first choice of*

*treatment for patients with exudative AMD. Pegaptanib, bevacizumab,*

*ranibizumab, and aflibercept are the four antiangiogenic*

*agents that can be injected intravitreally but, presently,*

*pegaptanib is rarely used and bevacizumab, ranibizumab, and*

*aflibercept are the three commonly used medications.*

*As for the treatment strategy, three treatment algorithms*

*have emerged:*

*1. Monthly: An anti-VEGF agent is injected every 4 weeks. The*

*goal of this approach is to prevent the accumulation of blood*

*and fluid due to the underlying exudative process. This*

*approach was initially used in many of the early clinical*

*trials, but has now become the least popular approach*

*compared with the other two techniques.*

*2. Pro re nata or “as needed”: An anti-VEGF agent is injected*

*every time fluid or blood is present, as detected on exam and*

*imaging. The primary goal with this approach is to minimize*

*the number of injections and to only give injections when*

*exudation is present.*

*3. Treat-and-extend: An anti-VEGF agent is injected when fluid*

*or blood is present. The patient is then brought back at a set*

*interval, and if there is no blood or fluid on the follow-up*

*exam, the patient is given another injection and the interval*

*between follow-up visits (time between injections) is*

*lengthened. The typical increment for lengthening between*

*exams is usually 1 to 2 weeks. If, on a follow-up exam, there*

*is blood or fluid present, the patient is injected and the*

*interval between visits decreases to the last interval*

*where the patient did not have blood or fluid on exam.*

*The primary goal with this approach is to extend a patient to*

*the maximum interval of visits before blood or fluid*

*reappears.*

*38.5 Rehabilitation and Follow-up*

*Macular degeneration is the most common cause of significant,*

*irreversible visual loss in the elderly population. Low vision rehabilitation,*

*including magnifiers and focused lights, should be*

*considered in these cases. However, before embarking on the*

*purchase of such equipment, the patient must be counseled as*

*to the limitations and expense involved.*

~~~~~CASE 39 Myopic Degeneration~~~~~

*39 Myopic Degeneration*

*Amir Mohsenin and William E. Smiddy*

*Abstract*

*Myopic degeneration parallels age-related macular degeneration*

*in the categorization into atrophic versus neovascular*

*forms and in treatment of neovascularization. The pathophysiology*

*seems similar in that visual loss follows from progressive*

*retinal pigment epithelium atrophy and may culminate in the*

*egress of choroidal neovascular vessels through attenuated*

*areas of Bruch’s membrane. Although the neovascularization is*

*commonly more self-limited than in exudative AMD, mitigation*

*strategies can preserve somewhat better vision than natural*

*history. Recently, anti-vascular endothelial growth factor (anti-*

*VEGF) treatment with ranibizumab has been approved, and*

*efficacy with other anti-VEGF agents has been reported; these*

*are now the mainstays for treatment of neovascular forms.*

*There is still no treatment for atrophic forms, despite many*

*investigators over the years experimenting with limiting staphylomata,*

*but this is an area where stem cells or even gene therapy*

*might prove useful in the future.*

*Keywords: choroidal neovascularization, myopia, macula, anti-*

*VEGF, intravitreal injections*

*39.1 History*

*A 38-year-old urologist presented with a 1-year history of visual*

*loss in the right eye. He had been told that he had a choroidal*

*neovascular membrane (CNVM) in the right eye that was*

*not amenable to any treatment. At the time of presentation, he*

*had a 1-month history of distortion with a paracentral scotoma*

*in his left eye. The patient was noted to be a high myope with a*

*spherical equivalent refraction of –10 diopters.*

*Examination disclosed vision of 20/200 in the right eye and*

*20/20 in the left eye. The slit-lamp examination was unremarkable.*

*The funduscopic examination showed a tilted (myopic)*

*disc and a pigmented CNVM surrounded by pigment epithelial*

*atrophy (▶Fig. 39.1). In the left eye, there was a similar tilted*

*myopic disc with a prominent lacquer crack extending across*

*the superior aspect of the fovea with some hemorrhage on the*

*nasal side of the fovea (▶Fig. 39.2). The fluorescein angiogram*

*confirmed the large subfoveal CNVM in the right eye*

*(▶Fig. 39.3). However, it also showed a smaller, extrafoveal*

*CNVM superior to the left fovea.*

*Fig. 39.1 Funduscopic appearance of right eye at presentation. A rim of retinal pigment epithelial atrophy surrounds a central area of choroidal*

*neovascularization. The optic nerve head is tiled with some peripapillary atrophy. The vision was 20/200.*

*Retina*

*126*

*No treatment was recommended for the right eye. Argon*

*blue-green laser treatment was recommended and performed*

*for the CNVM in the left eye. The patient maintained 20/20*

*vision in the left eye without recurrent neovascularization for 6*

*years.*

*He then returned with a 1-month history of decreased central*

*vision in the left eye. He characterized the loss of vision as*

*finding everything to be cloudy. The visual acuity was 20/200 in*

*the right eye and 20/30 in the left eye. The slit-lamp examination*

*was unremarkable. The funduscopic examination of the*

*right eye showed a somewhat enlarged area of retinal pigment*

*epithelium atrophy approximately three times the size of the*

*original (untreated) CNVM. There were signs of chronic leakage.*

*In the left eye, there was a nearly one-disc-area region of retinal*

*pigment epithelial atrophy corresponding to the previous laser*

*treatment scar. However, along the inferior and temporal*

*(foveal side) of this there was evidence of recurrent CNVM*

*(▶Fig. 39.4).*

*Laser treatment was performed utilizing the krypton laser in*

*the left eye. The patient returned to Peru for further follow-up*

*examination locally.*

*The patient had a history of glaucoma for which he was using*

*Propine drops OU initially. Upon presentation, his glaucoma regimen*

*had been changed to a beta-blocker OU. The intraocular*

*pressures were 14mm Hg in the right eye and 13mm Hg in the*

*left eye on second presentation and 9mm Hg in the right eye*

*and 12mm Hg in the left eye upon initial presentation. Also, retinal*

*lattice degeneration was noted in the periphery of both eyes,*

*although no atrophic holes were seen in association with this.*

*Differential Diagnosis—Key Points*

*1. Pathologic myopia with CNVM. The patient was a high*

*myope (–10 D). Myopic degeneration characteristically*

*occurs only in patients with high myopia (> 6 diopter*

*refractive error).*

*2. Fundus characteristics of pathologic myopia can include a*

*tilted optic nerve head, posterior staphyloma, lacquer*

*cracks, and retinal lattice degeneration. Peripapillary retinal*

*pigment epithelial atrophy is often present and can make*

*assessment of glaucomatous optic nerve changes difficult.*

*3. The patient also had retinal lattice degeneration, without*

*atrophic holes. Prophylactic treatment of such lesions is*

*probably not indicated at this stage. If the fellow eye*

*(especially if highly myopic) developed a retinal*

*detachment, then the patient would be at a higher risk for*

*developing a retinal detachment in the fellow and*

*prophylactic laser or retinocryopexy treatment should be*

*considered, but many would still not recommend*

*treatment.*

*Fig. 39.3 Fluorescein angiographic appearance of the right eye at*

*initial presentation. It shows a large subfoveal choroidal neovascular*

*membrane. The broad margin of a chorioretinal atrophy surrounds the*

*area of choroidal neovascularization.*

*Fig. 39.2 Funduscopic appearance of left eye. A lacquer crack is*

*evident coursing across the superior macula. Along the nasal aspect of*

*this is slight subretinal fluid consistent with a choroidal neovascular*

*membrane.*

*Fig. 39.4 Fluorescein angiographic appearance 6 years after treatment*

*confirms a juxtafoveal recurrence of the choroidal neovascularization*

*inferior and temporal to the original scar.*

*Myopic Degeneration*

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*4. The fluorescein angiogram and clinical features show*

*characteristic features of CNVM. There are several*

*conditions that may be the cause of choroidal*

*neovascularization. Most common is age-related macular*

*degeneration, but this is unlikely in this young patient.*

*Other causes of choroidal neovascularization include*

*presumed ocular histoplasmosis syndrome, which is usually*

*accompanied by atrophic chorioretinal scars (“histo spots”)*

*distributed throughout the retina, typically most*

*prominently in the midperiphery. These were not present in*

*this case. Any chorioretinal scar, whether it is from previous*

*inflammatory or from infectious chorioretinitis, may*

*ultimately give rise to choroidal neovascularization.*

*5. A trauma-induced choroidal rupture may also be the site of*

*choroidal neovascularization, and should be considered in*

*the differential diagnosis.*

*39.2 Diagnosis*

*Subretinal choroidal neovascularization and recurrence secondary*

*to myopic degeneration, OU.*

*39.3 Diagnostic Tests*

*Aside from clinical examination, the fluorescein angiogram*

*remains the gold standard for the diagnosis and delineation of a*

*CNVM. Indocyanine green (ICG) angiography may also contribute*

*information regarding the nature and location of more*

*poorly defined CNVM. Optical coherence tomography (OCT) has*

*become an essential tool in both the diagnosis and management*

*of macular edema associated with CNVMs. In addition,*

*OCT can aid in the diagnosis of myopic macular schisis. Combined*

*A- and B-scan ultrasonography may demonstrate the*

*increased axial length or a staphyloma that commonly accompanies*

*patients with myopic degeneration.*

*39.4 Medical Treatment*

*Intravitreal injection of anti-vascular endothelial growth factor*

*(anti-VEGF) agents is the mainstay treatment for myopic CNVM.*

*The safety and efficacy profile of intravitreal anti-VEGF injections*

*has largely been established from studies investigating*

*their role in the treatment of neovascular macular degeneration.*

*Anti-VEGF injections have been shown to be effective as*

*monotherapy for myopic CNVM and studies comparing bevacizumab*

*to ranibizumab have shown similar efficacy.*

*Other treatment modalities have also been tested. Prior to*

*the advent of anti-VEGF agents, photodynamic therapy (PDT)*

*with verteporfin was a commonly used therapy. Studies comparing*

*anti-VEGF to PDT have shown anti-VEGF to be superior*

*while the benefit of combining anti-VEGF and PDT has not been*

*well established. Laser photocoagulation has also been utilized*

*as primary treatment for selected neovascular membranes.*

*Choroidal neovascularization is seen in about 5% of patients*

*with axial length>26.5mm, is bilateral in 12% of those cases, and*

*is often represented as a Fuchs’ spot—a subfoveal dark spot generally*

*accepted to represent a late, self-limited stage of neovascularization.*

*There may be two types of neovascularization, with elderly*

*patients having a more progressive form of vessel growth and*

*younger patients frequently having a more focal, self-limited form*

*that causes less visual loss. Lacquer cracks (characteristic breaks in*

*Bruch’s membrane) appear to represent the point of entry for choroidal*

*neovascularization, as they have been found to be more frequent*

*in cases with neovascular membranes. Frequently, the*

*patient will present with focal, well-defined choroidal neovascularization*

*surrounded by retinal pigment epithelial atrophy. Such*

*cases (as in this patient’s right eye) are characteristically not*

*accompanied by significant subretinal fluid.*

*39.5 Surgical Management*

*Surgical intervention for myopic CNVM has fallen to the wayside*

*largely in favor of medical management. Pars plana vitrectomy*

*with excision of subretinal CNVMs carries significant risks*

*including but not limited to retinal detachment and endophthalmitis.*

*Visual acuity gains after surgery are modest at best*

*and inferior to anti-VEGF monotherapy.*

*39.6 Rehabilitation and Follow-up*

*Patients with nonexudative myopic degeneration may commonly*

*suffer visual symptoms just as severe as those with exudative*

*complications. Specifically, a loss of central vision from a*

*moderate-to-severe degree is extremely common. Patients are*

*typically recommended for follow-up examinations twice*

*annually; however, patients should monitor their central visual*

*acuity with an Amsler grid. New distortion or central metamorphopsia*

*should prompt ophthalmological consultation.*

*In cases of myopic CNVM, follow-up examinations are typically*

*performed 4 weeks following initial anti-VEGF treatment.*

*The follow-up interval can later be extended based on response*

*to treatment and stability. OCT is usually performed at each*

*visit in order to identify subclinical CNVM or for the development*

*of macular schisis.*

*Rehabilitation efforts include the use of low vision aids. Typically,*

*with the loss of macular function, the need for magnifiers*

*and focal delivery of light are the general strategies. These may*

*take the form of high plus lenses in a spectacle, magnifying loupes,*

*telescopic magnification lenses, or closed circuit video instruments.*

*There is some promise in the possible use of implantable microchip*

*technology, but this technology is still in its infancy.*

~~~~~CASE 40 Idiopathic Central Serous Chorioretinopathy~~~~~

*40 Idiopathic Central Serous Chorioretinopathy*

*Ella Leung*

*Abstract*

*Central serous chorioretinopathy (CSCR) is characterized by the*

*detachment of the neurosensory retina from the underlying*

*retinal pigment epithelium. Risk factors include steroids, type A*

*personality, and pregnancy. Most CSCRs resolve spontaneously*

*within 3 months. Treatment for persistent cases includes photodynamic*

*therapy.*

*Keywords: central serous chorioretinopathy, neurosensory detachment,*

*subretinal fluid, macular detachment, photodynamic*

*therapy*

*40.1 Case History*

*A 35-year-old engineer presented with blurriness in his left eye*

*for 3 weeks. He denies any past medical history, trauma, diabetes,*

*hypertension, steroids, or previous surgeries. On examination,*

*the visual acuity was 20/20 in the right eye and 20/50 in*

*the left eye. With a + 2.00 lens, the vision in the left eye*

*improved to 20/30. Anterior segment examination and intraocular*

*pressures were unremarkable in both eyes. A dilated fundus*

*examination of the right eye was normal. The left eye had*

*an elevated, circumscribed neurosensory detachment of the*

*retina.*

*There were no retinal tears, hemorrhages, or exudates. The*

*patient noted central metamorphopsia on Amsler grid testing*

*of his left eye. On optical coherence tomography (OCT), there*

*was subretinal fluid under the fovea in the left eye. Fluorescein*

*angiography (FA) of the left eye revealed an expanding area of*

*leakage in the macula (▶Fig. 40.1).*

*The patient was observed closely. One month later, the subretinal*

*fluid completely resolved, and the vision returned to 20/20.*

*Differential Diagnosis—Key Points*

*1. Albrecht von Graefe first described a central serous*

*detachment of the retina in 1866, calling it recurrent central*

*retinitis. Others have named it capillarospastic central*

*retinitis, central angiospastic retinopathy, and*

*chorioretinopathia centralis serosa.1 In the 1960s, Donald*

*Gass introduced the term “central serous*

*chorioretinopathy” (CSCR). The range of names reflect the*

*hypothesized etiologies and differential diagnoses for the*

*disease.*

*2. The pathophysiology of CSCR is unclear. It may be related to*

*increased aldosterone causing an upregulation of potassium*

*channels in the choroidal endothelial cells, leading to fluid*

*leakage, choroidal thickening, increased hydrostatic*

*pressure, defects in the retinal pigment epithelium (RPE),*

*and subsequent accumulation of subretinal fluid.2,3 Steroids*

*can precipitate or exacerbate the condition. Other reported*

*risk factors include male gender, type A personalities,*

*excess stress, psychotropic medications, Cushing’s disease,*

*hypertension, and pregnancy (▶Table 40.1).1,4*

*3. The differential diagnoses of CSCR include serous retinal*

*detachments due to vascular, inflammatory, neoplastic, and*

*anatomic abnormalities of the macula (▶Table 40.2). A*

*thorough history and appropriate imaging can help*

*determine the diagnosis.*

*4. CSCR typically causes serous detachments in young to*

*middle-aged men, while choroidal neovascular membranes*

*(CNVMs) from exudative age-related macular degeneration*

*appear as gray or yellow-green plaques in older individuals.1*

*Eyes with CNVMs from primary ocular histoplasmosis have*

*peripapillary atrophy and punched-out chorioretinal lesions.*

*Polypoidal choroidal vasculopathy features grapelike*

*clusters of dilated vessels that are most characteristically*

*imaged with indocyanine green angiography. Isolated*

*cavernous or capillary hemangiomas appear as collections*

*of dilated, tortuous blood vessels. Diffuse choroidal*

*hemangiomas in Sturge–Weber syndrome cause the fundus*

*to appear red-orange “ketchup” in color.*

*5. Local or systemic inflammationmay result in cystoidmacular*

*edema and subretinal fluid. Patients with posterior scleritis have*

*pain, thickened sclera, and a possible “Tsign” on echography.*

*Sympathetic ophthalmia has a preceding history of trauma or*

*surgery. Patients with Vogt–Koyanagi–Harada diseasemay have*

*Fig. 40.1 (a) A red-free photo of the patient with central serous chorioretinopathy in the left eye. (b) Fluorescein angiography demonstrated leakage*

*in the macula. (c) Heidelberg OCT showed subretinal fluid under the fovea. (The images are provided courtesy of Luiz Roisman, MD.)*

*Table 40.1 Risk factors associated with central serous chorioretinopathy*

*Pharmacologic Systemic Other*

*Corticosteroids Hypertension Idiopathic*

*Psychotropic*

*medications*

*Systemic lupus*

*erythematosus*

*Pregnancy*

*Cushing’s disease*

*Helicobacter pylori*

*infection*

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*systemic manifestations such as poliosis, vitiligo, tinnitus, and a*

*positive family history. CSCR, on the other hand, is painless*

*without signs of intraocular inflammation.*

*6. Benign and malignant neoplasms, such as choroidal*

*melanomas and atypical choroidal nevus, may cause serous*

*retinal detachments. Choroidal melanomas are classically*

*elevated, dome-shaped brown masses and may have*

*orange pigment. Leukemia and carcinoma can present as*

*yellow-white choroidal infiltrates or vitritis. Congenital*

*abnormalities such as optic disc pits may result in fluid*

*extending from the optic nerve margin to the macula. CSCR*

*is not due to other ocular pathologies.*

*40.2 Imaging andWorkup*

*The diagnosis of CSCR is based on the appropriate clinical setting,*

*physical examination, and exclusion of other causes of*

*neurosensory detachments. CSCR can be visualized on fundus*

*examination as a circumscribed neurosensory detachment of*

*the macula. There may be a hyperopic shift, metamorphopsia,*

*mild dyschromatopsia, reduced contrast sensitivity, and*

*decreased visual acuity. Retinal pigment epithelium mottling*

*may indicate areas of prior leakage.*

*On OCT, there is fluid between the neurosensory retina and*

*RPE. Enhanced depth imaging OCT may show a thickened*

*choroid with increased choroidal vascular diameters.3 FA or*

*indocyanine green angiography may demonstrate midphase*

*hyperfluorescent plaques. The pathognomonic “smokestack” on*

*FA is found only in a minority of patients; more commonly, “inkblots”*

*or expanding pinpoint leakages from focal RPE defects are*

*seen.3 Diffuse leakage may occur in cases of bullous CSCR.3*

*Hyperautofluorescent areas of leakage and fluid tracts on fundus*

*autofluorescence can become hypoautofluorescent over time.*

*Scotomas on microperimetry may develop and correlate with the*

*affected areas.1 Multifocal electroretinograms can demonstrate*

*depression beyond the areas of serous detachment.3*

*40.3 Diagnosis*

*Central serous chorioretinopathy.*

*40.4 Treatment*

*40.4.1 Medical Management*

*CSCR is usually a self-limited disease that resolves spontaneously*

*within 3 months. Treatment may be considered in chronic*

*cases or for occupational purposes. Stopping systemic corticosteroids*

*may lead to faster resolution of CSCR, while increasing*

*corticosteroids may exacerbate the disease.*

*Systemic treatments that have been investigated include oral*

*rifampin, methotrexate, carbonic anhydrase inhibitors, adrenergic*

*receptor antagonists such asmetoprolol and propranolol, and aldosterone*

*or mineralocorticoid receptor antagonists such as ketoconazole,*

*mifepristone, eplerenone, spironolactone, and finasteride.1*

*These treatments have yet to be shown in prospective, randomizedcontrolled*

*trials to significantly improve visual acuity.5 Although*

*Helicobacter pylori has been associated with CSCR, treating the*

*infection has not been shown to have a beneficial effect on vision.6*

*In chronic cases, photodynamic therapy (PDT) or focal argon*

*laser applied to the point of leakage may lead to fluid resorption.*

*The laser may stimulate the RPE to increase resorption of*

*subretinal fluid, or it may cause temporary vascular hypoperfusion*

*with subsequent remodeling.7 A meta-analysis found that*

*PDT was superior to focal laser photocoagulation and anti-vascular*

*endothelial growth factor injections in resolving subretinal*

*fluid.8 Indirect laser may also be used to barricade the area*

*of leakage. Potential complications include scotomas, subretinal*

*neovascularization, and expansion of the laser burns.3 Other*

*treatments currently being investigated include subthreshold*

*micropulse laser and transpupillary thermotherapy.*

*40.4.2 Surgical Management*

*There are no surgical treatment options for CSCR.*

*40.5 Rehabilitation and Follow-up*

*CSCR resolves spontaneously in 60 to 80% of patients within 3*

*months, although there may be residual mottling of the retinal*

*pigment epithelium.3 CSCR can recur in 18 to 50% of patients,*

*and 20% of patients may develop CSCR in the contralateral eye.3*

~~~~~CASE 41 Epiretinal Membrane~~~~~

*41 Epiretinal Membrane*

*Ajay E. Kuriyan*

*Abstract*

*Epiretinal membranes (ERMs) are commonly seen patients and*

*can be visually significant. Clinical exam and optical coherence*

*tomography are used to diagnose ERMs. Vitrectomy and ERM*

*peel, with or without internal limiting membrane peel, is*

*employed in cases of visually significant ERMs.*

*Keywords: epiretinal membrane, macular pucker, cellophane*

*maculopathy, vitrectomy*

*41.1 History*

*A 73-year-old woman presented with an 18-month history of*

*progressively decreasing vision in the right eye. She had metamorphopsia*

*and best corrected Snellen visual acuity of 20/200.*

*A retinal detachment was repaired with a primary pars plana*

*vitrectomy, endolaser, and gas 2 years previously. Funduscopic*

*examination of the right eye showed a prominent epiretinal*

*membrane (ERM) with moderate vascular distortion*

*(▶Fig. 41.1). Optical coherence tomography (OCT) demonstrated*

*an ERM with an abnormal foveal contour (▶Fig. 41.2)*

*Differential Diagnosis—Key Points*

*1. There are relatively few entities to consider in the*

*differential diagnosis of an appearance such as this one.*

*Cystoid macular edema may give the appearance of a more*

*diffuse preretinal membrane, probably because of the*

*altered reflection created by a stippling of the internal*

*retinal surface induced by the edema. A diagnostic subset of*

*an ERM is the vitreomacular traction formation that follows*

*a zone of incomplete posterior vitreous separation. Folds in*

*the retina associated with current or previous hypotony*

*retinopathy may also simulate the clinical appearance of an*

*ERM, but the OCT usually distinguishes it by virtue of*

*lacking preretinal tissue. Additionally, the OCT of a patient*

*with choroidal folds from hypotony will have folds in the*

*retinal pigment epithelium (RPE) layer on OCT, which would*

*not be present in patients with ERMs.*

*2. The classification of ERMs is generally based on morphology*

*or etiology. Morphology runs a full spectrum from mild*

*cellophanelike changes (cellophane maculopathy or surface*

*wrinkling retinopathy) to a more severe distortion of the*

*macular components (macular pucker). All of these terms*

*describe ERMs. The etiologic groups are idiopathic or*

*secondary ERMs. Posterior vitreous separation may be a*

*stimulating factor for the formation of idiopathic*

*membrane. As a general rule, the clinical appearances of*

*idiopathic and secondary ERMs are the same, although*

*membranes following retinal tear or detachment may be*

*prominently pigmented; it is the history and other*

*associative features that may allow one to distinguish*

*between these diagnoses. Entities that cause secondary*

*ERM include a retinal break formation (as in this patient)*

*with or without retinal detachment, inflammatory*

*disorders, retinal vascular disorders, trauma, or previous*

*surgery.*

*3. The classic symptomatology includes a subacute onset of*

*decreased vision most commonly characterized by*

*metamorphopsia. The visual loss may be biphasic; not*

*infrequently, the first phase of visual loss may be more*

*generalized and attributable to debris in a separated*

*vitreous. Usually, the ERM has formed maximally by 3 to 6*

*months and its appearance or effect on vision changes little*

*thereafter. Associated features include the distortion of the*

*macular vessels, which may in turn cause a vascular leakage*

*(▶Fig. 41.3, not the patient in this case) and cystoid edema*

*(▶Fig. 41.4, not the patient in the case), obstructed*

*axoplasmic flow, and, in the most severe cases, a low-lying*

*tractional retinal detachment. Cases secondary to previous*

*retinal detachment may have a pigmented component to*

*the ERM, but the vast majority of idiopathic and secondary*

*cases are translucent.*

*41.2 Test Interpretation*

*The principal test that is routinely utilized to evaluate ERM is*

*OCT, which allows visualization of the hyperreflective membrane*

*on the surface of the retina. Distortion of the foveal contour,*

*increased foveal thickness, and, in some patients, cystoid*

*edema can be seen using OCT. Additionally, hyporeflective*

*changes in the outer retinal structures (e.g., ellipsoid zone disruption)*

*can be visualized with OCT. However, this can be due*

*to shadowing artifact from inner retina hyperreflective changes*

*secondary to the ERM. Shadowing artifact can be detected by*

*assessing relative hyporeflectivity of the RPE layer on OCT.*

*Although rarely performed for ERMs, fluorescein angiography*

*demonstrates mild diffuse retinal vascular leakage seen*

*throughout the distribution of the ERM. This is in contrast to*

*cases of diabetic macular edema, in which the leakage is*

*typically more focal in areas of leaking microaneurysm, or*

*cases of cystoid macular edema, in which the leakage is centered*

*on the fovea. The vascular distortion may be more apparent*

*on fluorescein angiography than on clinical examination.*

*Ultrasound is rarely used in this diagnosis, but may show a high*

*posterior vitreous separation that may be of some value in distinguishing*

*this from an impending or full-thickness macular*

*hole in which the posterior vitreous separation may not yet*

*have occurred.*

*Epiretinal Membrane*

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*41.3 Diagnosis*

*ERM secondary to previous peripheral retinal break and retinal*

*detachment, right eye.*

*41.4 Medical Management*

*Medical management may involve treatment of an underlying*

*inflammatory disorder. There is no known medical treatment*

*for ERMs secondary to peripheral retinal breaks or idiopathic*

*membranes. Observational follow-up examination is recommended*

*when the visual acuity loss and symptoms are minimal.*

*ERMs normally form over a few months, but usually do not*

*cause any additional visual loss after their formation. Thus, a*

*patient may be reassured that visual acuity, once stable, will*

*likely not decline further.*

*41.5 Surgical Management*

*Once the attributable best corrected visual acuity reaches the*

*20/40 to 20/60 range or worse, or in selected cases in which the*

*visual acuity is better but the metamorphopsia is more severe*

*and out of proportion to the visual acuity, surgical treatment*

*may be considered. Surgical treatment includes vitrectomy,*

*which is typically facilitated by a preexisting posterior vitreous*

*detachment. Next, the ERM is engaged with a vitreoretinal pick.*

*If there is not an edge under which the pick can be safely*

*placed, a sharp instrument such as a barbed MVR blade is used*

*to cut down and create an edge in the macula. Typically, the*

*thickest part of the ERM is sought in such cases. Naturally, the*

*center of the fovea should be avoided whenever possible in*

*developing such an edge. The membrane is then gently raised*

*from the retinal surface, ideally releasing any adhesions from*

*the macula first. Once approximately half of the circumference*

*Fig. 41.1 Clinical appearance immediately before epiretinal membrane*

*peeling. The epiretinal membrane can be seen most prominently*

*temporal to the fovea. There is vascular distortion that is most*

*apparent temporally.*

*Fig. 41.2 Optical coherence tomography immediately before epiretinal*

*membrane peeling. The hyperreflective epiretinal membrane can be*

*seen on the surface of the retina. There is foveal contour distortion and*

*thickening of the retina.*

*Fig. 41.3 Fluorescein angiography of a different patient, which*

*demonstrates more prominent vascular distortion superotemporal to*

*the fovea. There are several areas of focal leakage in association with*

*these distorted vessels. Most prominent is an area of focal leakage*

*superior to the fovea.*

*Fig. 41.4 Optical coherence tomography of a different patient who*

*presented with an epiretinal membrane shows cystoid macular edema.*

*Retina*

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*of the membrane has been released, intraocular forceps are*

*used to complete the removal of the membrane in one large*

*piece. Often, the internal limiting membrane is removed along*

*with this. When the ERM is thinner, it may be necessary to*

*remove it in multiple pieces.*

*The patient in this case underwent a vitrectomy with*

*removal of the ERM. By 3 months postoperative, the visual*

*acuity had improved to 20/60 and her metamorphopsia had*

*markedly improved. The appearance of the macula showed no*

*evidence of ERM formation (▶Fig. 41.5). The postoperative OCT*

*showed decreased foveal thickness and improvement of the*

*foveal contour (▶Fig. 41.6).*

*41.6 Rehabilitation and Follow-up*

*Postoperative treatment typically involves topical corticosteroid*

*and antibiotic drops. The visual acuity improves most rapidly*

*during the 6 weeks following surgery and is usually*

*maximally improved by 3 to 6 months postoperatively. There*

*may be small degrees of improvement even after this. The surgical*

*complication rate is acceptably low with less than 5% of*

*patients developing any complication (the most common complication*

*is retinal detachment). Phakic patients have an*

*extremely high rate of progressive nuclear sclerosis, as do all*

*eyes after vitrectomy, but cataract surgery may be performed in*

*an uncomplicated fashion. Most series of ERM report visual*

*acuity improvement of a magnitude of approximately 50 in 80%*

*of cases. The recurrence of ERMs is very rare, with less than 3%*

*developing a clinically significant recurrence. The most important*

*prognostic factor associated with best overall final vision is*

*good preoperative vision.*

~~~~~CASE 42 Vitreomacular Traction~~~~~

*42 Vitreomacular Traction*

*Thalmon R. Campagnoli and William E. Smiddy*

*Abstract*

*Vitreomacular traction has become recognized as a more common*

*and more varied condition with the advent of spectraldomain*

*optical coherence tomography (OCT) testing. However,*

*OCT testing must be used in conjunction with clinical assessment*

*of symptoms and clinical course to determine if any intervention*

*is necessary. Only cases that are symptomatic,*

*seemingly progressive, and causing enough visual loss to be*

*inducing more than a minimal degree of visual loss should even*

*be considered for intervention. Intervention classically was limited*

*to surgical intervention, but intravitreal injection of ocriplasmin*

*has now become available as an approved treatment*

*modality; however, cases with a limited zone of vitreofoveal*

*attachment, those without associated epiretinal proliferation,*

*and younger, phakic patients are probably the ideal candidates.*

*Even more recently, there has been a resurgence of interest and*

*good reported results with using simply an expansile intravitreal*

*gas injection in such cases (“pneumatic maculopexy”). In*

*addition, expectant observation has been demonstrated to be a*

*suitable approach, especially for cases with minimal or no*

*symptoms. The OCT is invaluable as an adjunct for diagnosis*

*and monitoring.*

*Keywords: vitreomacular traction, vitreous detachment, macular*

*hole, ocriplasmin, intravitreal injection, vitrectomy*

*42.1 History*

*A 78-year-old woman presented with a 3-month history of progressively*

*worsening blurred vision and metamorphopsia in*

*the right eye interfering with driving and reading abilities. The*

*vision was 20/60 OD and 20/40 OS. Slit-lamp examination demonstrated*

*clear cornea, absence of cataract, and intraocular*

*pressure of 13mm Hg in both eyes (OU). Fundoscopic examination*

*showed focal areas of adherent posterior vitreous to the*

*macula associated with raised retinal tissue, OD, and a nonspecific*

*loss of foveal reflex, OS. Optical coherence tomography*

*(OCT) in OD demonstrated a hyperreflective layer correspondent*

*to the posterior hyaloid partially attached to the macula,*

*leading to elevation and distortion of the retina (▶Fig. 42.1).*

*The OCT OS also showed focal vitreomacular attachment with*

*distortion of the inner foveal layers.*

*An intravitreal ocriplasmin injection was performed OD,*

*without improvement in vision or OCT appearance after 1*

*month (▶Fig. 42.1b). A pars plana vitrectomy (PPV) was*

*performed OD with release of the vitreomacular traction (VMT)*

*and improvement of the foveal contour (▶Fig. 42.2). The vision*

*was 20/30 OD 1-month postoperatively. The OS has remained*

*unchanged with vision of 20/40 without clinically important or*

*progressive symptoms, so it has been observed.*

*Differential Diagnosis—Key Points*

*1. This patient developed VMT. VMT is a vitreoretinal interface*

*abnormality originated by the elevation of the posterior*

*cortical vitreous when it is incompletely separated from the*

*macular region, generating retinal traction and distortion in*

*the area where it remains attached, leading to vision*

*changes (decreased vision, metamorphopsia, photopsia,*

*diplopia). It is essential to distinguish it from a full-thickness*

*macular hole (FTMH) and an epiretinal membrane (ERM), as*

*the treatment urgency and approach would be very*

*different. Also, myopic traction maculopathy should be*

*distinguished from VMT since surgical approach, if decided*

*upon, would entail differences.*

*2. VMT prevalence ranges between 1 and 2% depending on*

*the diagnostic modality and population ethnicity. Age is a*

*major risk factor for VMT occurrence, and its incidence can*

*be as high as 60 to 65% in eyes with ERM. Uveitis, retinal*

*breaks, and retinal vascular diseases (vein occlusions,*

*diabetic retinopathy, macular telangiectasia) are also*

*correlated to increased VMT formation.*

*3. OCT is the most definitive method to diagnose VMT, and to*

*distinguish it from the other entities on the differential*

*diagnosis listed above (▶Fig. 42.1). A history of slowly and*

*progressive visual loss, metamorphopsia, photopsia, or*

*diplopia over several months should prompt investigation.*

*Ophthalmic examination with fundus contact lens at the slit*

*lamp provides ideal visualization of the vitreomacular*

*interface anatomy due to its superior magnification and*

*stereoscopic view; however, a suspended precorneal fundus*

*lens is also helpful for diagnosis, but does not offer as much*

*objective detail as OCT.*

*4. Spontaneous resolution of VMT can occur, especially in*

*cases in which the vitreoretinal attachment involves a*

*diameter less than 1,500 μm of the macular surface on*

*OCT. However, persistence of VMT can lead to worsening*

*visual acuity and major complications such as cystoid*

*macular edema, foveal neurosensory detachment, and*

*lamellar or FTMH formation.*

*Retina*

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*42.2 Test Interpretation*

*OCT is the most accurate method to diagnose VMT. The appearance*

*of a thin, hyperreflective layer focally attached to a distorted*

*macular surface and concurrently detached from the*

*perifoveal region (“gull wing” or “pagoda sign”) best characterize*

*VMT. An OCT-based classification subdivide VMT into (1)*

*focal (total extension of vitreofoveal adhesion ≤ 1,500 μm) or (2)*

*broad (total adhesion > 1,500 μm). Intraretinal pseudocysts are*

*usually seen in the area of vitreoretinal attachment, and neurosensory*

*retinal detachment may also ensue, especially if the*

*traction is significant and/or the attachment is broad.*

*In cases of generalized macular thickening, fluorescein*

*angiography (FA) may demonstrate vascular leakage associated*

*with areas of intraretinal pseudocysts. However, the widespread*

*use of OCT and its superior imaging quality to identify*

*architectural changes involving the retinal layers and surface*

*limit the role of FA for diagnosis and/or monitoring of VMT and*

*its associated retinal changes, even though FA may be helpful in*

*diagnosing and/or monitoring retinal vascular diseases known*

*to coexist with VMT.*

*42.3 Diagnosis*

*1. VMT OD.*

*2. VMT OS, nonprogressive.*

*42.4 Management*

*Management of VMT depends mostly on the patient’s symptoms.*

*Observation is preferred when the patient’s symptoms and*

*vision loss are minimal. Thirty to forty percent of VMT cases*

*present spontaneous release of the traction and stabilization or*

*resolution of symptoms within 1 to 2 years, especially when the*

*attachment is focal. However, approximately 60 to 65% of eyes*

*may present worsening visual acuity according to some reports,*

*particularly when there is broad attachment and important*

*intraretinal cystoid changes.*

*PPV used to be the only surgical treatment available for VMT.*

*The necessary mechanical changes for traction release are usually*

*obtained by the removal of the vitreous gel with special*

*attention to extricating the focal foveal attachment so as to*

*avoid creating a macular hole. While many surgeons advocate*

*for the internal limiting membrane peeling, there is no clear*

*answer regarding the benefit of its removal in VMT. Most*

*recently, ocriplasmin was approved as a pharmacologic option*

*to treat VMT. Ocriplasmin, a recombinant protease, targets the*

*adhesive components of the vitreoretinal adhesion resulting in*

*its separation from the retina in some cases. A cornerstone*

*study evaluating the efficacy of ocriplasmin intravitreal injection*

*for VMT treatment in comparison to placebo (saline injection)*

*demonstrated benefit in more than double of cases*

*treated with ocriplasmin (26.5% resolution of adhesion vs.*

*10.1%). It appears that the best use of ocriplasmin is in younger*

*patients (< 65 years old), phakic eyes, eyes without an ERM,*

*eyes with an associated FTMH, and in cases of focal VMT; however,*

*the relatively small number of studies evaluating ocriplasmin*

*and reports of complications such as dyschromatopsia,*

*electroretinographic changes, and ellipsoid layer disruption*

*may be concerning for its widespread use.*

*Fig. 42.1 Optical coherence tomography image showing (a) vitreomacular attachment at the fovea with evidence of slight traction which (b)*

*progressed to more evident traction over the ensuing month.*

*Fig. 42.2 Optical coherence tomographic appearance after surgery,*

*showing no residual vitreous attachment and a virtual normalization of*

*the inner retinal layers.*

*Vitreomacular Traction*

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*The use of intravitreal injection of expansile gas has also been*

*demonstrated to be beneficial for VMT resolution; however,*

*there is no controlled, randomized study that could definitively*

*prove its efficacy and safety.*

*42.5 Rehabilitation and Follow-up*

*The rate of visual improvement after PPV for VMT is around*

*80%, but most others gain stabilization of their vision.*

*In cases in which a decision for observation is taken, it is recommended*

*that patients can be educated to self-monitor for*

*worsening metamorphopsia, decreased vision, or development*

*of scotoma through periodic evaluations with Amsler grid*

*testing.*

~~~~~CASE 43 Vitreous Hemorrhage~~~~~

*43 Vitreous Hemorrhage*

*William E. Smiddy and Thalmon R. Campagnoli*

*Abstract*

*Vitreous hemorrhage is most commonly associated with retinal*

*vascular disease, usually indicating a proliferative retinopathy,*

*but an important cause not to miss is when it occurs secondary*

*to a new retinal tear. Proliferative diabetic retinopathy frequently*

*heralds its presence in this way, prompting appropriate*

*treatment aimed at reversing and controlling the retinal neovascularization.*

*Other proliferative retinopathies that may*

*present with a vitreous hemorrhage include branch retinal vein*

*occlusion, sickle retinopathy, or proliferations due to other syndromes*

*or ischemia. Choroidal vascular diseases, most commonly*

*choroidal neovascularization due to wet age-related*

*macular degeneration, may manifest as vitreous hemorrhage*

*through a retinal “breakthrough” mechanism. Most important*

*due to the opportunity to treat during a window of opportunity*

*is vitreous hemorrhage in association with a posterior vitreous*

*detachment, especially when secondary to a retinal tear which*

*might be treatable before the onset of retinal detachment. The*

*mainstay of diagnostic modalities (when the vitreous hemorrhage*

*is so severe as to prevent direct visualization) is B-scan*

*ultrasound. Close follow-up is the paradigm of clinical followup,*

*especially if the ultrasound test has not shown definite tear*

*or detachment. Mimicking conditions include vitreous opacities*

*due to inflammatory disease.*

*Keywords: vitreous hemorrhage, retinal tear, retinal detachment,*

*posterior vitreous detachment, ultrasound*

*43.1 History*

*This 90-year-old woman presented with a 3-month history of*

*sudden decreased vision in the left eye. Her visual acuity was*

*20/40 OD and 2/200 OS. Intraocular pressures were 12mm Hg*

*in each eye. Slit-lamp examination showed a well-positioned*

*posterior chamber lens implant on the right. There was vitreous*

*adherent to the wound superiorly. In the left eye, she had*

*2 + nuclear sclerosis. There was a very dense vitreous hemorrhage*

*in the left eye precluding a view posteriorly.*

*Past ocular history was pertinent for vision of 20/50 on the*

*right and 20/200 on the left 3 years previously due to atrophic*

*age-related macular degeneration OD and a previously treated,*

*subfoveal choroidal neovascular membrane OS. Medical history*

*was negative for diabetes or hypertension.*

*B-scan/A-scan ultrasonography showed vitreous hemorrhage*

*with posterior vitreous detachment (PVD) OS. There was no*

*retinal tear or detachment, and a disciform scar could not be*

*resolved in the left macula.*

*She was observed without treatment for 3 months. On follow-*

*up, the visual acuity improved to 20/400 and a subfoveal*

*laser scar with contiguous subretinal hemorrhage extending*

*inferiorly to the midperiphery was visible.*

*Differential Diagnosis—Key Points*

*1. Spontaneous vitreous hemorrhage in an elderly patient,*

*especially with the history of previously treated macular*

*degeneration, suggests the possibility of breakthrough*

*bleeding into the vitreous cavity from a subretinal*

*hemorrhagic process. Extension of subretinal hemorrhage*

*before breakthrough bleeding occurs may compound*

*sightimpairing tissue damage from the underlying*

*neovascularization process.*

*2. The most common causes of vitreous hemorrhage in*

*nondiabetic patients are PVD, retinal tear (with or*

*without avulsed retinal vessel syndrome), and retinal*

*detachment. Other less common or historically obvious*

*causes include blunt trauma, Terson’s syndrome,*

*choroidal melanoma, penetrating trauma, and*

*macroaneurysms.*

*3. Prompt diagnosis and treatment may prevent further or*

*permanent visual loss. Vitreous hemorrhage at the time of*

*PVD is associated with a higher risk of retinal tear (23–45%)*

*than PVD without hemorrhage (3–12%). Untreated*

*proliferative retinopathies should also be considered in all*

*cases.*

*4. Vitreous hemorrhage often occurs in proliferative*

*retinopathies. The most common cause of vitreous*

*hemorrhage in a patient with diabetes mellitus is*

*proliferative diabetic retinopathy. Other proliferative*

*etiologies include branch retinal vein occlusion, sickle cell*

*retinopathy, or choroidal neovascularization. Often, the*

*possibility of these entities is apparent from the previous*

*history or examination of the fellow eye.*

*5. It may be difficult to differentiate vitreous blood, especially*

*when chronic, from vitreous opacities due to inflammatory*

*disorders. Conditions such as toxoplasmosis, pars planitis, or*

*other forms of intermediate and posterior uveitis may*

*present with vitreous opacities. In such cases, careful*

*examination for granulomatous signs in the anterior*

*segment may betray the diagnosis. Pars planitis may lead to*

*neovascularization and vitreous hemorrhage directly. Clues*

*may sometimes be obtained from careful examination of*

*the fellow eye and careful delineation of the previous*

*history.*

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*43.2 Test Interpretation*

*One key element of the clinical examination is the presence or*

*absence of an afferent pupillary defect. More extensive disease,*

*such as retinal detachment or extensive subretinal hemorrhage*

*with breakthrough bleeding, often manifests with an afferent*

*pupillary defect. Indirect ophthalmoscopy with scleral depression*

*may allow a view of the peripheral retina despite substantial*

*degrees of blood in the midvitreous. Seeing the peripheral*

*retina intact at or near the ora serrata for 360Ε lends some confidence*

*in ruling out associated retinal detachment.*

*The most important ancillary test to rule out progressive*

*causes for vitreous hemorrhage is echography (▶Fig. 43.1). It is*

*generally possible to rule out retinal detachment with echography.*

*In some selected cases, a peripheral retinal tear may be*

*detectable by ultrasound. Proliferative retinopathies may frequently*

*be able to be diagnosed by echography as the vitreoretinal*

*attachment of the retinal neovascularization may be*

*evident.*

*If it is uncertain whether the vitreous opacities may represent*

*inflammatory cells rather than red blood cells, laboratory*

*testing (such as toxoplasmosis titers, TB skin testing, syphilis*

*serologies) or even diagnostic vitrectomy may be indicated.*

*43.3 Diagnosis*

*Vitreous hemorrhage due to breakthrough bleeding associated*

*with choroidal neovascularization, OS.*

*43.4 Medical Treatment*

*There are no known medical treatments to hasten the clearance*

*of vitreous hemorrhage. Having the patient sleep in a slightly*

*inclined position does not hasten the clearance of the hemorrhage,*

*but it may allow the blood to settle inferiorly and facilitate*

*examination of the patient. The temporary, partial visual*

*improvement is reassuring to the patient.*

*Laser treatment, when possible, is the mainstay of treatment*

*for most proliferative retinopathies.*

*43.5 Surgical Treatment*

*Vitrectomy for cases of nonclearing vitreous hemorrhage in*

*eyes with acceptable visual potential is the mainstay of surgical*

*treatment. The appropriate timing and indication for surgery*

*are controversial. In patients with known proliferative retinopathies,*

*such as diabetic retinopathy, surgical intervention is*

*dependent on a variety of factors, including the chronicity of*

*the hemorrhage, the presumed severity of the existing proliferation,*

*and the degree of previous laser photocoagulation*

*applied. Generally, type I diabetics undergo earlier vitrectomy*

*compared to type II diabetics, with vitrectomy usually being*

*recommended for patients with nonclearing vitreous hemorrhage*

*of 2 to 6 months’ duration.*

*Patients with vitreous hemorrhage not associated with proliferative*

*retinopathies, retinal detachment, or retinal tears are*

*generally observed. If there are no signs of spontaneous clearing*

*within 3 to 6 months, vitrectomy can be recommended.*

*However, it is important to attempt to assess the visual potential*

*in such cases. In patients with macular degeneration, the*

*visual potential is understandably limited. A special case is vitreous*

*hemorrhage due to penetrating trauma or a globe rupture.*

*Usually, further vitreous surgery, which may include*

*vitrectomy, scleral buckling, and other maneuvers, is recommended*

*within 2 weeks of onset to preempt irreversible cicatricial*

*changes.*

*43.6 Rehabilitation and Follow-up*

*In this patient, the visual acuity was improving 2 months after*

*presentation. The visual potential was 20/200, and there was*

*good vision in the fellow eye. Surgical intervention therefore*

*was deferred. However, even in patients in whom the vitreous*

*hemorrhage is noted to be due to breakthrough bleeding from*

*macular degeneration, vitrectomy can be considered. The most*

*common setting in which vitrectomy is offered despite limited*

*visual potential would be in a patient with bilateral visual loss.*

*Furthermore, it is important to counsel patients preoperatively*

*as to appropriate expectations.*

~~~~~CASE 44 Retinitis Pigmentosa~~~~~

*44 Retinitis Pigmentosa*

*Byron L. Lam*

*Abstract*

*Retinitis pigmentosa (RP) is a group of genetically heterogeneous*

*inherited retinal degenerative disorders characterized by*

*progressive rod and cone photoreceptor dysfunction and death.*

*The prevalence of RP is approximately 1 per 3,000 to 4,000 persons.*

*Gradual progressive nyctalopia and progressive loss of*

*peripheral vision are common early symptoms. Early gray retinal*

*degenerative changes typically start in the midperipheral*

*retina and advances with formation of pigment clumping and*

*vascular attenuation toward the macula. Other potential features*

*include posterior subcapsular cataract and cystoid macular*

*edema, both of which are treatable. Most patients retain*

*good central vision until advanced stages of the disease. Rate of*

*progressive visual loss is highly variable, and total visual loss in*

*both eyes occurs in a minority of patients. Over 150 genes are*

*found to cause RP with autosomal recessive, autosomal dominant,*

*or X-linked inheritance. Approximately 50% of RP cases*

*are sporadic without family history. Commercialized genetic*

*testing is available although, not all genotypes of RP are yet*

*known. Benefits of genetic testing include determining hereditary*

*pattern, ruling out syndromic RP, and participating in*

*available clinical trials. Some evidence suggests the benefit of*

*oral vitamin A palmitate, DHA (docosahexaenoic acid), and*

*lutein, but given the diversity of genotypes and the lack of consistent*

*beneficial laboratory data, there is a lack of general*

*agreement among RP specialist to recommend these supplements.*

*Retinal implant providing rudimentary vision is*

*approved for treatment of very advanced RP with light perception*

*or worse in both eyes. Numerous clinical trials are under*

*way to test a wide range of treatment strategies.*

*Keywords: retinitis pigmentosa, retinal dystrophy, hereditary*

*retinal degeneration*

*44.1 History*

*A 24-year-old woman with progressive visual difficulties at*

*night was evaluated. Since the age of 10, the patient has had*

*trouble performing outdoor activities after dusk. A year ago, the*

*patient stopped driving at night, because she no longer felt safe.*

*For many years, the patient has been “clumsy” and often*

*walked into surrounding objects she could not see well. The patient*

*was otherwise healthy. Family history was negative for*

*ocular problems, and there was no consanguinity.*

*Best-corrected visual acuity was 20/25 in each eye, with no*

*relative afferent pupillary defect. Goldmann visual fields revealed*

*large midperipheral ring-shaped scotomas (▶Fig. 44.1). Funduscopic*

*examination showed atrophy of the midperipheral and*

*peripheral retina with areas of pigment clumping (“bone spicules”;*

*▶Fig. 44.2). Attenuation of the retinal vasculature in the*

*area of retinal atrophy was evident. Full-field electroretinography*

*(ERG) showed nondetectable rod and cone responses.*

*Differential Diagnosis—Key Points*

*1. In a young patient with progressive night visual difficulties*

*or nyctalopia and decreased peripheral vision, a diagnosis of*

*hereditary retinal degeneration should be considered.*

*Among this group of disorders, retinitis pigmentosa (RP) is*

*the most common and has a prevalence of approximately 1*

*per 3,000 to 4,000 persons in the general population. RP is*

*a group of genetically heterogeneous inherited retinal*

*degenerative disorders characterized by early rod*

*photoreceptor dysfunction followed by progressive rod and*

*cone photoreceptor dysfunction and death. Nyctalopia and*

*progressive loss of peripheral vision are common early*

*symptoms. Visual acuity and macular function, in contrast,*

*are usually relatively spared in most but not all affected*

*persons until late in the disease. Symptoms typically start*

*insidiously between the second and fifth decades of life and*

*continue to progress gradually. The primary retinal finding is*

*retinal atrophy with vascular attenuation and pigmentary*

*clumping (traditionally referred to as “bone spicules”) that*

*typically begins in the midperipheral regions of the retina,*

*where there is the highest density of rod photoreceptors.*

*With time, the areas of retinal degenerations spread*

*peripherally as well as centrally. Other ophthalmoscopic*

*signs may include cystoid macular edema (CME), atrophic*

*macular lesions, optic nerve atrophy, vitreous syneresis, and*

*mild vitritis. Central posterior subcapsular cataract is also*

*common in RP and often acquires a stellate shape with*

*progression. Approximately 50% of RP patients have no*

*family history of RP and are designated as having sporadic*

*RP, with most having autosomal recessive RP. The remaining*

*50% of RP patients have pedigrees consistent with*

*autosomal dominant (20–25%), X-linked (10–15%), and*

*autosomal recessive (15%) inheritance.*

*2. Aside from RP, other conditions which may produce*

*progressive nyctalopia in healthy individuals with no other*

*associated systemic symptoms include choroideremia,*

*gyrate atrophy, and vitamin A deficiency. Choroideremia is*

*an X-linked recessive chorioretinal dystrophy characterized*

*by a progressive degeneration of the choroid and the retinal*

*pigment epithelium. Choroideremia results from defects in*

*the human Rab escort protein-1 (REP-1) gene that encodes*

*for a component of rab geranylgeranyl transferase, an*

*enzyme involved in cellular transport. Affected males with*

*choroideremia usually start to have onset of poor night*

*vision and decreased peripheral vision starting in the first*

*two decades of life. The central vision is the last to be*

*affected but is invariably affected in all affected males by the*

*fourth and fifth decades of life. Female carriers are*

*asymptomatic but have a diffuse or localized “moth-eaten”*

*appearance of the retinal pigment epithelium. Gyrate*

*atrophy is an autosomal recessive chorioretinal dystrophy*

*due to a generalized deficiency of the mitochondrial matrix*

*enzyme ornithine aminotransferase. Many patients are first*

*Retina*

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*diagnosed with the disease when poor night vision becomes*

*noticeable between the age of 20 and 40 years. Multiple,*

*discrete scallop-shaped areas of chorioretinal atrophy occur*

*initially in the peripheral and midperipheral regions of the*

*fundus. Over time, the lesions coalesce and progress toward*

*the macula with corresponding, progressive impairment of*

*peripheral vision and night vision. Worldwide, dietary*

*vitamin A deficiency is a considerable cause of progressive*

*nyctalopia. The prevalence is higher in less developed*

*countries, and nyctalopia is often the earliest symptom.*

*With progression, dryness of the conjunctiva and cornea as*

*well as metaplastic keratinization of areas of the conjunctiva*

*may occur.*

*3. Several retinal degenerative disorders associated with*

*pigmentary retinal atrophy have been traditionally listed*

*under the broad category of syndromic or secondary RP.*

*The disorders include Usher’s syndrome, Bardet–Biedl*

*syndrome, Refsum’s syndrome, Bassen–Kornzweig*

*syndrome, and neuronal ceroid lipofuscinosis*

*(Batten’s disease). These conditions are associated*

*with other systemic findings and are not likely in our*

*healthy adult patient. Of interest, toxic retinopathies*

*such as thioridazine-induced retinopathy may also*

*produce a RP-like clinical picture. Of interest, Leber’s*

*congenital amaurosis refers to a group of genetically*

*heterogeneous inherited retinal degenerative disorders*

*characterized by severe congenital diffuse retinal*

*dysfunction with severe visual loss and the development*

*of nystagmus noted within the first year life. The*

*retinal appearance is usually normal initially but*

*diffuse retinal degenerative RP-like changes develop*

*over time.*

*Fig. 44.1 Goldmann visual fields showed midperipheral ring-shaped scotomas in each eye.*

*Fig. 44.2 Funduscopic findings were similar for both eyes. A view of the left fundus showing retinal atrophy midperipherally near the vascular arcades.*

*The retinal atrophy is more apparent in a view of the inferior quadrant of the retina. Prominent choroidal vasculature appearance and retinal vascular*

*attenuation is evident in the area of the retinal atrophy, and areas of pigmentary clumping (“bone spicules”) are visible.*

*Retinitis Pigmentosa*

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*44.2 Test Interpretation*

*Commonly used clinical automated 30-degree visual fields*

*show variable amount of constriction depending on disease*

*stage. Automated kinetic and Goldmann visual field testing*

*often reveal midperipheral ring-shaped scotoma in patients*

*with early RP. As the disease progresses, the scotoma expands*

*and the visual field becomes more constricted.*

*Optical coherence tomography (OCT) is very useful in identifying*

*CME as well as foveal atrophy associated with RP. Given*

*some RP patients respond to medical treatments for RP-related*

*CME, OCT is of diagnostic value in RP patients with decreased*

*visual acuity.*

*Full-field ERG is an extremely valuable tool in diagnosing*

*patients in early stages of RP, who may have no or mild symptoms*

*and the retinal atrophy may or may not be clinically apparent.*

*The ERG responses are dramatically reduced in early*

*stages in RP. Patients with early stages of RP have significantly*

*reduced and prolonged dark-adapted rod ERG responses and*

*reduced but less affected light-adapted cone responses. With*

*further progression of the disease, the rod and cone ERG*

*responses diminish and become nondetectable. Therefore, the*

*ERG responses of most RP patients are often small or nondetectable.*

*In fact, it is not unusual for ERG responses to be nondetectable*

*on initial evaluation in some RP patients.*

*Genetic testing has become an increasingly useful tool in*

*determining the specific RP genotype and thus the hereditary*

*pattern. The genotypes of RP are numerous and extremely*

*diverse. In a given affected individual, the RP is associated with*

*specific change in a specific gene. The alteration may occur in*

*one allele in cases of dominant RP and X-linked RP or the*

*changes may occur in a homozygous or heterozygous fashion in*

*both alleles in cases of recessive RP. A vast number of specific*

*codon mutations in over 100 genes are found to be associated*

*with RP, with recessive RP being the most genetically diverse.*

*The protein alterations from the RP genotypes ultimately cause*

*photoreceptor dysfunction and eventual death through different*

*biochemical mechanisms such as the renewal and shedding*

*of photoreceptor outer segments, the visual transduction cascade,*

*the retinol (vitamin A) metabolism, etc.*

*44.3 Diagnosis*

*Retinitis pigmentosa, sporadic, moderately advanced.*

*44.4 Medical Management*

*For severe RP resulting in bare light perception or no light perception*

*vision, retinal implants are approved for treatment*

*under humanitarian or conventional approval in the United*

*States or in European countries. The basic premise involves the*

*utilization of a video camera that transmits visual signals to an*

*electrode array implanted to the retina. The vision provided is*

*artificial, primitive, and pixilated and allows the possibility of*

*improvement in mobility.*

*In a previous prospective study, oral vitamin A palmitate*

*(15,000 IU) daily may help to delay the progression of RP, while*

*oral vitamin E daily may hasten progression. Oral lutein and*

*DHA (docosahexaenoic acid) may have some modest beneficial*

*effect to delay progression or RP. Given the diversity of genotypes*

*in RP and that vitamin A treatment is found to be harmful*

*for some genotypes that could cause RP (e.g., ABCA4), there is a*

*lack of general agreement among RP specialists with respect to*

*recommending these supplements.*

*Of interest, oral acetazolamide has been found to be more*

*effective than topical agents such as dorzolamide in treating*

*CME in RP. Reducing retinal exposure to damaging solar ultraviolet*

*light with sunglasses is recommended in RP patients. For*

*those RP patients with reduced visual acuity, low vision aids*

*may be helpful.*

*Counseling of patients and their families regarding visual*

*prognosis and disease susceptibility should be provided. However,*

*the clinical expression of a known genotype may have*

*some interindividual variability even for affected individuals of*

*the same family.*

*44.5 Rehabilitation and Follow-up*

*If cataract or CME develops, treatment should be considered.*

*Cataract extraction may be challenging in some cases because*

*of weakened zonular lens support in eyes with RP. Multiple*

*laser posterior capsulotomies after cataract extraction are often*

*necessary in RP patients because postoperative fibrotic reaction*

*of the posterior capsule is common. Periodic yearly liver function*

*tests may be helpful in RP patients placed on vitamin A*

*therapy. However, the risk of toxicity from the recommended*

*dosage is low, and whether repeated liver function testing is*

*necessary in all patients is uncertain.*

~~~~~CASE 45 Choroiditis~~~~~

*45 Choroiditis*

*Sarah P. Read*

*Abstract*

*There are a variety of features allowing categorization of choroiditis*

*entities, which may facilitate their accurate diagnosis, such*

*as unilateral versus bilateral, granulomatous versus nongranulomatous,*

*extent of involvement (panuveitis vs. anterior or*

*intermediate), and systemic versus nonsystemic associated*

*signs. The clinical course and other specifically characteristic*

*features may confirm or allow more definitive diagnoses of specific*

*entities. The principal entities presenting with choroiditis*

*include Behçet’s disease, Vogt–Koyanagi–Harada (VKH) syndrome,*

*sympathetic ophthalmia, a variety of infectious causes (e.g.,*

*toxoplasmosis, Lyme borreliosis, tuberculosis, and syphilis), sarcoidosis,*

*various white dot syndromes, and postsurgical inflammation.*

*Some entities have characteristic appearances with*

*various imaging modalities (e.g., pinpoint areas of hyperfluorescence*

*and posterior scleritis by ultrasound examination with*

*VKH syndrome). A multiplicity of laboratory tests may be helpful*

*in corroborating a clinical diagnosis, but must be interpreted*

*carefully in context of the clinical presentation and course.*

*Keywords: inflammation, infection, endophthalmitis, uveitis*

*45.1 History*

*A 24-year-old Hispanic woman complained of constant pain in*

*the right eye for 3 weeks, blurred vision, redness, and tearing*

*for 1 week, and a 1-month history of headache and neck stiffness.*

*Computed tomography (CT) of the brain was normal. A*

*lumbar puncture showed a mild pleocytosis. She noted flulike*

*symptoms for 2 days previously. She denied any history of*

*trauma.*

*On examination, visual acuity was 20/20 in both eyes. Intraocular*

*pressure was 18mm Hg in the right eye and 16mm Hg*

*in the left eye. Slit-lamp examination disclosed moderate anterior*

*chamber cell and flare in the right eye with granulomatous*

*keratic precipitates on the corneal endothelium. A mild anterior*

*chamber inflammatory reaction was noted in the left eye. Vitreous*

*cells were present in the right eye. Funduscopic examination*

*of the right eye showed optic disc edema with focal areas*

*of serous retinal detachment and folding of the retina within*

*the macular region. The left eye was unremarkable. B-scan*

*ultrasonography of the right eye showed diffuse choroidal*

*thickening with low reflectivity and a shallow serous macular*

*detachment. Treatment with topical prednisolone acetate 1%*

*and cycloplegics was initiated.*

*The patient returned 1 week later with persistent pain and*

*markedly decreased visual acuity in the right eye to 3/200*

*vision. Although the anterior chamber reaction had decreased*

*slightly in the right eye, the left eye had increased cell and flare*

*with a few keratic precipitates. The funduscopic examination*

*showed increased optic disc edema, subretinal fluid and retinal*

*folds, and focal yellow-white lesions at the level of the retinal*

*pigment epithelium (RPE) in the macula (▶Fig. 45.1). Although*

*the vision was 20/25 in the left eye, a new focal area of subretinal*

*fluid in the nasal macula was noted. Fluorescein angiography*

*of the right eye demonstrated multiple areas of pinpoint*

*hyperfluorescence in the juxtapapillary region and macula that*

*leaked in the later frames (▶Fig. 45.2). The area of thickening in*

*the left eye adjacent to the optic disc had a similar appearance*

*on fluorescein angiography.*

*Fig. 45.1 Funduscopic appearance of the patient’s right eye showing*

*focal yellow-white lesions at the level of the RPE superior and temporal*

*to the macula. Note the optic nerve had swelling.*

*Fig. 45.2 Fluorescein angiography of the same eye at the same time*

*showing prominent disc edema, but also end-point hyperfluorescence*

*corresponding to RPE lesions.*

*Uveitis*

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*Differential Diagnosis—Key Points*

*1. One of the first steps in evaluating patients with intraocular*

*inflammation is defining the location and extent of tissue*

*involvement. Panuveitis involves inflammation of all*

*segments of the eye: anterior segment, vitreous, and the*

*retina and/or choroid. Causes of panuveitis include Behçet’s*

*disease, sympathetic ophthalmia, tuberculosis, sarcoidosis,*

*Vogt–Koyanagi–Harada (VKH) syndrome, and infectious*

*endophthalmitis. Additionally, it is important to determine*

*the primary tissue layer involved (e.g., retina or choroid) and*

*whether the lesions are unifocal or multifocal. Causes of*

*multifocal choroiditis, as in the presented case, include*

*autoimmune disorders (sympathetic ophthalmia, VKH*

*syndrome, and sarcoidosis), infectious diseases*

*(histoplasmosis), or other inflammatory causes (white dot*

*syndromes).*

*2. A second potentially distinguishing feature of patients with*

*uveitis is the onset of symptoms. Acute causes of uveitis*

*include postsurgical infection, trauma, toxoplasmosis, the*

*white dot syndromes (acute posterior placoid pigment*

*epitheliopathy and multiple evanescent white dot*

*syndrome), VKH syndrome, acute retinal necrosis, and most*

*causes of anterior uveitis.*

*3. Most causes of posterior uveitis are bilateral in presentation.*

*Cases that remain unilateral upon follow-up examination*

*may include sarcoidosis, trauma, parasitic disease (such as*

*toxoplasmosis), retained intraocular foreign body, and*

*postsurgical uveitis. Bilateral involvement may indicate a*

*systemic cause of inflammation, such as autoimmune*

*disorders and endogenous infectious etiologies. Some cases*

*may present with unilateral inflammation, but manifest*

*bilaterality only on subsequent follow-up examination, as*

*was the case with the patient presented here.*

*4. Careful examination of the anterior chamber reaction with*

*identification of granulomatous versus nongranulomatous*

*type of inflammation is helpful in narrowing the differential*

*diagnosis. Causes of granulomatous inflammation include*

*sarcoidosis, VKH syndrome, sympathetic ophthalmia,*

*toxoplasmosis, ocular Lyme borreliosis, tuberculosis, and*

*syphilis.*

*5. Neurologic signs and symptoms warrant further*

*investigation to rule out meningeal infection or central*

*nervous system (CNS) disorder. A CT scan with and without*

*contrast or magnetic resonance imaging (MRI) of the brain*

*may be diagnostic. Lumbar puncture with cerebrospinal*

*fluid (CSF) sent for cell count and differential, protein,*

*glucose, VDRL, bacterial stains, and culture may aid in*

*establishing the diagnosis. Primary intraocular B-cell*

*lymphoma can masquerade as chronic uveitis with*

*associated neurologic abnormalities. Appropriate blood*

*tests to evaluate for malignancy or systemic infection may*

*include a complete blood count with differential, ANA, RPR,*

*FTA-ABS, Lyme titer, ACE, and PPD with anergy panel and a*

*chest X-ray when the diagnosis is uncertain.*

*6. Several associated signs and symptoms along with patient*

*demographics are important in the diagnosis of posterior*

*uveitis, and may eliminate the need for extensive laboratory*

*and ancillary testing. VKH syndrome is thought to be a*

*primary inflammatory condition directed at melanincontaining*

*cells. Patients with VKH syndrome are typically*

*found in groups with greater skin pigmentation (Hispanic,*

*Asian, Native American, and African American), females,*

*and ages 20 to 40 years old. A link has been found between*

*VKH syndrome and HLA-DR4 and DQ4, though the*

*prognostic significance is unclear. VKH syndrome is*

*associated with a number of systemic manifestations*

*including auditory symptoms (tinnitus, hearing loss) or*

*cutaneous findings (vitiligo, alopecia, poliosis). Neurologic*

*symptoms (nausea, headache, vertigo, stiff neck) or signs*

*(CSF pleocytosis) are frequent findings. Criteria for the*

*diagnosis of VKH syndrome were set forth by the American*

*Uveitis Society in 1978 (see list below).*

*7. The clinical course of the disease is important in confirming*

*the diagnosis. VKH syndrome, for example, generally*

*follows three phases. The initial prodromal stage mimics a*

*viral illness with neurologic signs and symptoms (fever,*

*vertigo, tinnitus, meningism). This is followed by a uveitic*

*stage with rapid vision loss associated with bilateral*

*posterior uveitis, exudative retinal detachment, hyper- and*

*hypopigmentation of the RPE, peripapillary retinal elevation*

*or disc edema, and thickening of the posterior choroid.*

*Finally, in the convalescent stage, chronic changes are seen*

*including a “sunset glow” fundus (yellow-orange retinal*

*pigment epithelial color change), Dalen-Fuchs’ nodules*

*(yellow-white choroidal granulomatous inflammatory*

*infiltrates), poliosis, vitiligo, and retinal pigment epithelial*

*mottling.*

*8. VKH syndrome and sympathetic ophthalmia share many*

*characteristics, including fluorescein angiographic*

*appearance, clinical characteristics, and a strong association*

*with HLA-DR4. Therefore, a careful history to elicit even a*

*remote history of penetrating ocular trauma is important.*

*Exudative retinal detachments can occur in central serous*

*retinopathy, uveal effusion syndrome, and age-related*

*macular degeneration; however, these diseases will lack the*

*inflammation and systemic symptoms characteristic of VKH*

*syndrome.*

*Vogt–Koyanagi–Harada Syndrome: Criteria for Diagnosis (American*

*Uveitis Society, 1978)*

*1. No history of ocular trauma or surgery.*

*2. At least three of the following:*

*a) Bilateral chronic iridocyclitis.*

*b) Posterior uveitis, including exudative retinal detachment,*

*forme fruste of retinal detachment, disc hyperemia or*

*edema, and “sunset-glow” fundus.*

*c) Neurologic signs (tinnitus, stiff neck, CNS problems, or CSF*

*pleocytosis).*

*d) Cutaneous findings (alopecia, vitiligo, poliosis).*

*45.2 Test Interpretation*

*Evaluation of the patient begins with a careful history, in this*

*case with special emphasis on prior ocular surgery or trauma,*

*systemic infections or inflammatory diseases, neurologic or*

*auditory symptoms, and skin or hair depigmentation. Patient*

*Choroiditis*

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*demographics are important clues to the diagnosis of intraocular*

*inflammation, since many causes of intraocular inflammation*

*affect characteristic patient populations. Next, a complete*

*ocular examination must be performed to evaluate the location*

*and type (granulomatous vs. nongranulomatous) of inflammation,*

*the distribution and appearance of choroidal inflammatory*

*lesions, and any associated posterior pole pathology,*

*including disc edema and/or serous retinal detachment.*

*Fluorescein angiography is an important adjunct in the diagnosis*

*of posterior uveitis, as entities with similar clinical*

*appearance may have very different fluorescein angiographic*

*characteristics. Fluorescein angiography in the acute phase of*

*VKH syndrome typically shows numerous pinpoint areas of*

*hyperfluorescence at the level of the RPE overlying areas of choroiditis*

*with subretinal dye pooling. There is little to no retinal*

*vessel leakage in the acute stage, which can distinguish VKH*

*syndrome from other disorders. Optic disc edema is present in*

*approximately 70% of patients. During the chronic phase, multiple*

*retinal pigment epithelial window defects are seen. A similar*

*angiographic appearance is seen in patients with*

*sympathetic ophthalmia. Patients with lymphoma or a form of*

*“white dot syndrome,” such as acute posterior multifocal placoid*

*pigment epitheliopathy (APMPPE) and multiple evanescent*

*white dot syndrome (MEWDS), may have a similar clinical*

*appearance but have distinct fluorescein angiographic characteristics.*

*B-scan ultrasonography can be helpful in evaluating patients*

*with posterior uveitis in order to rule out posterior scleritis*

*(scleral thickening present), uveal effusion syndrome (may have*

*scleral thickening and often involve the peripheral choroid), or*

*infiltrative lesions. Echographic features of VKH syndrome*

*include diffuse, low-to-medium reflective choroidal thickening,*

*mild vitreous opacities, and serous retinal detachment located*

*in the posterior pole. In the acute phase, lumbar puncture*

*shows a lymphocytic pleocytosis in 84% of patients with normal*

*protein levels.*

*More recently, optical coherence tomography (OCT) has been*

*used to evaluate for recurrence in these patients. Increased choroidal*

*thickening has been associated with anterior segment*

*inflammation in some patients.*

*45.3 Diagnosis*

*Vogt–Koyanagi–Harada syndrome.*

*45.4 Medical Management*

*Prompt treatment with systemic corticosteroids (80–200mg*

*per day orally), a cycloplegic agent, and topical prednisolone*

*acetate 1% (frequency tailored to control anterior segment*

*inflammation) may result in rapid resolution of symptoms of*

*redness, pain, and photophobia. The sooner treatment is initiated,*

*the more rapid the resolution of symptoms. H2-blockers,*

*such as ranitidine 150mg twice daily orally, should be administered*

*to protect against gastric ulcer formation while on highdose*

*systemic steroid treatment. In particularly severe cases,*

*initial treatment with intravenous steroids may be considered.*

*Oral prednisone should be tapered very slowly (over 4–6*

*months) with careful observation as nearly half of recurrences*

*occur within this time period. If symptoms do not resolve with*

*prednisone, other systemic immunosuppressants such as cyclosporine,*

*cyclophosphamide, chlorambucil, and azathioprine can*

*be used.*

*45.5 Surgical Management*

*Surgical intervention does not play a direct role in the management*

*of most causes of posterior uveitis that are a result of a*

*systemic inflammatory disease. Exudative retinal detachments*

*usually resolve with resolution of intraocular inflammation.*

*Complications associated with chronic intraocular inflammation,*

*such as cataract formation, angle-closure glaucoma, or*

*choroidal neovascularization, may require future surgical intervention.*

*45.6 Rehabilitation and Follow-up*

*The patient should be followed frequently in the initial stages of*

*the disease in order to adjust treatment with corticosteroids for*

*adequate control of inflammation and prevention of sequelae,*

*such as posterior synechiae and angle closure. Early aggressive*

*treatment with systemic corticosteroids can be followed by a*

*gradual taper with less frequent ocular examination once a*

*decrease in inflammation and exudative detachment is noted.*

*When steroids alone do not control intraocular inflammation,*

*the patient is intolerant of the side effects of steroids, or relapses*

*occur while on high-dose steroid treatment, other immunosuppressive*

*agents can be used. Once complete resolution of*

*inflammation and serous detachment is achieved, a slow taper*

*over 6 months decreases the risk of acute reactivation of*

*disease. Patients should be monitored on a regular basis for*

*evidence of cataract, choroidal neovascularization, or angleclosure*

*glaucoma.*

~~~~~CASE 46 Retinitis~~~~~

*46 Retinitis*

*Sarah P. Read*

*Abstract*

*Retinitis is caused by infectious agents, typically opportunistic*

*agents that emerge in a compromised host. The most common*

*setting is in eyes of human immunodeficiency virus (HIV)-positive*

*or acquired immune deficiency syndrome (AIDS) patients.*

*Viral, fungal, and parasitic etiologies are most common, but*

*uncommon bacterial agents may also flourish as a cause of retinal-*

*based inflammation. Since these are almost exclusively*

*microbial in nature, their natural course is typically progressive*

*and leads to severe visual loss. Toxoplasmosis and herpetic retinitis*

*may occur in immunocompetent individuals. Secondary*

*changes may include retinal detachment. Diagnosis is commonly*

*established through clinical appearance and culture or*

*detection of viral activity through techniques such as polymerase*

*chain reaction (PCR) testing of procured samples. Association*

*with choroiditis may allow suspicion of pneumocystis or*

*Cryptococcus species. Treatment centers around delivery of the*

*appropriate antimicrobial such as inserting ganciclovir implants*

*or other antimicrobials. Treatment of the underlying immunodeficiency*

*is a necessary goal and has been greatly aided in the*

*case of AIDS by HAART (highly active antiretroviral therapy).*

*Keywords: immunodeficiency syndrome, cytomegalovirus, toxoplasmosis,*

*syphilis*

*46.1 History*

*A 32-year-old woman with a 10-year history of acquired*

*immune deficiency syndrome (AIDS) complained of new onset*

*of multiple black spots in the visual field of the right and left*

*eyes for 2 weeks. She had a CD4 count of 64 and was on highly*

*active antiretroviral therapy (HAART).*

*Examination revealed a best corrected visual acuity of 20/30*

*in the right eye and 20/40 in the left eye. The intraocular pressure*

*was 10mm Hg in each eye. The anterior segment was*

*unremarkable with no anterior chamber cell or flare. Funduscopic*

*examination of the right eye showed creamy yellowishwhite*

*retinitis with prominent, associated hemorrhage within*

*the lesion (▶Fig. 46.1). There was active vitritis and vascular*

*sheathing superior to the disc extending along the superotemporal*

*arcade. The left eye had a peripheral area of retinitis temporally*

*(▶Fig. 46.2).*

*Differential Diagnosis—Key Points*

*1. Any complaint of floaters in a patient with a positive test for*

*human immunodeficiency virus (HIV) and a relatively low*

*CD4 count should prompt a complete funduscopic*

*examination. A high index of suspicion for cytomegalovirus*

*(CMV) retinitis exists, since 20 to 30% of HIV-positive*

*patients will develop this opportunistic infection in their*

*lifetimes. CMV is a DNA virus and CMV retinitis is thought to*

*represent a systemic activation of a latent infection. The*

*rate of CMV infection is markedly higher in those patients*

*with CD4 counts below 100. Prior to the development of*

*HAART, CMV retinitis was commonly seen within 1 year*

*after diagnosis with AIDS; since the advent of HAART*

*therapy, CMV retinitis is being diagnosed much later in the*

*course of the disease.*

*2. Patients often present with floaters, photopsias, and cloudy*

*vision. Exam can show mild inflammation, but there is often*

*little conjunctival injection. The presentation of CMV*

*retinitis is varied and often takes one of three forms. The*

*classic or fulminant form includes hemorrhagic necrosis that*

*can follow the blood vessels, as seen in ▶Fig. 46.1. The*

*granular form of disease shows a central area of atrophy*

*Fig. 46.1 Fundus photograph of right eye at presentation shows*

*confluent wedge of retinitis with prominent hemorrhage extending*

*from the superior nerve head margin anteriorly into the midperiphery.*

*Fig. 46.2 The left eye had a large area of retinitis without hemorrhage*

*in temporal midperiphery.*

*Retinitis*

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*with surrounding white border of activity, seen in*

*▶Fig. 46.2. These two forms can be seen simultaneously as*

*in our patient. Uncommonly, CMV can present with a*

*frosted branch angiitis in areas without retinitis.*

*3. The prognosis of CMV retinitis is variable and dependent on*

*the location and extent of the lesion. Retinal detachment is*

*estimated to complicate the disease in 50% of patients after*

*1 year. These detachments are due to atrophic holes that*

*develop in the necrotic retina. The efficacy of prophylactic*

*laser has not been proven in these patients.*

*4. Although CMV retinitis is the most common chorioretinal*

*inflammatory condition in HIV-positive patients, several*

*conditions may have similar fundus appearances. Acute*

*retinal necrosis (ARN), which is most commonly caused by*

*the herpes zoster virus, presents with a similar retinitis.*

*However, ARN is much less common, often associated with*

*prior herpes zoster dermatitis, and progresses rapidly with*

*new disease foci, with an occlusive vasculitis. Generally, ARN*

*tends to progress in a circumferential fashion, whereas CMV*

*progresses along the arcades. Unlike CMV retinitis, ARN*

*presents with prominent anterior and posterior segment*

*inflammation.*

*5. Toxoplasmosis may also present with a similar appearance*

*in HIV-positive individuals. Whereas the vast majority of*

*toxoplasmosis seen in an immunocompetent population is*

*unilateral and consists of small areas of retinitis often*

*adjacent to areas of chorioretinal scarring, HIV-positive*

*patients rarely have preexisting chorioretinal scars, develop*

*larger lesions, and may present bilaterally in up to 40% of*

*cases. This is because retinitis due to toxoplasmosis most*

*commonly represents reactivation of congenital infection in*

*immunocompetent individuals, whereas a significant*

*proportion of immunocompromised patients have acquired*

*new infection.*

*6. In patients with AIDS, syphilis may also present as a retinitis,*

*with a vitritis and underlying large pale placoid subretinal*

*lesions. These lesions are usually focal but may be bilateral.*

*In addition to the opportunistic infections that cause*

*retinitis, both Pneumocystis carinii and Cryptococcus*

*neoformans can present with multifocal choroiditis. Neither*

*condition typically causes a prominent retinitis.*

*7. Because the symptoms of CMV retinitis may initially be mild*

*and often occur in the context of significant concurrent*

*illness, many patients present relatively late in the course of*

*infection. For this reason, ophthalmoscopic screening is*

*recommended every 3 to 6 months in HIV-positive patients*

*with a CD4 count below 100. Direct ophthalmoscopy*

*provides only a small field of view and may be further*

*limited in the presence of media opacities, so complete*

*ophthalmic examination with indirect ophthalmoscopy is*

*advised.*

*46.2 Test Interpretation*

*The diagnosis of CMV retinitis is based primarily on the ophthalmoscopic*

*appearance. Both serologic testing and viral culture*

*are of limited value because a large proportion of*

*unaffected individuals show evidence of previous exposure to*

*CMV, and many HIV-positive patients are chronic carriers of*

*the virus in their throat, urine, and blood. A marker for CMV*

*viral load may become available shortly and would be of use in*

*following these patients. The use of anterior chamber paracentesis*

*for the detection of viral DNA has proven a useful means to*

*evaluate viral activity.*

*46.3 Diagnosis*

*CMV retinitis, OU, in a patient with AIDS.*

*46.4 Medical Management*

*The initial management of CMV is usually medical with either*

*intravenous ganciclovir or foscarnet. After 2 to 3 weeks of highdose*

*induction of ganciclovir (5 mg/kg once daily) or foscarnet*

*(60 mg/kg three times daily), patients who respond well to*

*treatment may be switched to lower-dose daily intravenous*

*therapy or oral therapy. Cidofovir (5 mg/kg) has been approved*

*by the FDA for treatment of CMV. Because of its long half-life, it*

*can be administered intravenously once per week for induction*

*and then every 2 weeks for maintenance. Patients with progression*

*despite induction or those with disease that imminently*

*threatens the macula may benefit from intravitreal injection of*

*ganciclovir (2,000 μg) or foscarnet (1.2mg). It is important to*

*note that intravitreal injection alone will not treat the systemic*

*CMV infection. Since ganciclovir has myelotoxic side effects and*

*foscarnet can result in renal toxicity, those patients who cannot*

*tolerate systemic administration of these drugs or who progress*

*despite it may benefit from intravitreal insertion of a ganciclovir*

*implant that delivers adequate concentrations of the drug*

*for 4 to 8 months.*

*46.5 Surgical Management*

*Ganciclovir implants offer a therapeutic alternative for patients*

*with unilateral disease, especially if complications with systemic*

*therapy are encountered.*

*Retinal detachment is a frequent complication of CMV retinitis,*

*between 40 and 50% within the first year. Some small*

*peripheral detachments may be contained by laser demarcation.*

*However, because most of the retinal detachments seen*

*are the result of multiple areas of necrosis and often extend to*

*the posterior pole, pars plana vitrectomy with silicone oil tamponade*

*is usually the procedure of choice. Often, a ganciclovir*

*implant is inserted at the time of the procedure. Overall,*

*approximately 90% of CMV-related retinal detachments achieve*

*anatomic success with this approach.*

*46.6 Rehabilitation and Follow-up*

*With improvements in the care of HIV-positive patients,*

*median survival after CMV infection has increased significantly.*

*Therefore, issues such as cataract formation and long-term visual*

*outcomes have become more important. Even after an initial*

*flare-up of CMV retinitis is controlled medically or surgically,*

*close follow-up with photographic documentation is essential.*

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~~~~~CASE 47 The White Dot Syndromes~~~~~

*47 The White Dot Syndromes*

*Tayyeba K. Ali, Blake A. Isernhagen, and Thomas Albini*

*Abstract*

*Several conditions may present with what appears to be white*

*spots due to inflammatory foci at the level of the choroid. While*

*there is some overlap with other causes of choroiditis, the white*

*dot syndromes are characteristically less fulminant, but in some*

*entities may result in severe levels of visual loss. Many of these*

*are known to be caused by infectious etiologies, but most are*

*only presumed to be due to viral infections. Most are self-limited,*

*with some resulting in little or no residual visual deficit*

*(e.g., acute retinal pigment epitheliitis, multiple evanescent*

*white dot syndrome, and acute posterior multifocal placoid pigment*

*epitheliopathy [APMPPE]). Diagnostic investigations*

*almost exclusively consist of imaging modalities—fluorescein*

*angiography and optical coherence tomography—as some entities*

*have characteristic features (e.g., leakage with serpiginous*

*choroiditis; early hypofluorescence followed by late staining in*

*APMPPE). Other entities might have associated vitritis (e.g.,*

*birdshot chorioretinopathy or multifocal choroiditis). Still*

*others might be secondarily compromised by choroidal neovascularization*

*(e.g., punctate inner choroidopathy).*

*Keywords: chorioretinopathy, panuveitis, epitheliopathy*

*47.1 History*

*A 26-year-old healthy Caucasian man had a 1-week history of*

*decreased vision and “blind spots” in both eyes. He reported*

*recent fevers and headaches 3 weeks prior to his ocular symptoms.*

*His best-corrected visual acuity was 20/30 in each eye.*

*Intraocular pressures were normal, and there was no afferent*

*pupillary defect. The anterior segment was normal, and there*

*was no anterior or vitreous cellular inflammation. The posterior*

*segment contained multiple, flat, deep, creamy, placoid lesions*

*in the posterior pole of both eyes (▶Fig. 47.1).*

*Fluorescein angiography (FA), indocyanine green angiography*

*(ICG), and optical coherence tomography (OCT) were performed.*

*The FA revealed multiple separate areas of early*

*hypofluorescence with late staining that corresponded to areas*

*of decreased fluorescence on ICG (▶Fig. 47.2 and ▶Fig. 47.3).*

*The OCT showed areas of increased reflectivity in the outer*

*retina, disruption of the outer segments, and retinal pigment*

*epithelium (RPE) abnormalities that corresponded to the*

*lesions on fundus examination (▶Fig. 47.4).*

*Differential Diagnosis-Key Points*

*1. Acute posterior multifocal placoid pigment epitheliopathy*

*(APMPPE).*

*2. Serpiginous choroiditis (SC).*

*3. Multiple evanescent white dot syndrome (MEWDS).*

*4. Birdshot chorioretinopathy (BSCR).*

*5. Multifocal choroiditis and panuveitis (MCP).*

*6. Punctate inner choroidopathy (PIC).*

*7. Acute retinal pigment epitheliitis (ARPE).*

*Anyone presenting with decreased vision, central scotoma,*

*photopsias, photophobia, or floaters should undergo a*

*thorough history and full eye examination, including a dilated*

*fundus exam.*

*47.2 Case Description (APMPPE)*

*Presenting ocular symptoms: decreased central vision, photopsias.*

*Systemic symptoms: viral prodrome, headaches.*

*Ocular signs: multiple, deep, creamy, placoid lesions. Lesions*

*are larger than in MEWDS and are at the level of the outer retina*

*and RPE.*

*Systemic signs: rarely may be associated with neurological*

*abnormalities, including CNS vasculitis.*

*47.3 Acute Posterior Multifocal*

*Placoid Pigment Epitheliopathy*

*47.3.1 Epidemiology*

*APMPPE typically occurs in younger patients between the ages*

*of 20 and 30 years but has also been reported in older patients*

*up to the seventh decade of life. It is equally prevalent in men*

*and women and is more common in Caucasian patients.*

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*Fig. 47.1 Fundus photograph of numerous deep cream-colored*

*placoid lesions in the posterior pole.*

*Fig. 47.2 Fluorescein angiogram with early hypofluorescence (blockage) of the lesions on the left and late staining of the same lesions on the right.*

*Fig. 47.3 Indocyanine green angiography of the same eye in*

*▶Fig. 47.2 that shows decreased fluorescence of the same lesions.*

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*47.3.2 History*

*Patients with APMPPE are typically healthy and present with*

*complaints of sudden painless vision loss in one or both eyes. A*

*preceding viral illness has been associated with the development*

*of APMPPE, and many patients will report recent fevers,*

*headache, and/or other symptoms indicating a recent upper*

*respiratory infection. It is important to obtain a thorough history*

*and review of systems on all patients. There are reported*

*cases of concurrent cerebral vasculitis in some patients, and*

*neuroimaging with appropriate referral may be indicated.*

*47.3.3 Clinical Findings*

*APMPPE is most commonly bilateral, but it can present unilaterally*

*or asymmetrically. There is minimal anterior and vitreous*

*cellular inflammation on clinical exam. The primary clinical*

*findings include bilateral multiple deep, creamy-yellow lesions*

*involving the RPE. Many times, these lesions are discrete and*

*small to medium in size, but the lesions may also become large*

*and confluent in more severe cases. As the acute lesions heal,*

*they become depigmented with RPE migration and pigment*

*clumping. Mild retinal vasculitis and optic nerve edema may*

*also be seen on clinical exam during the acute phase.*

*47.3.4 Imaging*

*FA and ICG have characteristic findings that assist in making*

*the diagnosis of APMPPE. The FA reveals early hypofluorescent*

*patches representing blocking of the choroidal circulation from*

*swollen RPE cells, followed by late staining of these same*

*lesions due to the diffusion of dye from the choroid through the*

*damaged RPE cells. The ICG reveals hypofluorescent choroidal*

*lesions throughout the angiogram that correspond to the*

*lesions seen clinically. There are frequently more lesions visible*

*on FA/ICG than on clinical fundus examination.*

*OCT is another useful imaging tool to assist in the diagnosis*

*of APMPPE. The OCT will show disruption of the outer segments*

*with abnormal underlying RPE, and the outer nuclear layer is*

*frequently hyperreflective in areas that correspond to the*

*lesions on clinical exam and FA/ICG. Intraretinal fluid and subretinal*

*fluid have also been reported in some cases of APMPPE.*

*As the lesions heal, there is improvement in the anatomic structure*

*of the outer segments and RPE but permanent changes*

*usually persist.*

*47.3.5 Treatment and Prognosis*

*APMPPE is a self-limited disease that resolves without treatment*

*over the course of several weeks to months and has a very*

*good prognosis. Approximately 80% of patients will have a final*

*visual acuity of 20/40 or better. Despite the observation that*

*APMPPE is a self-limited condition, oral corticosteroids are frequently*

*used and are recommended when the lesions involve*

*the central macula or if there is concomitant cerebral vasculitis.*

*Recurrences are uncommon but APMPPE can overlap with SC*

*and become a chronic inflammatory disease. This clinical condition*

*is now referred to as relentless placoid chorioretinitis and*

*is treated similarly to SC.*

*47.4 Serpiginous Choroiditis*

*47.4.1 Epidemiology*

*SC is a rare condition that typically occurs in patients between the*

*ages of 30 and 60 years with an equal predilection for males and*

*females. SC tends to occur in Caucasians and patients from India.*

*47.4.2 History*

*Patients frequently present with complaints of unilateral painless*

*decreased vision with central or paracentral visual field*

*defects. Unlike APMPPE, it is uncommon for the patient to have*

*had a recent viral illness. It is important to ask all patients about*

*exposure to tuberculosis and to obtain a complete review of*

*past medical problems and review of systems. Tuberculosis has*

*been implicated as the cause of uveitis in some patients whose*

*clinical presentation resembles SC.*

*47.4.3 Clinical Findings*

*Similar to APMPPE, there is rarely significant anterior chamber*

*cell or vitritis. The primary clinical findings involve the posterior*

*pole where confluent, deep, flat, creamy-colored lesions*

*are seen. Classically, these lesions extend from the peripapillary*

*region and spread centrifugally. The disease frequently*

*becomes bilateral but is commonly asymmetric. As these*

*lesions heal, they become atrophic and there is RPE migration*

*with pigment clumping. SC is a chronic condition and new*

*lesions typically occur at the edges of old healed lesions. Sometimes*

*skip lesions develop, which represent new foci of inflammation.*

*Many times, lesions at different stages are seen in*

*patients who present with SC.*

*Fig. 47.4 OCT of a single lesion that reveals*

*increased reflectivity in the outer retina,*

*disruption of the outer segments, and RPE*

*abnormalities.*

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*47.4.4 Imaging*

*SC is a chronic condition and it is important to document the*

*location and size of lesions with detailed colored drawings and/*

*or fundus photography. During the acute stage of disease, the*

*FA closely resembles the pattern seen in APMPPE with early*

*blocking followed by late staining of the active lesions. However,*

*unlike APMPPE, there is frequently leakage around the*

*active lesions in the midphase of the angiogram prior to staining*

*of the previously hypofluorescent lesions.*

*ICG is also useful in diagnosing and following patients with*

*SC. Active lesions can be either hyperfluorescent or hypofluorescent*

*on ICG and usually have indistinct borders. All inactive*

*lesions will be hypofluorescent with well-demarcated margins.*

*Another noninvasive and sensitive method to help diagnose*

*and follow patients with SC is fundus autofluorescence (FAF).*

*Areas of active disease will appear hyperfluorescent. In patients*

*with previous episodes of SC, the areas of hyperfluorescence*

*are usually at the edge of old hypofluorescent scars. The*

*increased fluorescence of the active lesions is from the accumulation*

*of fluorescent material due to inflamed and damaged*

*RPE cells secondary to the underlying choroiditis. The areas of*

*healed scars are hypofluorescent due to the severe damage of*

*the RPE following the active phase of the disease.*

*OCT findings are similar to APMPPE in active lesions but inactive*

*scarred lesions will show significant atrophy of the outer*

*retina and RPE. OCT can help identify and follow choroidal neovascular*

*membranes (CNVMs) that develop in areas of old chorioretinal*

*scars.*

*47.4.5 Treatment and Prognosis*

*SC is a chronic condition that requires long-term treatment*

*with periocular steroids and/or immunosuppression. Prior*

*to initiating treatment, it is important to obtain laboratory*

*evaluation to rule out infectious etiologies such as tuberculosis*

*and syphilis. Tuberculosis has been implicated as the underlying*

*etiology in some patients with choroiditis that resembles SC*

*and antituberculosis therapy is indicated for initial treatment in*

*these patients.*

*47.5 Multiple Evanescent White*

*Dot Syndrome*

*47.5.1 Epidemiology and History*

*Patients who present with MEWDS are typically young, myopic*

*females who are otherwise healthy.*

*Patients characteristically report an acute sudden decrease in*

*vision in one eye. They may also have photopsias and/or a paracentral*

*blind spot(s). They may or may not report symptoms of*

*a preceding viral infection.*

*47.5.2 Clinical Findings*

*Findings in MEWDS are usually unilateral with mild vitritis, but*

*without anterior chamber cellular inflammation. The principal*

*findings on fundus examination are small, discrete, deep, white*

*lesions in the posterior pole that can also involve the midperiphery*

*with a granular appearance in the macula manifested by*

*small white and orange specks (▶Fig. 47.5). Optic nerve edema*

*and mild retinal vasculitis may also be observed.*

*47.5.3 Imaging*

*The FA shows early hyperfluorescence with late staining of the*

*lesions and hyperfluorescence of the optic nerve (▶Fig. 47.6).*

*ICG shows hypofluorescence of the corresponding lesions seen*

*clinically, but there is usually more involvement on ICG than is*

*seen on clinical examination and on FA.*

*Fig. 47.5 Fundus photograph of a patient with MEWDS that*

*demonstrates the granular appearance of the macula with small white*

*and orange specks.*

*Fig. 47.6 Fluorescein angiography with hyperfluorescence of the*

*lesions seen clinically in ▶Fig. 47.5.*

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*FAF can be used to help determine the extent of RPE involvement.*

*In the acute phase of disease, the involved areas are*

*hyperfluorescent (▶Fig. 47.7). However, unlike other more*

*severe chorioretinopathies, there is usually minimal permanent*

*damage to the RPE. Follow-up studies frequently return to normal*

*fluorescence or faint hypofluorescence in the previously*

*involved areas.*

*On OCT, changes to the outer retina are seen with disruption*

*of the outer segments (▶Fig. 47.8). Following the acute phase,*

*there may be a return to a more normal anatomical configuration*

*consistent with resolution of the patient’s visual*

*symptoms.*

*47.5.4 Treatment and Prognosis*

*Patients with MEWDS usually do not require laboratory evaluation*

*or treatment. The visual prognosis is good and most*

*patients will have significant improvement in vision to 20/30 or*

*better within 4 to 8 weeks. Recurrences are uncommon, but if*

*these become frequent, immunosuppression may be used to*

*help control the disease course.*

*47.6 Birdshot Chorioretinopathy*

*47.6.1 Epidemiology*

*BSCR, also known as vitiliginous chorioretinopathy, most commonly*

*occurs among middle-aged Northern European women.*

*However, it can occur in any Caucasian group, and patients’ age*

*ranges from 15 to 79 years.*

*47.6.2 History*

*This posterior uveitis is characterized by vitritis, retinal vasculitis,*

*and multiple, bilateral, hypopigmented chorioretinal lesions*

*emanating from the optic nerve in a radial pattern. Patients*

*typically have no systemic findings, though some studies suggest*

*a higher prevalence of cardiovascular disease. There is a*

*strong association with HLA-A29, which can sometimes help*

*confirm the diagnosis. The disease course is chronic, most often*

*requiring immunomodulatory therapy (IMT).*

*47.6.3 Clinical Findings*

*BSCR is a bilateral disease, characterized by a quiet, nonpainful*

*eye, minimal anterior cell, vitritis without pars plana exudation,*

*retinal vasculitis (frequently with cystoid macular edema [CME]*

*and optic nerve swelling), and distinct, deep cream-colored*

*spots scattered throughout the fundus (▶Fig. 47.9). Patients’*

*visual complaints may be greatly out of proportion to the exam*

*findings, which may be elucidated via electroretinogram (ERG)*

*testing. The most common complication associated with BSCR*

*is CME, followed by epiretinal membrane (ERM) formation,*

*CNVM, and even retinal detachment.*

*47.6.4 Imaging*

*FA findings vary based on disease stage and activity. While,*

*early in the course of the disease, FA may not correspond with*

*the creamy lesions seen on fundus exam, typically one will see*

*early hypofluorescence with late staining. The FA is most useful*

*in determining the extent of the CME and other vascular leakage*

*and also in following the clinical course of the disease. ICG*

*depicts well-demarcated hypofluorescent choroidal lesions,*

*often more numerous than seen clinically (▶Fig. 47.10).*

*OCT shows inner segment/outer segment (IS/OS) disruption*

*as well as RPE loss. ERG will typically show a preserved a-wave,*

*with a reduced b-wave. Visual field testing may show generalized*

*constriction, paracentral or central scotoma, or an enlarged*

*blind spot. Goldmann visual field is thought to be more sensitive*

*than Humphrey visual field testing.*

*Fig. 47.7 Fundus autofluorescence with extensive areas of*

*hyperautofluorescence that indicates more involvement of the RPE*

*than is appreciated on clinical exam and FA.*

*Fig. 47.8 OCT of the same patient reveals an*

*abnormal outer retina, disruption of the outer*

*segments, and an irregular RPE.*

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*47.6.5 Treatment and Prognosis*

*Global retinal dysfunction ensues if these patients are not*

*aggressively treated. While periocular and oral corticosteroids*

*have been used to suppress disease activity, many patients will*

*have progressive visual deterioration secondary to either recurrence*

*or sequelae, such as CME. Thus, due to the waxing and*

*waning nature of most BSCR, IMT is recommended in order to*

*preserve maximum retinal function and vision. Monotherapy*

*with cyclosporine or in conjunction with either low-dose steroids*

*or an additional IMT agent is recommended. If multiple*

*agents are to be used, cyclosporine (CSA) can be used at a lower*

*dose (2.5–5 mg/kg/day) and mycophenolate, azathioprine, or*

*low-dose steroids can be added. This decreases the cardiovascular*

*side effects associated with CSA, oftentimes avoiding the*

*need to stop the medication or add on an antihypertensive*

*medication.*

*If left untreated, 80 to 90% of birdshot patients will end up*

*with unilateral or bilateral severe vision loss with decrease in*

*central and peripheral vision. Disease progression and control*

*can be monitored with yearly FA/ICG and OCT imaging. Initial,*

*aggressive treatment with multiple IMT agents for 2 years may*

*put the disease into remission and help preserve good vision in*

*these otherwise healthy individuals.*

*47.7 Multifocal Choroiditis and*

*Panuveitis*

*47.7.1 Epidemiology and History*

*MCP most commonly occurs in young, myopic women,*

*although it has been reported in the 6- to 69-year-old range, in*

*hyperopes, and in men. The white dot syndrome is described as*

*having histoplasmosislike lesions with vitritis and anterior segment*

*inflammation. Most patients will have bilateral, though*

*asymmetric, disease. The course is recurrent and chronic. This*

*chronicity may lead to CME, ERM, and CNVM, which is the leading*

*cause of vision loss in these patients.*

*47.7.2 Clinical Findings*

*MCP is characterized by decreased or blurred vision, with less*

*frequent complaints of photopsias and floaters. Visual acuity*

*averages 20/50, but has been reported as poor as light perception.*

*Mild to moderate anterior uveitis is present with nongranulomatous*

*keratic precipitates, posterior synechiae, and cell.*

*On dilated fundus examination, one will see oval, yellow-gray*

*lesions at the level of the RPE in the posterior pole and midperiphery.*

*These lesions will develop into round, punched-out chorioretinal*

*scars. Findings may be associated with optic disc*

*edema or peripapillary atrophy. On perimetry, there may be an*

*enlarged blind spot, and typically, a depressed ERG is noted.*

*47.7.3 Imaging*

*MCP is a clinical diagnosis based on fundus findings and presence*

*of vitritis and anterior segment inflammation. FA usually*

*shows early hypofluorescence and late staining. Inactive scars*

*will have window defects. One may also see angiographic leakage*

*or a CNVM on FA. Acute disease will show hypofluorescent*

*choroidal lesions on ICG that resolve with treatment. OCT will*

*show IS/OS disruption and RPE involvement.*

*Autofluorescence provides an additional tool that may help*

*differentiate acute versus chronic, as well as subclinical, disease.*

*Larger areas of hypoautofluorescence often coincide with*

*lesions seen on clinical exam, while smaller areas may be preor*

*subclinical disease.*

*47.7.4 Treatment and Prognosis*

*Visual prognosis is guarded in patients who do not receive adequate*

*and aggressive therapy, as the disease is chronic and*

*recurrent in nature. Visual loss is greatly due to development of*

*Fig. 47.10 Indocyanine green angiography with numerous small*

*hypofluorescent spots throughout the fundus corresponding to areas*

*of choroidal inflammation.*

*Fig. 47.9 Fundus photograph of a patient with BSCR that shows*

*numerous distinct hypopigmented creamy lesions that are more*

*prominent in the nasal fundus.*

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*CNVM, but also can be secondary to CME, ERM, RPE atrophy and*

*scarring, optic neuropathy, or neovascular glaucoma. Vision can*

*be preserved with periocular and systemic steroids in conjunction*

*with early initiation of immunosuppression. CNVM can be*

*treated with laser photocoagulation, intravitreal steroids, or even*

*anti-vascular endothelial growth factor (anti-VEGF) therapy.*

*47.8 Punctate Inner*

*Choroidopathy*

*47.8.1 Epidemiology and History*

*PIC is a rare disease affecting young, myopic women in their*

*30 s. These patients present with blurred vision and a scotoma.*

*It is rare to see inflammation, and a fundus examination will*

*show yellow lesions in the posterior pole. It is a self-limiting*

*disease with a good visual outcome, though CNVM can occur*

*and lead to visual decline.*

*47.8.2 Clinical Findings*

*PIC is diagnosed when there are multiple small deep, yellow*

*lesions in the outer retina and inner choroid confined to the posterior*

*pole (▶Fig. 47.11). They may resemble POHS (presumed*

*ocular histoplasmosis syndrome) spots, but these patients are*

*not typically from endemic areas or have prior exposure to histoplasmosis.*

*Also, an inflammatory reaction is absent. Development*

*of CNVM is the leading cause of vision loss.*

*47.8.3 Imaging*

*This is primarily a clinical diagnosis; however, fundus imaging*

*can have a classic appearance. On FA, one would see early*

*hyperfluorescence with arteriovenous staining. Serous detachments*

*and CNVMs may be present and can be visualized on FA.*

*ICG typically shows hypofluorescent areas, which may correlate*

*with choroidal hypoperfusion.*

*OCT will show IS/OS disruption as well as RPE elevation with*

*a collection of sub-RPE deposits. These areas may correlate with*

*localized fibrotic lesions during the active phase of the disease.*

*47.8.4 Treatment and Prognosis*

*Patients typically do well and do not often require treatment,*

*with vision that is 20/40 or better. However, if there is a CNVM*

*present or lesions are close to the fovea, treatment with systemic*

*or local steroids is indicated. Anti-VEGF injections have*

*also been shown to be effective for treatment of CNVMs related*

*to PIC. Patients requiring multiple courses of systemic steroids*

*may benefit from steroid-sparing immunosuppression, which*

*has been shown to be effective in a small group of patients.*

*47.9 Acute Retinal Pigment*

*Epitheliitis*

*47.9.1 Epidemiology*

*ARPE usually occurs in healthy patients during the second to*

*fourth decade of life and is more common in men. The condition*

*is rare and likely underreported due to the transient nature*

*and mild symptoms. The etiology is hypothesized to be viral,*

*but no studies have validated this theory.*

*47.9.2 History*

*Patients present with acute unilateral or bilateral decreased*

*vision. They may also report a central scotoma or metamorphopsia*

*that can be elucidated on Amsler grid testing. Unlike*

*other conditions, such as APMPPE, patients do not endorse a*

*recent viral illness.*

*47.9.3 Clinical Findings*

*Visual acuity may range from 20/20 to 20/100 in the affected*

*eye(s) and there is absence of anterior and vitreous cellular*

*inflammation. The primary area of ocular involvement is the*

*RPE, and during the acute phase of inflammation, there are*

*multiple, deep, small, dark spots surrounded by a yellow halo in*

*the posterior pole. As the lesions heal, the halo disappears and*

*there may be pigment migration around the lesions.*

*47.9.4 Imaging*

*FA will typically show early hyperfluorescent spot(s) with a*

*hypofluorescent center that corresponds to the lesions seen*

*clinically. During the later phases of the angiogram, there is*

*increased fluorescence of the lesions that is more consistent*

*with a window defect than staining or leakage. Sometimes, the*

*FA will be normal and fail to reveal any lesions.*

*OCT reveals disruption of the outer and inner photoreceptor*

*segments with an irregular RPE. As the lesion(s) heal, there is*

*improvement in the anatomic structures.*

*47.9.5 Treatment and Prognosis*

*The visual prognosis is good in ARPE, and no treatment is routinely*

*indicated. Most patients will have a return of vision to*

*20/30 or better within 3 months. There have been no significant*

*ocular complications secondary to ARPE, and if the disease*

*recurs or complications arise, an alternative diagnosis should be*

*suspected.*

*Fig. 47.11 Fundus photograph of a patient with PIC who has old*

*chorioretinal scars in the inferior macula and small white lesions*

*centrally representing new foci of active chorioretinal inflammation.*

~~~~~CASE 48 Vascular Tumor~~~~~

*48 Vascular Tumor*

*Eric D. Hansen and William E. Smiddy*

*Abstract*

*Vascular tumors are characteristic of a broad range of ocular*

*conditions, ranging from hemangiomas associated with phacomatoses*

*to idiopathic conditions. Distinguishing their clinical*

*appearance as a predominantly exudative form or endophytic*

*or vitreoretinal form may help identify the correct diagnosis.*

*Similarly, identifying the vasoproliferation as arising from the*

*retinal or choroidal vasculature allows distinction. In the case of*

*phacomatoses, numerous clinical features may assist in diagnoses,*

*such as systemic clinical associations or family history*

*patterns. Important differential diagnostic entities include*

*neoplasms with prominent vascular components. Careful biomicroscopy*

*in conjunction with fluorescein angiography or echographic*

*evaluation is important not only to distinguish the*

*various benign proliferative entities, but also to exclude the diagnosis*

*of malignancies with prominent vascular components.*

*Keywords: intraocular tumor, retinal proliferation, hemangioma,*

*phacomatosis, ocular neoplasm*

*48.1 History*

*A 20-year-old man presents for evaluation of a peripheral retinal*

*lesion in the left eye found on routine ophthalmic examination.*

*The patient is asymptomatic and has no other past ocular*

*history. He has no known systemic medical problems. A family*

*history screening discloses his father and two siblings carry a*

*diagnosis of von Hippel–Lindau disease. Visual acuity is 20/20*

*bilaterally. External examination is unremarkable. There is no*

*afferent pupillary defect. Visual field and motility examinations*

*are unremarkable. Slit-lamp examination is normal. The left*

*fundus contains several dilated, tortuous arterioles and venules*

*emanating from the optic disc and traveling nasally*

*(▶Fig. 48.1). These vessels lead to a collection of reddish-pink*

*nodules surrounding a large reddish-orange lesion emanating*

*from the surface of the retina. There is a small associated area*

*of subretinal fluid with adjacent exudate (▶Fig. 48.2). Funduscopic*

*examination of the right eye is normal.*

*Differential Diagnosis—Key Points*

*● Cavernous hemangioma.*

*● Racemose hemangioma.*

*● Retinal macroaneurysm.*

*● Coats’ disease.*

*● Retinal granuloma.*

*● Familial exudative vitreoretinopathy (FEVR).*

*● Retinoblastoma.*

*● Astrocytic hamartoma.*

*● Uveal melanoma.*

*● Vasoproliferative tumor.*

*1. With the family history of von Hippel–Lindau disease and*

*the classic appearance of the lesions, the diagnosis of retinal*

*angiomatosis is readily made in this patient. Benign retinal*

*hemangiomas were first described by von Hippel in 1904*

*and are sometimes referred to as von Hippel tumors. The*

*appearance of retinal angiomas may vary greatly, and they*

*are generally described according to their location, their*

*size, and their pattern of growth. Peripheral retinal angiomas*

*are associated with a dilated, tortuous feeding arteriole and*

*draining venule, whereas juxtapapillary or peripapillary*

*angiomas often do not feature the accompanying vessels.*

*These associated vessels may present as twin vessels,*

*separated by no more than a venule width. The*

*presentation also varies greatly with size. Early lesions may*

*be so small that they are clinically imperceptible except with*

*imaging modalities. As the angiomas grow, they may be*

*first noted as small yellow or red nodules with dilated*

*vessels, and later as the typical reddish-orange mass with*

*dilated feeding vessels. Angiomas arising from the inner*

*retina have an endophytic appearance, while those arising*

*from the outer retina result in an exophytic appearance. A*

*sessile morphology is also described in the literature.*

*2. Retinal angiomas tend to manifest clinically in one of two*

*forms. The exudative form is characterized by progressive*

*vascular leakage from the angioma, resulting in*

*accumulation of subretinal fluid and exudate. Loss of vision*

*in these cases may result from exudative retinal*

*detachments or from accumulation of exudative material in*

*the central macula from a peripheral angioma. The*

*endophytic, or vitreoretinal, form is characterized by*

*reactive fibrosis of the overlying vitreous and gliosis, leading*

*to epiretinal membranes and retinal traction. Vision loss*

*occurs secondary to tractional or combined tractional–*

*rhegmatogenous retinal detachments, or secondary to the*

*distortion caused by epiretinal membranes. Interestingly,*

*epiretinal membranes formation may occur centrally even in*

*peripheral angiomas.*

*3. In the current case, the family history and the classic*

*funduscopic appearance of the retinal lesions quickly*

*narrow the differential diagnosis; however, other entities*

*may mimic retinal angiomas. Cavernous hemangiomas*

*present as a cluster of dilated vessels centered around a*

*retinal vein, but these typically lack dilated feeder vessels*

*and tend not to cause retinal exudation. Racemose*

*hemangiomas also present with dilated tortuous arterioles*

*and venules. Distinguishing features in this entity include*

*the lack of a terminal lesion and the absence of exudation.*

*Retinoblastoma and astrocytic hamartoma arise from the*

*retina, but these lesions are typically yellowish-white as*

*opposed to the reddish-orange appearance of an angioma,*

*and vary in demographics and timing of presentation. An*

*arteriolar macroaneurysm may simulate an early angioma;*

*however, the patient’s age and the lack of associated*

*hypertensive changes of the retinal vasculature should help*

*differentiate between the two entities. Retinal angiomas*

*present in the second to third decade of life. A retinal*

*granuloma, particularly papillary lesions due to a nematode,*

*foreign body, or inflammatory disease, may be*

*Tumors*

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*indistinguishable from a juxtapapillary angioma. Associated*

*findings and ancillary tests should assist in determining the*

*correct diagnosis. In cases with exudative retinal*

*detachment, consideration should be given to*

*retinoblastoma, Coats’ disease, and FEVR. Uveal*

*melanomas, although commonly different in appearance*

*and presentation, can mimic retinal angiomas and should*

*always be considered with large endophytic lesions.*

*Papillary or peripapillary angiomas can be particularly*

*perplexing to the clinician and require careful attention as*

*these can present similar to a wide variety of retinal lesions.*

*4. Distinguishing between von Hippel lesions and*

*vasoproliferative retinal tumors, or acquired capillary*

*hemangiomas, can also present unique challenges, as the*

*appearance of these masses can be quite similar. However,*

*the vasoproliferative tumor does not exhibit the dilated*

*feeder vessels associated with retinal angiomas. In addition,*

*vasoproliferative tumors often occur in the setting of an*

*existing retinal disease and have preponderance for the*

*inferior quadrants and the extreme periphery. Retinal*

*angiomas, conversely, are commonly found in the*

*midperiphery of the temporal quadrants.*

*5. Multiple angiomas, whether unilateral or bilateral, suggests*

*the presence of von Hippel–Lindau disease. A careful family*

*history and review of systems looking for features*

*consistent with von Hippel–Lindau disease should be taken*

*in all patients with retinal angiomas.*

*6. Unlike peripheral retinal hemangiomas, peripapillary and*

*capillary hemangiomas are generally not associated with*

*von Hippel–Lindau syndrome.*

*48.2 Test Interpretation*

*The diagnosis of a retinal angioma is usually made clinically.*

*Slit-lamp biomicroscopy may provide a diagnostic view of*

*posterior lesions, while indirect ophthalmoscopy provides the*

*optimal view of more peripheral lesions. However, ancillary*

*tests can assist in making the diagnosis in difficult cases.*

*Fluorescein angiography is helpful in differentiating some*

*angiomas, particularly exophytic masses. Angiography typically*

*reveals the dilated retinal arteriole in the early arterial phase*

*followed by hyperfluorescence of the tumor itself due to filling*

*of the individual capillaries. The venous phase generally reveals*

*the prominently dilated venule as well as continued hyperfluorescence*

*of the angioma (▶Fig. 48.3). Late-phase angiography*

*will exhibit continued hyperfluorescence of the angioma as*

*well as possible leakage of fluorescein.*

*Although less common in practice, fluorescein angioscopy*

*may assist detecting early angiomas. Early lesions may be very*

*small or subtle due to the reddish coloration of the lesion,*

*which blends into the underlying retinal pigment epithelium*

*and choroid on indirect ophthalmoscopy. Use of angioscopy*

*by performing indirect ophthalmoscopy with the use of an*

*Fig. 48.1 Examination of the posterior pole of the left eye*

*demonstrates the multiple tortuous, dilated vessels arising from the*

*optic disc and radiating toward the nasal periphery. Note that the*

*affected vessels include arterioles and venules.*

*Fig. 48.2 Peripheral examination revealed a collection of reddishorange*

*tumors. Each had an associated dilated feeding arteriole and*

*draining venule. There also was a small associated area of adjacent*

*subretinal fluid and exudate.*

*Fig. 48.3 Laminar venous phase fluorescein angiogram reveals filling of*

*dilated arterioles and hyperfluorescence of the angiomas. Laminar*

*filling of the venules is also seen.*

*Vascular Tumor*

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*excitation light during fluorescein injection can assist in locating*

*very small angiomas.*

*Ultrasound examination identifies and quantitates some retinal*

*angiomas, especially if larger than 2mm. B-scan ultrasonography*

*typically yields a high-density echo at the inner border of*

*the mass with a uniform acoustic signal throughout the mass.*

*Associated retinal detachment and subretinal fluid may be*

*demonstrated; however, no choroidal component will be noted.*

*A-scan ultrasonography demonstrates a high spike at the internal*

*border of lesion and a high internal reflectivity.*

*Computed tomography (CT) and magnetic resonance imaging*

*(MRI) will generally characterize only larger tumors and those*

*with exudative retinal detachments. CT may demonstrate an*

*enhancing intraocular mass. MRI will have a low signal intensity*

*from a retinal angioma. This results in an isointense to*

*hyperintense signal on Tl-weighted images and an isointense to*

*hypointense signal on T2-weighted images with respect to the*

*vitreous. The lesion will demonstrate moderate enhancement*

*with gadolinium administration. Unfortunately, the MRI*

*appearance is not diagnostic, as ocular melanomas and retinoblastomas*

*may have similar characteristics. These imaging*

*modalities remain important, however, as patients should*

*undergo neuroimaging to exclude central nervous system (CNS)*

*findings of von Hippel disease.*

*48.3 Diagnosis*

*1. Multiple retinal angiomas OS.*

*2. von Hippel–Lindau disease.*

*48.4 Surgical Management*

*The management of retinal angiomas first hinges on the decision*

*whether to treat or continue observation. The treatment of*

*asymptomatic angiomas is controversial; however, lesions causing*

*vision loss or impending vision loss should generally be*

*treated. Large observational studies have demonstrated that*

*angiomas can exhibit stability, regress, or progressively enlarge*

*and result in visual impairment. While smaller lesions (less*

*than 2.5 disc diameters) are more easily treated and present*

*less risk of complications, these smaller lesions are also more*

*likely to remain stable or spontaneously regress.*

*Treatment modalities vary depending primarily on the size*

*and location of the lesion. The management mainstays of retinal*

*angiomas include observation, laser photocoagulation, and cryotherapy.*

*More recent treatment options include antiangiogenic*

*medications and transpupillary thermotherapy. Laser can*

*be particularly effective against smaller lesions, but has shown*

*effect in lesions up to 4.5mm in size. Treatment of the feeder*

*vessel or direct treatment of the lesion has shown similar success.*

*Some advocate a stepwise approach, initiating feeder vessel*

*treatment to induce closure of the vessels followed by direct*

*treatment of the angioma. Larger and more peripheral tumors*

*can be successfully treated with double or triple freeze-thaw*

*cryotherapy. Plaque radiotherapy using apex dose of 1,000 to*

*5,000 cGy may be used with large angiomas. External beam*

*radiotherapy is employed in the setting of an angioma associated*

*with abundant subretinal fluid and exudate. Surgical management*

*with pars plana vitrectomy may relieve vitreoretinal*

*traction, remove epiretinal membranes, and treat the angiomas*

*directly, although such surgeries are often technically difficult*

*and fraught with complications such as hemorrhage and*

*recurrence.*

*Novel therapeutic options consisting of systemic or intravitreal*

*antiangiogenic medicines targeting Vascular endothelial growth*

*factor or platelet-derived growth factor have been investigated,*

*although the early results of these studies are inconclusive.*

*Angiogenesis, directed by such molecules, is thought to play an*

*important role in the pathophysiology of retinal angiomas.*

*The response to treatment may take numerous treatments*

*and several months; in some cases, a paradoxical response with*

*increasing subretinal fluid, exudate, and vitreoretinal traction*

*occurs. These untoward responses tend to occur in larger lesions*

*and contribute to the rationale for treatment of early lesions.*

*Importantly, epiretinal membranes may resolve spontaneously*

*after treatment of the angioma; therefore, surgeons should wait*

*4 to 6 months before considering surgical correction.*

*48.5 Rehabilitation and Follow-up*

*Von Hippel–Lindau disease should be considered in any patient*

*with retinal angiomatosis. Von Hippel–Lindau is an autosomal*

*dominant condition affecting organ systems throughout the*

*entire body (▶Table 48.1). It one of the recognized phakomatoses*

*with an incidence estimated to be 1 in 35,000 to 1 in*

*40,000. The von Hippel–Lindau gene is located on chromosome*

*3p25–26, coding for a tumor-suppressor protein. The disease*

*requires a “two-hit” mechanism similar to retinoblastomas, and*

*mutations causing von Hippel–Lindau disease can occur via*

*deletion, truncating mutations, or missense mutation. Classically,*

*the diagnosis is made in patients exhibiting two or more*

*findings consistent with von Hippel–Lindau disease if there is*

*no family history or in patients with one finding and an affected*

*first-degree relative. Genetic testing is also available to assist in*

*early diagnosis.*

*Retinal angiomas develop in a majority (49–85%) of patients*

*with von Hippel–Lindau disease. They tend to be the initial*

*findings of the disease, usually in the patient’s early- to mid-*

*20 s. However, retinal examinations should begin early in childhood,*

*as angiomas have been described in children younger*

*than 10 years. Because of the high risk of developing angiomas,*

*these patients deserve periodic ophthalmic examination with*

*Table 48.1 Clinical manifestations of von Hippel–Lindau disease*

*Eye Retinal angiomas*

*Central nervous system Cerebellar hemangioblastoma*

*Medullary hemangioblastoma*

*Spinal cord hemangioblastoma*

*Syringobulbia*

*Syringomyelia*

*Renal Renal cell carcinoma*

*Hemangioblastoma cysts*

*Adrenal glands and sympathetic*

*chain*

*Pheochromocytoma*

*paraganglioma*

*Pancreas Hemangioblastoma cysts*

*Epididymis cysts*

*Tumors*

*160*

*indirect ophthalmoscopy. Annual to biannual examination for*

*affected individuals and first-degree relatives is recommended.*

*The systemic features of this disease are potentially debilitating*

*or fatal; therefore, patients and first-degree relatives must*

*undergo periodic systemic screenings. Systemic screenings*

*include imaging of the CNS and the thoracic and abdominal*

*cavities. In addition, 24-hour urine collection analysis for pheochromocytoma*

*is warranted. As retinal angiomas are often the*

*presenting feature of this disease, the ophthalmologist must*

*work in concert with other specialists to ensure that patients*

*with or at risk for von Hippel–Lindau disease receive the appropriate*

*initial workup and subsequent follow-up.*

~~~~~CASE 49 Choroidal Melanoma~~~~~

*49 Choroidal Melanoma*

*Basil K. Williams, Jr.*

*Abstract*

*Choroidal melanoma is the most common primary intraocular*

*tumor in adults. These lesions are frequently pigmented, but a*

*small percentage may be primarily amelanotic. There is a broad*

*differential diagnosis for pigmented lesions of the choroid, but*

*ancillary imaging studies can assist in making the diagnosis.*

*Characteristic findings include low to medium internal reflectivity*

*on A-scan ultrasonography and a dome- or mushroomshaped*

*lesion with intrinsic vascularity on B-scan ultrasonography.*

*Fundus autofluorescence may demonstrate hyperautofluorescence*

*representing orange-pigmented lipofuscin, and*

*optical coherence tomography may identify subretinal fluid.*

*Prognostic information may be attained by anatomic staging,*

*pathologic assessment, or gene expression profiling. The most*

*common forms of treatment are radiation, often with plaque*

*brachytherapy, and enucleation for large melanomas. Periodic follow-*

*up examination is required to determine response to treatment,*

*identify recurrence, and assess for complications. These*

*patients also require long-term systemic evaluation to monitor*

*for metastasis, which most commonly occurs in the liver.*

*Keywords: choroid, eye, melanoma, pseudomelanoma, tumor,*

*uvea*

*49.1 History*

*A 55-year-old Caucasian man presented with a 2-week history*

*of photopsias and blurred central vision in the right eye for the*

*previous 3 days. Past medical history was notable for hypertension,*

*hypercholesterolemia, and skin cancer. Past ocular history*

*was remarkable for macular degeneration.*

*Examination disclosed a visual acuity of 20/60 in the right*

*eye and 20/20 in the left eye. Intraocular pressures were 15mm*

*Hg in both eyes. There was a 1 + right afferent pupillary defect.*

*Slit-lamp examination was notable for mild nuclear sclerotic*

*alterations in both eyes. Dilated funduscopic examination of the*

*right eye revealed a dome-shaped moderately pigmented inferotemporal*

*mass with an exudative retinal detachment located*

*anterior to the mass (▶Fig. 49.1). Examination of the left eye*

*was unremarkable. The lesion had a thickness of 4.5mm and*

*base of 11.9 Å~ 10.1mm confirmed by echography. B-scan ultrasonography*

*demonstrated a dome-shaped lesion with an exudative*

*retinal detachment and choroidal excavation*

*(▶Fig. 49.2a, b). There was no evidence of extrascleral extension.*

*A-scan ultrasonography revealed low internal reflectivity*

*and a regular internal structure. Fluorescein angiography of the*

*right eye demonstrated a lesion with intrinsic vascularity and*

*progressive late leakage. The patient underwent a medical*

*workup to rule out the presence of metastasis, including liver*

*function tests and a chest X-ray that was unremarkable.*

*The patient was diagnosed with a medium-sized posterior*

*uveal melanoma. After discussion of alternative treatment*

*options, the patient underwent fine-needle aspiration biopsy*

*for gene-expression profiling at the time of iodine-125 radioactive*

*plaque placement.*

*Gene profiling yielded a class 1A tumor, prompting annual*

*liver ultrasound for metastatic evaluation. Seven months following*

*radioactive plaque therapy, visual acuity in the right eye*

*was 20/40 and there was progressive nuclear sclerosis of the*

*lens. The mass had decreased in size posttreatment to a height*

*of 2.3mm (▶Fig. 49.3). There were significant pigmentary alterations*

*of the lesion with resolution of the overlying neurosensory*

*detachment. The remainder of the retina remained*

*normal, without radiation-related changes (▶Fig. 49.4).*

*49.2 Differential Diagnosis*

*The differential diagnosis of a choroidal lesion includes choroidal*

*nevus, congenital hypertrophy of the retinal pigment epithelium*

*(CHRPE), peripheral disciform lesion, melanocytoma,*

*metastatic carcinoma, choroidal hemangioma, and choroidal*

*detachment. Choroidal nevi are the most common pseudomelanoma.*

*They are typically asymptomatic, lack orange pigment*

*and subretinal fluid, are less than 2mm thick, and rarely demonstrate*

*growth. CHRPE lesions are flat, heavily pigmented*

*lesions with sharp borders and a surrounding hypopigmented*

*halo. Peripheral disciform lesions tend to show blockage on fluorescein*

*angiography and frequently resolve spontaneously.*

*Melanocytomas of the optic nerve are typically jet-black in*

*color—a color rarely seen in choroidal melanomas. Metastatic*

*melanoma lesions are more frequently bilateral and multifocal,*

*and demonstrate higher internal reflectivity than choroidal*

*melanomas on ultrasound. Choroidal hemangiomas demonstrate*

*high internal reflectivity on ultrasound with widespread,*

*diffuse leakage on fluorescein angiography. Choroidal detachment*

*typically occurs in the setting of intraocular surgery,*

*hypotony, or uveitis, and is often accompanied by pain.*

*Fig. 49.1 Color photograph of the right eye demonstrating a*

*pigmented lesion located inferotemporal to the macula with an*

*exudative retinal detachment at the anterior portion of the lesion.*

*Tumors*

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*49.3 Test Interpretation*

*The diagnosis and staging of choroidal melanoma require clinical*

*examination and local and systemic ancillary testing. The*

*history is typically not very useful in differentiating choroidal*

*melanomas from other simulating lesions. The most common*

*presenting symptoms include visual acuity loss, persistent photopsias,*

*and visual field defects. Clinical examinations including*

*slit-lamp biomicroscopy and indirect ophthalmoscopy are the*

*most important tools in evaluating choroidal melanomas.*

*Lesions are pigmented in greater than 50% of cases, but may be*

*primarily amelanotic in up to 15% of cases. They usually present*

*with a dome configuration but may have a mushroom-shaped*

*appearance if the lesion breaks through Bruch’s membrane. The*

*tumor appears as a mass deep to the retina often with an associated*

*exudative retinal detachment and occasionally producing*

*a vitreous hemorrhage. Adjacent structures may be affected*

*causing cataract, rarely secondary glaucoma, and dilated episcleral*

*(sentinel) vessels when affecting the ciliary body.*

*Combined A- and B-scan ultrasonography is the most important*

*ancillary test in the evaluation of patients with choroidal*

*melanomas and simulating lesions. It is useful for establishing*

*the diagnosis, documenting the size of the lesion, and determining*

*the therapeutic approach. A-scan ultrasonography*

*Fig. 49.2 (a) A-scan ultrasound of the mass in the right eye revealed low internal reflectivity. (b) B-scan ultrasound of the mass in the right eye*

*revealed a dome-shaped, regularly structured mass with a shallow exudative retinal detachment choroidal excavation.*

*Fig. 49.3 B-scan ultrasound of the mass at 6 months follow-up*

*revealing a decrease in tumor thickness with resolution of the*

*anteriorly located retinal detachment.*

*Fig. 49.4 Color photograph of the right eye posttreatment*

*demonstrating substantial pigmentary alterations involving the original*

*extent of the tumor and the remainder of the retina did not reveal*

*radiation-related vasculopathy of the retina.*

*Choroidal Melanoma*

*163*

*typically reveals low to medium internal reflectivity, a regular*

*internal structure, and intrinsic vascularity. It can also provide*

*information on the presence or absence of scleral infiltration*

*and extraocular extension. B-scan ultrasonography often demonstrates*

*a dome or mushroom shape, intrinsic vascularity,*

*solid consistency, sound attenuation, choroidal excavation, and*

*orbital shadowing. Moreover, B-scan ultrasonography provides*

*basal and apical dimensions that can be used to document size*

*for periodic observation and for assessment of regression after*

*treatment.*

*Fundus photography is most useful for documentation of size*

*and location of suspicious small lesions to evaluate and monitor*

*for growth. Additionally, this modality allows for documentation*

*of response to therapy.*

*Because of improved diagnostic accuracy via clinical examination*

*and ultrasonography, fluorescein angiography is of limited*

*use in diagnosing choroidal melanomas, but may be*

*extremely useful in the evaluation of simulating lesions such as*

*peripheral disciform lesions or choroidal hemangiomas. A choroidal*

*melanoma may demonstrate intrinsic vasculature, “hot*

*spots,” vascular leakage, and late staining within the tumor.*

*Fundus autofluorescence imaging is one of the newer techniques*

*utilized in the diagnosis of melanomas. The orange-pigmented*

*lipofuscin, helpful in the differentiation of nevi from*

*melanomas, is brightly autofluorescent. This is especially useful*

*in amelanotic lesions, in which the lipofuscin may appear black*

*in color.*

*Optical coherence tomography (OCT) is another ancillary test*

*that aids in diagnosis, particularly in small or potential melanomas.*

*Enhanced depth imaging may be used to measure the*

*thickness of small melanomas to monitor for growth, but these*

*measurements are not interchangeable with those obtained by*

*ultrasound. Additionally, OCT can be used to determine if there*

*is subretinal fluid undetectable by clinical exam, as this factor*

*makes the lesion more likely to be a melanoma than a nevus.*

*Fine-needle aspiration, tumor resection, or enucleation provides*

*adequate tissue for gene expression profiling. This assay is*

*a well-validated polymerase chain reaction–based test that*

*measures mRNA expression of 12 discriminating genes and 3*

*control genes. Based on the results, choroidal melanomas are*

*divided into two prognostic categories. Class 1 tumors have low*

*metastatic potential and are further subdivided into class 1A*

*and class 1B, which have 2 and 21% 5-year metastatic risk,*

*respectively. Class 2 tumors have a high risk of metastasis,*

*reported to be 72% at 5 years. Appropriate risk stratification*

*allows for individualized management including metastatic*

*screening and targeted therapy.*

*49.4 Diagnosis*

*Right eye: medium-sized choroidal melanoma.*

*49.5 Classification*

*Historically, choroidal melanomas have been divided into three*

*categories based on tumor thickness and basal dimensions,*

*including small, medium, and large (▶Table 49.1). These categories*

*were based on the Collaborative Ocular Melanoma Study*

*(COMS), a prospective randomized multicenter clinical trial*

*designed to evaluate alternative methods of management for*

*choroidal melanoma. More recently, the American Joint Committee*

*on Cancer Staging updated the classification to stratify*

*by anatomic stage for prognostication of metastatic death and*

*disease using the universal tumor (T), node (N), and metastasis*

*(M) (TNM) staging classification. In addition to basal diameter*

*and tumor thickness, extraocular extension, ciliary body*

*involvement, status of regional lymph nodes, and systemic*

*metastasis play a role in the anatomic designation.*

*49.6 Management*

*Optimal management depends on tumor location and size, status*

*of the fellow eye, results of metastatic workup, and patient*

*preferences. Treatment options include transpupillary thermotherapy,*

*plaque radiotherapy, charged particle irradiation, enucleation,*

*and local resection.*

*Laser thermal therapy has been used with short-term success*

*for small melanomas that are less than 3mm in height and*

*without high-risk characteristics. It is also used as adjunctive*

*therapy for some larger melanomas depending on tumor location*

*and radiation effect.*

*49.7 Surgical Management*

*Treatment options vary based on melanoma size using the data*

*from the COMS and TNM classification results. Enucleation*

*remains the treatment of choice for large choroidal melanomas*

*in eyes with little or no vision and those with severe glaucoma.*

*The most common alternative to enucleation is radiation therapy,*

*which provides globe salvage. Plaque brachytherapy is the*

*most common form of radiation currently utilized and is the*

*method examined in the COMS for medium-sized tumors. The*

*surgical procedure involves a conjunctival peritomy with tumor*

*localization via any combination of direct visualization, transillumination,*

*and echography. The plaque is positioned over the*

*involved sclera and three or four 5–0 nylon sutures are used to*

*secure the plaque to the sclera in a temporary fashion. Ultrasonography*

*is used to confirm proper plaque positioning, after*

*which the sutures are secured. The eye is then irrigated with*

*antibiotics, and the conjunctiva is closed with 7–0 Vicryl*

*sutures. The eye is patched with a lead shield, and the plaque*

*remains in place from 3 to 7 days, depending on the size of the*

*Table 49.1 COMS classification of choroidal melanoma*

*Small*

*● Apical height 1.0–2.4mm*

*● Basal diameter 5.0–16mm*

*Medium*

*● Apical height 2.5–10mma*

*● Basal diameter ≤ 16mm*

*Large*

*● Apical height > 10mm (8mm for peripapillary*

*tumors)*

*● Basal diameter > 16mm*

*Note: As measured by ultrasound testing.*

*aChanged November 1990 from 3.1 to 8.0 mm.*

*Tumors*

*164*

*tumor and the rate of radiation delivery by the plaque (as calculated*

*by the radiation oncologist). Postoperatively, patients may*

*develop transient diplopia and radiation-related complications*

*including retinopathy, optic neuropathy, and cataract.*

*49.8 Rehabilitation and Follow-up*

*Follow-up examinations are performed every 3 months during*

*the first year, then extended to every 6 months for 2 years, and*

*ultimately yearly after that. Clinical examination, fundus photography,*

*and ultrasonography are performed in all patients,*

*and autofluorescence and OCT imaging are performed in*

*selected patients for documentation of tumor regression and*

*for the detection of local recurrences or complications. Ultrasonography*

*during the first 6 months following radioactive*

*plaque therapy may demonstrate an increase in height posttreatment*

*secondary to intratumor edema. Follow-up analysis*

*of patients with melanomas using gene expression profiling*

*demonstrated that class 1 tumors had 95% survival and class*

*2 had 31% survival at 8 years. This information led to systemic*

*monitoring that is tiered based on risk. Annual liver imaging is*

*recommended for low-risk class 1A patients. Intermediate-risk*

*class 1B patients require annual liver imaging and liver enzymes*

*staggered by 6 months. Lastly, high-risk class 2 patients require*

*liver imaging and liver enzymes every 6 months staggered by 3*

*months. Complications of globe-conserving radiotherapy include*

*radiation-vasculopathy and optic neuropathy, which occur at*

*rates of approximately 30 to 50% at 5 years and are clearly*

*increased for tumors adjacent to the optic nerve or fovea.*

~~~~~CASE 50 Dislocated Posterior Chamber Intraocular Lens~~~~~

*50 Dislocated Posterior Chamber Intraocular Lens*

*Thalmon R. Campagnoli, Mozart de O. Mello Jr., and William E. Smiddy*

*Abstract*

*A dislocated posterior chamber intraocular lens (PCIOL) is still*

*not an uncommon complication of cataract surgery, but probably*

*is now proportionally more common as a late occurrence*

*after the initial cataract surgery. Compromise of zonular integrity,*

*whether from initial surgical trauma, nonsurgical trauma,*

*or what might be a higher prevalence of pseudoexfoliation syndrome,*

*has increased the frequency of endocapsular dislocation.*

*Thus, it seems less common for there to be residual*

*capsular elements to assist in simply repositioning the IOL into*

*the sulcus. Accordingly, scleral fixation techniques or IOL*

*exchange is more common. Scleral fixation may be effected*

*with various suturing techniques, or with the more recently*

*reported haptic externalization maneuvers. Certain IOL designs*

*do not permit some of these techniques, so the surgeon should*

*be familiar with a range of options for surgical management.*

*Keywords: intraocular lens, scleral suture, cataract surgery complication,*

*vitrectomy, repositioning IOL*

*50.1 History*

*A 64-year-old woman presented with a sudden decreased*

*vision in the left eye 2 days after an uncomplicated extracapsular*

*cataract extraction surgery with posterior chamber intraocular*

*lens (PCIOL) insertion. During the procedure, a central*

*posterior capsular rupture was noted, but the IOL was placed*

*anterior to the remaining anterior capsule into the ciliary sulcus.*

*Her vision was 20/30 in the left eye with an aphakic correction.*

*Slit-lamp examination showed a 2 + microbullous corneal*

*edema superiorly and moderate cells in the anterior chamber.*

*The pupil was round, but there was vitreous incarceration in the*

*wound. The pupillary space was clear. Residual capsule was not*

*noted. Funduscopic examination disclosed a freely mobile PCIOL*

*within the vitreous cavity inferiorly. The retina was attached.*

*Surgery was recommended and performed with repositioning*

*of the dislocated PCIOL into the ciliary sulcus using a scleral*

*suturing technique to fixate the haptics. The scleral fixation*

*sutures were placed through two partial-thickness superotemporal*

*and inferonasal scleral flaps to cover the suture knots.*

*The IOL was in good position 1 month postoperatively with*

*vision at 20/60. The vision returned to 20/20 within 6 months and*

*remained so 6 years after the surgical repair. The IOL remained*

*centered and well positioned, with no sign of complication.*

*In the right eye, the vision was 20/400 due to nuclear*

*sclerosis.*

*Differential Diagnosis—Key Points*

*1. This patient developed the PCIOL dislocation following a*

*complicated cataract extraction (posterior capsular*

*rupture), the most common scenario for dislocated IOLs.*

*The specific details of the cause of the dislocation are*

*frequently not evident, although suboptimal posterior*

*capsule support following posterior capsular rupture during*

*cataract extraction is known to be a common element.*

*When dislocation occurs a few days or weeks after surgery,*

*the cause is less apparent and may be the result of*

*spontaneous IOL haptic rotation out of a zone of posterior*

*capsule remnant, asymmetric haptic placement, or zonular*

*dehiscence. Dislocation months or years after placement is*

*rare and may be due to traumatic or spontaneous loss of*

*zonular support, as in eyes with pseudoexfoliation*

*syndrome.*

*2. Visual symptoms such as decreased vision, glare, monocular*

*diplopia, or pain, and associated ocular complications*

*(inflammation, increased intraocular pressure, cystoid*

*macular edema, and coexisting retinal detachment [RD])*

*are the main indications for surgery. A mobile IOL in the*

*absence of other complications is surprisingly well tolerated,*

*but may be removed if symptomatic.*

*3. The optimal timing for intervention for intraoperative IOL*

*dislocation is probably during the initial cataract extraction.*

*The logistics are easier for the patient, but may be*

*impracticable for the surgeon. If this is not feasible, surgery*

*within 2 weeks for acute dislocation allows initial*

*inflammation to subside or to determine the visual or*

*refractive severity of the dislocation. Most cases do not*

*manifest dislocation intraoperatively, however. Thus, for*

*other cases, surgery is usually performed within a couple of*

*weeks unless other complications coexist or intervene.*

*4. A pars plana approach is generally preferred because it*

*allows optimal treatment of complications, but a limbal*

*approach may be suitable for decentered and subluxated*

*IOLs, which are readily accessible and not enveloped by*

*prolapsed vitreous. Regardless of the approach used, all*

*accessible vitreous should be removed to avoid subsequent*

*inflammatory and tractional complications.*

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*50.2 Test Interpretation*

*Clinical examination at the slit lamp and with indirect ophthalmoscopy*

*using a + 20D lens is the standard diagnostic method.*

*Echography may be helpful to rule out associated complications*

*when the anterior and posterior segments cannot be*

*visualized due to opaque ocular media (hyphema, inflammation,*

*or vitreous hemorrhage). A posteriorly dislocated PCIOL*

*appears as a large foreign body–like structure within the vitreous*

*cavity. Gonioscopy may be helpful to evaluate how much of*

*the peripheral lens capsule remains and to assess for unrecognized*

*vitreous incarceration in the cataract wound.*

*Since IOL exchange may become necessary, IOL power calculations*

*should be available if lens exchange is performed.*

*50.3 Diagnosis*

*Dislocated posterior chamber IOL, OS.*

*50.4 Medical Management*

*Topical miotics may satisfactorily reduce glare, eliminate*

*monocular diplopia, and improve visual function in selected*

*patients with decentration of the lens optic. Supportive treatment*

*with topical anti-inflammatory or ocular hypotensive*

*agents is the mainstay of medical treatment.*

*Observation only is pursued for PCIOLs with simple decentration,*

*if other superseding medical or ocular problems prohibit*

*further surgery, if aphakic contact lens correction is satisfactory,*

*or if the patient chooses not to pursue further surgery.*

*50.5 Surgical Management*

*The surgical management options available for dislocated*

*PCIOLs include IOL repositioning with or without sutures, or*

*IOL removal with or without exchange. Vitrectomy affords the*

*most options for control of complications, but in selected cases*

*a limbal approach allows effective achievement of necessary*

*objectives. The timing may be modified by associated complications,*

*but surgery is usually pursued within 2 weeks of acute*

*symptomatic dislocation.*

*Nonsutured repositioning of dislocated PCIOL in the ciliary*

*sulcus is the least traumatic surgical alternative. It is the preferred*

*approach in eyes with at least 6 clock hours of residual*

*peripheral capsular support. More extensive capsular support*

*is necessary, however, when the inferior capsule is absent or if*

*the residual capsule is questionable in extent.*

*Repositioning with transscleral suture (9–0 polypropylene)*

*fixation is elected in eyes without adequate capsular support*

*(▶Fig. 50.1). In some cases, it is unnecessary to suture both*

*haptics. Components common to all scleral suture fixation techniques*

*include (1) retrieving of the IOL; (2) introducing a suture*

*loop through the ciliary sulcus; (3) passing the suture loop*

*around the IOL haptic; (4) securing the suture to the sclera; and*

*(5) covering or burying the scleral suture knot. Many techniques*

*have been described to achieve these goals, and the*

*method chosen may be based on surgeon preference and experience,*

*IOL design, and associated circumstances. Transscleral*

*suturing techniques are vulnerable to a variety of complications*

*such as suture knot erosion, endophthalmitis, hemorrhage, IOL*

*torsion or malposition, and recurrent dislocation due to suture*

*breakage.*

*IOL removal with or without exchange is usually performed*

*for small optics implants, damaged haptics, for highly flexible*

*haptics unsuitable for suture support, when available instrumentation*

*is lacking, and in eyes with coexisting complex RD.*

*Avoiding IOL removal or exchange avoids endothelial trauma*

*and postsurgical astigmatism from reopening a limbal wound.*

*IOL removal rates have decreased, probably because of*

*improved repositioning techniques.*

*Special considerations are necessary with silicone plate IOLs.*

*After successful placement into the capsular bag, YAG capsulotomy*

*may allow posterior prolapse of the IOL. Also, insertion*

*without complete posterior capsular support may result in dislocation*

*(▶Fig. 50.2). Silicone plate IOLs can usually be repositioned*

*into the ciliary sulcus anterior to the residual anterior*

*capsule (▶Fig. 50.3). However, removal may be necessary.*

*The most frequent surgical complications in eyes with dislocated*

*PCIOL include cystoid macular edema (usually low grade),*

*elevated intraocular pressure, and RD. Although the incidence*

*of RD is relatively low (2%), careful intraoperative and postoperative*

*examinations of the retinal periphery to look for retinal*

*tears or detachment are necessary.*

*50.6 Rehabilitation and Follow-up*

*Although visual acuity outcomes after surgical management of*

*dislocated PCIOLs are usually good, the final visual acuity*

*depends on preoperative macular function, and complications*

*from the original cataract surgery. In a majority of cases, visual*

*Fig. 50.1 A schematic representation (surgeon’s view) depicts*

*preferred technique for scleral suture fixation of dislocated posterior*

*chamber lens implant. After doing a core vitrectomy, the eye wall is*

*mobilized and ultimately grasped with the forceps through the lefthand*

*sclerotomy site. Care is taken to grasp the optic rather than the*

*haptic. A 25-gauge needle prethreaded with a 9–0 Prolene suture is*

*introduced 1mm posterior to the limbus through the bed of a partialthickness*

*scleral flap at the 7:00 meridian. The IOL haptic is then*

*guided through the resultant loop with the left hand. The needle is*

*passed through the bed of the flap, securing the inferior haptic. A*

*similar maneuver is performed for the superior haptic.*

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*acuity is 20/40 or better. In this patient, after initial visual*

*improvement to 20/60, the final visual acuity reached 20/20 6*

*years postoperatively. The relatively low rates of RD and cystoid*

*macular edema limit the vision in only a minority of cases.*

~~~~~CASE 51 Cystoid Macular Edema~~~~~

*51 Cystoid Macular Edema*

*Andrew S. Camp and William E. Smiddy*

*Abstract*

*Cystoid macular edema (CME) is a common finding following*

*intraocular surgery. Identification of cystoid macular edema by*

*careful exam or retinal imaging is crucial to guide clinical management.*

*CME can often be treated medically, although surgical*

*intervention is occasionally necessary. CME was first*

*described when the technique of fluorescein angiography was*

*developed. It was classically associated with the post–cataract*

*surgery eye, particularly if there had been a ruptured capsule*

*and/or vitreous prolapse into the anterior chamber or wound.*

*Ocular coherence tomography is now the mainstay of diagnosis.*

*Improved surgical technique has surely decreased the incidence*

*of this, but expanded indications for cataract surgery have still*

*rendered the prevalence to be substantial. Topical treatment*

*with corticosteroids and nonsteroidal agents is the first-line*

*treatment, but surgical removal of prolapsed or incarcerated*

*vitreous when present is still an important option. Still, this*

*seems to occur more frequently with complicated cataract surgery,*

*especially with iris trauma intra- or even postoperatively,*

*or retained lens fragments, so being alert to preventing, detecting,*

*and correcting these is important. Sub-Tenon’s or intravitreal*

*corticosteroid injections are viable modalities if first-line*

*topical treatments have failed. Of course, CME may follow any*

*kind of ocular surgery, or be secondary to a host of inflammatory*

*disease entities. When CME is associated with other retinovascular*

*diseases, the therapeutic strategy should be directed*

*accordingly.*

*Keywords: cystoid macular edema, Irvine–Gass syndrome,*

*pseudophakic macular edema, cystoid, macula, edema, cataract*

*surgery, surgical complications, fluorescein angiography*

*51.1 History*

*A 66-year-old woman presented 8 weeks after phacoemulsification*

*complaining of decreased visual acuity in the right eye.*

*An acrylic intraocular lens was inserted into the ciliary sulcus at*

*the time of surgery due to a central posterior capsular rupture.*

*The patient reported that the visual acuity was excellent postoperatively*

*but declined substantially after the first 4 weeks.*

*The patient reported no other contributory medical or ophthalmic*

*history including diabetes mellitus or hypertension.*

*Examination disclosed best corrected visual acuity of 20/80*

*in the right eye. The pupil exam was normal and visual fields*

*were full to confrontation. The cornea was clear and of normal*

*thickness with a well-healed corneal incision temporally. The*

*iris appeared normal without peaking, the anterior chamber*

*was deep and quiet, and the intraocular lens was well centered*

*and appeared stable. Examination of the posterior pole revealed*

*a posterior vitreous detachment. The optic nerve head was normal*

*with a cup-to-disc ratio of 0.2. The retinal vessels were normal.*

*The macula was thickened with cystic spaces apparent in*

*the fovea upon examination with a Goldmann contact lens. The*

*peripheral retina was normal without holes, breaks, or tears.*

*Ocular coherence tomography demonstrated macular thickening*

*and cysts in the inner nuclear layer (▶Fig. 51.1). Fluorescein*

*angiography demonstrated late leakage of dye from*

*perifoveal vessels with a symmetric, petaloid pooling pattern*

*(▶Fig. 51.2).*

*Differential Diagnosis—Key Points*

*1. Thickening of the macula is a clinical finding that defines*

*macular edema. Various patterns and associations of*

*macular edema may occur with different etiologic disease*

*processes. Visualization of cystoid spaces within the fovea is*

*diagnostic of cystoid macular edema (CME), but often*

*requires examination with a Hruby or fundus contact lens*

*for clinical detection. CME represents accumulation of*

*intraretinal fluid (thought to be from retinal vascular*

*leakage) in the inner nuclear and outer plexiform layers. In*

*more exuberant cases, there may be focal subretinal fluid.*

*2. While postoperative inflammation is the most common*

*cause of CME, numerous conditions may present with CME.*

*These include any ocular surgical procedures (e.g.,*

*trabeculectomy, scleral buckling, strabismus surgery, and*

*vitrectomy), almost any cause of intraocular inflammation*

*(e.g., uveitis, choroiditis, or retinitis), retinal vascular*

*disease, retinal degenerations, epiretinal membranes, and*

*drugs (e.g., topical epinephrine, dipivefrin, betaxolol, or oral*

*niacin or tamoxifen). The use of prostaglandin analogs may*

*be an additional risk factor for development of CME*

*following cataract extraction. Drug-induced CME often does*

*not show leakage on fluorescein dye.*

*3. The incidence of pseudophakic CME varies according to the*

*definition used. Visually significant CME is loosely defined as*

*CME with a characteristic ophthalmoscopic appearance and*

*visual acuity worse than 20/40. Visually significant CME*

*occurs in 2 to 10% of patients after extracapsular cataract*

*surgery, but only in 0.1 to 2.35% of patients after*

*phacoemulsification. Angiographic CME, defined as the*

*presence of fluorescein leakage in a petaloid pattern in the*

*fovea, is quite frequent (20–30% of uncomplicated cataract*

*extractions), but may not be associated with visual loss.*

*Ocular coherence tomography identifies increased retinal*

*thickness in up to 41% of patients after uneventful*

*phacoemulsification. Posterior capsular rupture, vitreous*

*loss, and retained nuclear or cortical material increase the*

*incidence of CME and risk of visual loss.*

*4. The presence of vitreous incarceration into the limbal*

*wound, iridovitreal synechiae, or iridocapsular synechiae*

*may represent a mechanical stimulus for inflammation*

*(thought to be a consequence of mechanical iris irritation)*

*and may improve with surgical lysis.*

*5. The exact mechanism of CME is unclear. It has been*

*postulated that inflammatory mediators cause breakdown*

*of the blood–retinal barrier resulting in intraretinal fluid*

*accumulation. The mediators may be released as a result of*

*ultraviolet light exposure during and after cataract surgery,*

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*traction from vitreomacular adhesions directly stimulating*

*inflammation of the Müller’s cells, or more generalized*

*intraocular inflammation. Most research has focused on*

*components of the arachidonic acid pathway, but no*

*specific mediator has yet been identified.*

*6. The macular edema of CME is ophthalmoscopically distinct*

*in appearance from that of diabetic macular edema, but*

*overlap may exist. Distinguishing exacerbation of diabetic*

*macular edema and primary CME may be difficult, but*

*ocular coherence tomography or fluorescein angiography*

*may offer insights by defining the distribution pattern of*

*leakage. Pseudophakic CME may be expected to improve*

*with time, whereas macular edema from other causes will*

*likely worsen.*

*51.2 Test Interpretation*

*Fluorescein angiography is a useful adjunct to the clinical examination*

*in the diagnosis of CME. The characteristic angiographic*

*appearance consists of parafoveal capillary leakage with a petaloid*

*pattern of intraretinal pooling of dye. The optic disc may*

*demonstrate staining or leakage (especially in severe cases).*

*Ocular coherence tomography and retinal thickness analysis*

*have largely supplanted angiography since they allow for rapid,*

*quantitative, and noninvasive diagnosis and monitoring of CME.*

*CME appears as macular thickening and cystic spaces in the*

*outer plexiform layer on ocular coherence tomography imaging.*

*CME identified by ocular coherence tomography or fluorescein*

*angiography is much more common than clinically significant*

*disease.*

*51.3 Diagnosis*

*Postoperative (pseudophakic) cystoid macular edema, OD.*

*51.4 Medical Management*

*Medical management of CME consists of both prophylaxis and*

*treatment. Some clinicians advocate preoperative nonsteroidal*

*anti-inflammatory drugs (NSAIDs) or steroids to suppress the*

*arachidonic acid pathway. Typically, topical flurbiprofen or*

*suprofen is applied before the procedure, but this practice is*

*not consistently effective for prophylaxis.*

*The treatment of CME is controversial and often frustrating.*

*The majority of patients will resolve spontaneously within 3 to*

*4 months without treatment; many others will improve partially.*

*However, a substantial minority of patients may have persistent,*

*clinically significant CME. Initial treatment usually*

*consists of topical NSAIDs such as 0.5% ketorolac four times per*

*day, for 4 to 6 weeks. Studies of NSAID use in the treatment of*

*CME have yielded mixed results, and meta-analysis of the benefits*

*has not been conclusive. Topical corticosteroids, such as 1%*

*prednisolone four to eight times per day, are also used frequently,*

*but their efficacy is reduced in chronic CME. Combination*

*therapy of topical NSAIDs and corticosteroids appears to*

*have synergistic effects with improved outcomes compared to*

*use of either agent alone.*

*Periocular or intravitreal steroid injections may be beneficial*

*in cases failing topical treatment. However, the risk of increased*

*intraocular pressure following steroid injection must be considered.*

*Intravitreal injection of anti-vascular endothelial growth*

*factor (anti-VEGF) medications, such as ranibizumab, bevacizumab,*

*or aflibercept, has also been reported in cases of chronic,*

*intractable CME, but with lackluster results. Although studies of*

*intravitreal anti-VEGF agents have demonstrated clinical*

*improvement in patients with chronic CME, these studies are*

*hampered by small sample size, variable dosing and injection*

*schedules, and lack of randomization.*

*Fig. 51.1 Fluorescein angiogram frame from the*

*midvenous phase shows pooling of extravasated*

*dye in the macula.*

*Fig. 51.2 Ocular coherence tomography macula cross-section*

*demonstrating macular thickening and cysts.*

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*51.5 Surgical Management*

*Surgical management of CME is usually reserved for cases in*

*which the anterior segment manifests vitreomacular traction*

*or adhesion or for inflammation associated with retained lens*

*particles. Classically, vitreous prolapse to a limbal wound with*

*peaking of the pupil is recognized as a surgically treatable cause*

*of CME. In selected cases, Nd:YAG laser lysis of thin vitreous*

*stands extending to the wound or sweeping via a paracentesis*

*site at the slit lamp has been used with success. Pars plana*

*vitrectomy may be indicated in cases of vitreomacular traction*

*or inflammation due to retained lens material. Interestingly,*

*pars plana vitrectomy has also successfully improved chronic*

*CME in patients without clear vitreomacular traction or*

*retained lens material.*

*51.6 Rehabilitation and Follow-up*

*After initiation of medical treatment for CME, the patient*

*should be observed within 4 to 6 weeks. If no improvement is*

*noted, further treatment may be warranted. A sizeable proportion*

*of patients may develop recurrent CME after cessation of a*

*successful medical regimen; therefore, even patients who experience*

*improvement or resolution of their symptoms should be*

*followed carefully. Chronic CME is often associated with underlying*

*retinal pigment epithelium atrophy and attendant visual*

*loss even after the CME resolves.*

~~~~~CASE 52 Endophthalmitis~~~~~

*52 Endophthalmitis*

*Brian E. Goldhagen and William E. Smiddy*

*Abstract*

*Endophthalmitis is most commonly encountered following*

*intraocular surgery, especially after cataract surgery, but may*

*occur in several other settings—endogenous, late-onset blebassociated,*

*trauma-associated, or after intravitreal injections.*

*While the incidence is low (generally less than 0.1% of respective*

*cases), the especially high frequency of cataract surgery*

*and intravitreal injections keeps endophthalmitis from being a*

*rarely encountered entity. Generally, treatment is based on the*

*Endophthalmitis Vitrectomy Study findings despite those*

*results being derived only from acute postoperative pseudophakic*

*endophthalmitis cases. Hence, unless the visual loss is*

*severe (light perception or bare hand motions might prompt*

*vitrectomy), a vitreous tap and injection of antibiotics (these*

*authors prefer vancomycin and ceftazidime) and possibly corticosteroids*

*is promptly performed and the patient is followed*

*clinically. Exceptional cases may be suspected when there are*

*atypical presentations. For example, late-onset, characteristically*

*painless inflammation that appears to be associated with*

*capsular plaques suggest Propionibacterium acnes and a more*

*aggressive surgical approach with maximal removal of remnant*

*lens cortex and capsule (and possibly even the entire intraocular*

*lens/capsule unit) is necessary. Atypical bacterial and fungal*

*endophthalmitis should be suspected with late- or delayedonset*

*presentations, especially with indolent inflammation and*

*fluffy cortexlike accumulation. Prophylaxis of endophthalmitis*

*is still controversial in the settings of cataract surgery, intravitreal*

*injections, and trauma.*

*Keywords: infection, antibiotics, surgical complication, intraocular*

*lens complication, microbiology*

*52.1 History*

*This 59-year-old woman awoke with 10/10 eye pain and*

*decreased vision in her left eye. An uneventful combined cataract*

*and LASIK procedure had been performed 5 days previously*

*with a hitherto standard postoperative course. Her vision*

*was hand motion, and there was pronounced conjunctival*

*hyperemia, corneal edema, and anterior chamber reaction with*

*hypopyon, as well as fibrin present on the intraocular lens (IOL)*

*(▶Fig. 52.1). There was no view to the posterior pole and Bscan*

*ultrasonography demonstrated moderately dense membranous*

*vitreous opacities (▶Fig. 52.2).*

*The patient underwent a vitreous tap and injection of intravitreal*

*vancomycin, ceftazidime, and dexamethasone followed*

*by hourly treatment with topical fortified vancomycin and*

*ceftazidime, prednisolone four times per day, and cyclopentolate*

*three times per day. Vitreous cultures grew methicillinresistant*

*Staphylococcus epidermidis. As she improved clinically,*

*topical medications were gradually tapered. Her vision*

*had improved to 20/40 by 1 week; the final visual acuity*

*was 20/20 several months later after a laser capsulotomy*

*was performed.*

*Differential Diagnosis-Key Points*

*Endophthalmitis is a vision-threatening inflammatory reaction*

*of the intraocular fluids or tissues that can be categorized into*

*one of the following categories based on the clinical setting*

*and time of onset:*

*1. Acute postoperative endophthalmitis may occur after any*

*surgery including cataract surgery, glaucoma filtering*

*surgery, corneal transplantation, pars plana vitrectomy*

*(PPV), scleral buckling, and strabismus surgery. Classically*

*developing within a week of surgery, it typically presents*

*with rapid onset of vision loss, pain, and intraocular*

*inflammation. The most common causative organism is S.*

*epidermidis, followed by Staphylococcus aureus and other*

*Streptococcus species.*

*Acute postoperative endophthalmitis risk factors include*

*diabetes, posterior capsular rupture, and wound leaks. Risk can*

*be significantly reduced through the use of preoperative*

*povidone-iodine. The efficacy of preoperative topical*

*antibiotics, intraoperative subconjunctival antibiotics, or*

*postoperative topical antibiotics in reducing endophthalmitis is*

*unclear. The European Society of Cataract and Refractive*

*Surgeons reported results supporting the use of intracameral*

*cefuroxime during cataract surgery; however, there has been*

*controversy due to the study’s high rate of endophthalmitis in*

*its control group as well as potential safety concerns regarding*

*intracameral antibiotic use.*

*2. Chronic postoperative endophthalmitis is defined as*

*presenting more than 6 weeks after surgery, although its*

*average time of onset is about 1 year. In contrast with acute*

*postoperative, it characteristically presents with low-grade*

*inflammation, a white intracapsular plaque, and with or*

*without associated pain. The most common causative*

*organism is Propionibacterium acnes, followed by fungal*

*species.*

*3. Posttraumatic endophthalmitis is an uncommon, yet*

*severe, complication of open-globe injury. Symptoms*

*include pain out of proportion to the degree of injury and*

*hypopyon, but can greatly vary. Time of onset is also*

*variable. Risk factors include intraocular foreign body,*

*lens rupture, dirty wound, and delayed primary repair.*

*Gram-positive organisms, particularly S. epidermidis, are*

*the most common isolates. Bacillus species have also*

*been reported.*

*4. Bleb-associated endophthalmitis is a vision-threatening*

*complication of trabeculectomy surgery, which, in contrast*

*to blebitis, has vitreous involvement. Other symptoms*

*include eye pain, decreased vision, and hypopyon. Its onset*

*is usually delayed (wide variability, average about 5 years)*

*but may present acutely as well. Risk factors include bleb*

*leakage, use of antimetabolites, and inferior surgical*

*location. Streptococcus and coagulase-negative*

*Staphylococcus species are the major causative*

*organisms.*

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*52.2 Differential Diagnosis*

*Painful loss of vision with prominent inflammation in the*

*immediate postoperative period should be considered to be*

*infectious endophthalmitis until proven otherwise. Other noninfectious*

*processes that may present similarly include toxic*

*anterior segment syndrome, retained lens material, exacerbation*

*of preexisting uveitis, and vitreous hemorrhage (with*

*dehemoglobinized red blood cells). Important distinguishing*

*features include patient history, timing of presentation, and*

*presenting symptoms.*

*52.3 Diagnosis*

*Acute infectious postoperative endophthalmitis, left eye.*

*52.4 Management*

*Although vitreous sampling with cultures (blood, chocolate,*

*Sabouraud, thioglycolate) and smears (Gram and Giemsa stains)*

*is important in the diagnosis and management of endophthalmitis,*

*empirical treatment is initially instituted with boardspectrum*

*antibiotics. Ultrasonography is useful to assess the*

*severity of vitreous opacities in cases of suspected endophthalmitis*

*and look for retinal detachments, particularly in cases*

*with a limited view to the posterior pole.*

*52.4.1 Acute Postoperative*

*Endophthalmitis*

*Acute postoperative endophthalmitis management has historically*

*been guided by the Endophthalmitis Vitrectomy Study (EVS),*

*which enrolled patients with endophthalmitis following cataract*

*surgery. Based on results of this study, PPV is recommended in*

*patients presenting with light perception-only (LP) vision, while*

*tap and injection is recommended for those presenting with a visual*

*acuity better than LP. This study additionally found no benefit*

*to the use of systemic antibiotics (amikacin and ceftazidime) on*

*final visual acuity. The limitations of this study, now conducted*

*approximately 20 years ago, include the following:*

*1. The study may not be applicable to forms of endophthalmitis*

*other than postoperative cataract or secondary lens*

*implantation.*

*2. Fourth-generation fluoroquinolones were not evaluated.*

*3. Patients with no light perception vision or significant*

*opacification of the anterior chamber were excluded from*

*the study.*

*Intravitreal antibiotics, most commonly vancomycin (1.0 mg/*

*0.1mL) and either ceftazidime (2.25 mg/0.1mL) or amikacin*

*(0.4 mg/0.1mL), are recommended for all patients with postoperative*

*endophthalmitis. Dexamethasone may or may not be*

*added depending on the extent of inflammation and suspicion*

*for fungal involvement. Topical vancomycin (50 mg/mL) in*

*combination with an aminoglycoside or ceftazidime (50 mg/mL)*

*is also usually recommended.*

*Fig. 52.1 Slit-lamp examination showing conjunctival hyperemia,*

*hypopyon within the anterior chamber, and fibrin on the intraocular*

*lens.*

*Fig. 52.2 B-scan ultrasonography showing moderately dense*

*membranous vitreous opacities without evidence of retinal*

*detachment.*

*5. Post–intravitreal injection endophthalmitis is rare but has*

*become more commonly encountered since the increased*

*usage of intravitreal injection therapies. It typically presents*

*within the first few days after injection. Use of povidoneiodine*

*as well as a sterile lid speculum is recommended to*

*reduce risk of endophthalmitis, although there appears to*

*be no benefit of topical antibiotics usage. Streptococcus and*

*coagulase-negative Staphylococcus species are the most*

*common causative organisms. Aflibercept-associated sterile*

*inflammation may be challenging to distinguish from*

*endophthalmitis but frequently presents without pain,*

*hypopyon, or conjunctival hyperemia. Preservativecontaining*

*triamcinolone may also cause painless hypopyon*

*without infection.*

*6. Endogenous endophthalmitis, in contrast to the different*

*types of exogenous endophthalmitis discussed above, is*

*caused by a hematogenous spread of infectious organisms.*

*In addition to ocular findings, which may be unilateral or*

*bilateral, systemic signs and symptoms of infection are*

*common. Risk factors include immunodeficiency, diabetes,*

*intravenous drug use, indwelling catheters, and malignancy.*

*Fungal pathogens, particularly Candida albicans and*

*Aspergillus species, are more common than bacterial.*

*Endophthalmitis*

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*52.4.2 Chronic Postoperative*

*Endophthalmitis*

*Chronic postoperative endophthalmitis is managed typically*

*with PPV with either a partial capsulectomy or total capsulectomy*

*with IOL exchange/removal.*

*52.4.3 Posttraumatic Endophthalmitis*

*Posttraumatic endophthalmitis is usually managed aggressively*

*with PPV given the high virulence of bacteria typically involved.*

*52.4.4 Bleb-Associated Endophthalmitis*

*Bleb-associated endophthalmitis, like posttraumatic endophthalmitis,*

*is typically aggressive and is managed accordingly*

*with prompt PPV.*

*52.4.5 Post–Intravitreal Injection*

*Endophthalmitis*

*Post–intravitreal injection endophthalmitis is typically managed*

*by vitreous tap and injection of intravitreal antibiotics*

*(vancomycin and ceftazidime or amikacin) with or without*

*dexamethasone. Cases with suspected noninfectious inflammation,*

*particularly aflibercept-associated sterile inflammation,*

*are treated with topical steroids and close observation without*

*intraocular cultures.*

*52.4.6 Endogenous Endophthalmitis*

*Endogenous endophthalmitis management generally necessitates*

*systemic antibiotic or antifungal therapy given the extraocular*

*source of infection, with involvement of either an*

*infectious disease or medical specialist. Severe intravitreal*

*involvement may require intravitreal antibiotics or antifungals*

*with or without PPV.*

*52.5 Prognosis*

*Endophthalmitis has the potential for severe visual loss, and*

*prognosis is dependent on the type of endophthalmitis and virulence*

*of the involved organism.*

*According to the EVS, more than half of the acute postoperative*

*endophthalmitis patients achieved 20/40 vision. Chronic postoperative*

*endophthalmitis tends to have a more favorable visual*

*outcome, while posttraumatic and bleb-associated endophthalmitis*

*tend to be associated with poorest endophthalmitis*

*outcomes. Post–intravitreal injection endophthalmitis also tends*

*to have worse outcomes than acute postoperative endophthalmitis*

*due to a higher frequency of more virulent bacteria. The*

*visual prognosis of endogenous endophthalmitis appears to be*

*most closely linked to the promptness of treatment and*

*causative organism.*

~~~~~CASE 53 Suprachoroidal Hemorrhage~~~~~

*53 Suprachoroidal Hemorrhage*

*Carlos A. Medina Mendez, Ingrid U. Scott, and William E. Smiddy*

*Abstract*

*This chapter utilizes a typical clinical scenario to present and*

*discuss the history and examination findings of suprachoroidal*

*hemorrhage. Ancillary testing, medical management, surgical*

*management, rehabilitation, and follow-up are also discussed.*

*Emphasis is placed on comparing and contrasting suprachoroidal*

*hemorrhage to etiologies included in the differential diagnosis,*

*which includes rhegmatogenous retinal detachment,*

*exudative retinal detachment, and serous choroidal effusion.*

*Keywords: suprachoroidal hemorrhage, choroidal hemorrhage*

*53.1 History*

*A 78-year-old woman presented 4 days after a complicated cataract*

*surgery in her left eye, complaining of acute-onset severe*

*pain and loss of vision in the left eye. Past medical history was*

*notable for cardiac bypass surgery 2 years previously and systemic*

*hypertension. Past ocular history was significant for myopia*

*(–9.00 sphere) and primary open-angle glaucoma. Ocular*

*medications included timolol 0.5% in both eyes twice daily, dorzolamide*

*2% in both eyes three times per day, and prednisolone*

*acetate 1% in the left eye four times per day.*

*Vision was 20/60 in the right eye and hand motion in the left*

*eye. Intraocular pressure was 12mm Hg on the right and*

*39mm Hg on the left. Slit-lamp examination of the right eye disclosed*

*nuclear sclerotic lens changes. Slit-lamp examination of*

*the left eye was notable for 2 + conjunctival injection, a temporal*

*clear cornea incision reapproximated with interrupted nylon*

*sutures, a shallow anterior chamber, aphakia, and the appearance*

*of a bullous appositional retinal detachment posterior to the*

*iris plane (▶Fig. 53.1). An ultrasound examination demonstrated*

*appositional (“kissing”) suprachoroidal hemorrhages*

*(▶Fig. 53.2a). Because of the clotted nature of the suprachoroidal*

*blood on echography, observation including serial echography*

*was recommended (▶Fig. 53.2b). The patient’s elevated intraocular*

*pressure in the left eye was managed medically.*

*Eight days after presentation, echography demonstrated*

*persistent retinal apposition with liquefaction of the suprachoroidal*

*blood. A pars plana vitrectomy with drainage of the suprachoroidal*

*hemorrhage and fluid–gas exchange was performed.*

*A draining retinotomy was not performed since no retinal*

*breaks were identified, so the retinal elevation was deduced to*

*be exudative, secondary to the choroidal hemorrhage. At the 3-*

*month follow-up visit, vision in the left eye was 20/400.*

*Differential Diagnosis—Key Points*

*1. The differential diagnosis of the bullous retinal detachment*

*seen on the presenting examination includes*

*rhegmatogenous retinal detachment, exudative retinal*

*detachment, serous choroidal effusion, and suprachoroidal*

*hemorrhage (▶Fig. 53.3). Severe pain is not consistent with*

*a rhegmatogenous retinal detachment, but may accompany*

*exudative retinal detachments when due to scleritis or*

*uveitis. Tumor lysis syndrome from a tumor which has*

*undergone massive hemorrhage or regression may also*

*cause inflammation and pain, and mimic otherwise typical*

*suprachoroidal hemorrhage. Acute-onset severe pain, often*

*seen in the context of suprachoroidal hemorrhage, is not*

*typical of primary serous choroidal effusion.*

*2. The differential diagnosis of acute ocular pain accompanied*

*by a shallow anterior chamber after cataract surgery*

*includes aqueous misdirection, pupillary block, serous*

*choroidal detachment, and suprachoroidal hemorrhage.*

*Intraocular pressure is typically normal or elevated in all of*

*these conditions, except for serous choroidal detachment,*

*which is generally accompanied by a low intraocular*

*pressure. The retina and choroid are flat in aqueous*

*misdirection and pupillary block. If funduscopic evaluation*

*is not prohibited by appositional retinal detachment, the*

*differentiation between serous and hemorrhagic choroidal*

*detachments may be made on the basis of the color of the*

*choroidal elevations; serous choroidal detachments appear*

*as light-brown choroidal elevations, while hemorrhagic*

*choroidal detachments appear as dark-brown or dark-red*

*choroidal elevations. In some instances, transillumination*

*will allow or corroborate the distinction between*

*hemorrhagic and serous choroidal detachment.*

*3. The history of acute-onset severe ocular pain and vision loss*

*in a perioperative period is most consistent with*

*suprachoroidal hemorrhage. The patient described in this*

*case has several risk factors for the development of*

*suprachoroidal hemorrhage, including advanced age,*

*atherosclerotic cardiovascular disease, systemic*

*anticoagulation, hypertension, myopia, glaucoma, aphakia,*

*and recent intraocular surgery.*

*4. The nylon sutures reapproximating the temporal clear*

*cornea incision and the lack of an intraocular lens suggest*

*that a suprachoroidal hemorrhage (perhaps limited) may*

*have developed intraoperatively, leading the cataract*

*surgeon to end the case and close the cataract incision as*

*quickly as possible.*

*5. The first clue of an intraoperative suprachoroidal*

*hemorrhage may be an alteration of the light reflex (redreflex)*

*through the pupil or a tensing or anterior bowing of*

*the lens–iris diaphragm. A rapid increase in the firmness of*

*the eye to palpation is another indication of suprachoroidal*

*hemorrhage.*

*Suprachoroidal Hemorrhage*

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*53.2 Test Interpretation*

*A combination of the history and physical findings is the most*

*definitive way to diagnose a suprachoroidal hemorrhage.*

*Patients with suprachoroidal hemorrhage generally give a classic*

*history of sudden-onset severe ocular pain, usually during*

*or following intraocular surgery or ocular trauma. Intraocular*

*pressure may be normal or elevated, and examination typically*

*demonstrates a shallow or flat anterior chamber. Ophthalmoscopy*

*demonstrates dark-brown or dark-red choroidal*

*elevations.*

*In cases with overlying exudative appositional retinal detachment,*

*echography may be necessary to confirm the presence of*

*suprachoroidal hemorrhage and exclude such entities as choroidal*

*tumor with hemorrhage or age-related macular degeneration*

*disciform lesion with hemorrhage.*

*Fig. 53.1 Initial presentation of left eye. Vision is hand motion. Note*

*temporal clear cornea cataract incision reapproximated with nylon*

*sutures, aphakia, and dark-brown appositional choroidal detachments*

*(hemorrhagic) posterior to the iris plane.*

*Fig. 53.2 (a) Echography at initial presentation demonstrating appositional suprachoroidal hemorrhage (kissing choroidal detachment). (b)*

*Echography 8 days after presentation demonstrating liquefaction and decreased reflectivity of the suprachoroidal material. On dynamic*

*ultrasonography, the liquefied clot was noted to move with eye movements.*

*Fig. 53.3 Echography demonstrating serous choroidal detachments.*

*Note the absence of echoic fluid in the suprachoroidal space. The*

*choroid is attached anteriorly to the ciliary body (scleral spur) and*

*posteriorly at the exit foramina of the vortex veins.*

*Posterior Segment Complications*

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*53.3 Diagnosis*

*Appositional (“kissing”) suprachoroidal hemorrhage, right eye.*

*53.4 Medical Management*

*Given the often-guarded prognosis of eyes with suprachoroidal*

*hemorrhage, the preferred management of this potentially devastating*

*condition is prevention. Knowledge of risk factors permits*

*the employment of prophylactic measures to decrease the*

*likelihood of suprachoroidal hemorrhage. The surgical plan may*

*even be altered in high-risk patients. Preoperative intraocular*

*pressure should be normalized via medical therapy or anterior*

*chamber paracentesis prior to surgery. A Flieringa ring in*

*myopic eyes may minimize intraoperative hypotony and, thus,*

*decrease the risk of suprachoroidal hemorrhage. In “high-risk”*

*eyes, preplacement of sutures will permit rapid wound closure.*

*Intraoperative hypotony should be avoided, and intraoperative*

*blood pressure and tachycardia should be controlled.*

*If surgical intervention is not indicated (see below for a discussion*

*of indications for surgical management of suprachoroidal*

*hemorrhage) or if the suprachoroidal hemorrhage has not*

*become sufficiently liquefied to permit surgical intervention,*

*medications to control ocular hypertension and alleviate eye*

*pain are employed. While systemic and topical steroids may*

*stabilize blood vessel permeability (i.e., help prevent further*

*bleeding) and decrease ocular discomfort, their benefit in the*

*management of suprachoroidal hemorrhage remains unproven.*

*53.5 Surgical Management*

*For intraoperative suprachoroidal hemorrhage, all ocular incisions*

*should be sutured closed immediately. Vitreous prolapse*

*into the wound should be removed if possible. If the hemorrhage*

*is massive and threatens to extrude the retina and lens–*

*iris diaphragm, or if elevated intraocular pressure persists, a*

*sclerotomy could be considered in the meridian of maximal elevation,*

*ideally anterior to the ora serrata (approximately 7mm*

*posterior to the limbus), but these efforts are often ineffective.*

*It may be necessary to refill the globe with sterile balanced salt*

*solution or air/gas tamponade. The draining sclerotomy should*

*be left open to permit continued drainage postoperatively.*

*Although primary intraoperative suprachoroidal hemorrhage*

*drainage is almost never complete, it is usually successful in*

*controlling the intraocular pressure.*

*There are no randomized prospective controlled clinical trials*

*addressing the optimal timing of secondary surgical intervention*

*for intraoperative or postoperative suprachoroidal hemorrhage.*

*Most surgeons recommend waiting 7 to 14 days to allow*

*liquefaction of the hemorrhage to facilitate drainage of the*

*blood. Serial echography is useful for following the extent of*

*suprachoroidal hemorrhage liquefaction (▶Fig. 53.2).*

*Indications for surgery in eyes with suprachoroidal hemorrhage*

*include markedly increased intraocular pressure uncontrolled*

*with medical therapy, severe intractable eye pain,*

*“kissing choroidals” with retinal apposition, macular involvement*

*with anterior retinal displacement and iris touch, and*

*associated retinal detachment. Briefly, the surgical procedure*

*consists of a 360-degree conjunctival limbal peritomy, isolation*

*of each rectus muscle on a 2–0 cotton suture, and careful*

*examination with indirect ophthalmoscopy to determine the*

*areas of greatest suprachoroidal hemorrhage (if there is inadequate*

*visualization of the fundus, this information may be*

*obtained with echography). In eyes with massive suprachoroidal*

*hemorrhage, the placement of a pars plana infusion cannula*

*may be associated with iatrogenic retinal breaks or cannula*

*placement in the suprachoroidal space; thus, in aphakic or*

*pseudophakic eyes, a 1.5-mm infusion cannula or an infusing*

*#23 gauge butterfly needle may be placed via the limbus;*

*phakic eyes may require a lensectomy. A drainage sclerotomy is*

*made radially with a 64 Beaver blade in the area of greatest*

*hemorrhage approximately 7mm posterior to the limbus, but a*

*more posterior incision can be considered if the more anterior*

*sclerotomy fails to drain. A limited anterior vitrectomy may be*

*performed, with or without injection of perfluorocarbon liquid*

*to facilitate drainage. Some surgeons advocate the use of perfluorocarbon*

*liquid over air, as perfluorocarbon liquids force*

*the blood anteriorly, while air may cause an anterior tamponading*

*force with posterior displacement of the hemorrhage,*

*thereby necessitating more posterior drainage sites. Perfluorocarbon*

*liquids may also assist in the management of coexisting*

*retinal detachment. After drainage of as much of the liquefied*

*portion of the hemorrhage as possible, a 4- or 6-mm infusion*

*cannula may be placed through the pars plana into the vitreous*

*cavity and a standard pars plana vitrectomy is performed. Coexisting*

*retinal detachment is managed with a scleral buckle and/*

*or intraocular gas tamponade.*

*53.6 Rehabilitation and Follow-up*

*Risk factors for poor visual outcome include concurrent or*

*delayed retinal detachment, more than two quadrants of suprachoroidal*

*hemorrhage, vitreous incarceration in the wound/*

*bleb, afferent pupillary defect on presentation, poor presenting*

*visual acuity, and retinal apposition for > 14 days. Patients with*

*postoperative suprachoroidal hemorrhage generally achieve*

*better final visual acuities than do patients who develop suprachoroidal*

*hemorrhage intraoperatively or following trauma.*

~~~~~CASE 54 Ruptured Globe~~~~~

*54 Ruptured Globe*

*Jonathan H. Tzu and William E. Smiddy*

*Abstract*

*Ruptured globe encompasses a wide spectrum of ocular*

*involvement; hence, the prognosis and management depend on*

*the involved structures. Usually, the rupture is obvious from*

*clinical examination and history, but may present occultly and*

*hence certain signs must be heeded and pursued when present*

*—chemosis or extensive subconjunctival hemorrhage, vitreous*

*striae radiating to a possible occult defect, or afferent pupillary*

*defect. Commonly, the rupture may occur along a previous incision,*

*for example, after previous cataract surgery, but may occur*

*anywhere—limbus, in association with muscle insertions, or*

*more posteriorly as a result of coup or contra coup force. The*

*primary objective is to restore the integrity of the globe, but*

*most far posterior rupture sites are probably best left to heal*

*spontaneously. Secondary objectives include removal of vitreous*

*or lenticular opacities and addressing vitreous base traction*

*to prevent or treat retinal detachment. The timing for secondary*

*intervention has been debated since vitrectomy was introduced*

*40 years ago, but these authors favor secondary*

*intervention in the 1- to 2-week time frame after primary closure;*

*good results with early or even concurrent posterior segment*

*intervention have also been reported. Concurrent*

*intervention is especially effective when the rupture is anterior,*

*such as a limbal wound dehiscence. Magnetic resonance imaging*

*(MRI; when metallic foreign body is not present) or computed*

*tomography (CT) scan may be helpful diagnostically and*

*to assess occult ruptures.*

*Keywords: ocular trauma, scleral rupture, retinal detachment,*

*vitrectomy, scleral buckling*

*54.1 History*

*An 80-year-old woman presented the morning after falling at*

*her nursing home. Although the exact history was unclear,*

*periocular ecchymoses suggested direct ocular trauma on a*

*piece of furniture. Initially, the patient had not noticed pain or*

*visual loss, but upon waking the next morning she realized*

*poor vision and sought consultation. Cataract surgery with a*

*nuclear expression extracapsular technique had been performed*

*3 years previously. Before the injury, the vision had*

*been documented as 20/30, limited by some atrophic macular*

*degeneration changes.*

*Upon presentation, visual acuity was hand motions and the*

*intraocular pressure was 10mm Hg. The cornea appeared relatively*

*clear with a formed anterior chamber (▶Fig. 54.1). However,*

*there was conjunctival chemosis temporally and*

*superiorly (▶Fig. 54.2). While raising the upper lid, there was*

*no conjunctival laceration, but a scleral dehiscence was evident,*

*apparently at the previous cataract wound; upon examination*

*of the superotemporal quadrant, the posterior chamber implant*

*was seen in the subconjunctival space. The view posteriorly*

*was limited by a dense vitreous hemorrhage. The pupil was not*

*peaked, and there was no vitreous anterior to the iris.*

*The patient underwent vitrectomy that afternoon with placement*

*of an encircling scleral band. The intraocular lens was*

*removed. There was a sheet of vitreous streaming to the wound*

*from behind the dehisced iris. There was no retinal detachment,*

*but a focal subretinal hemorrhage limited to the superotemporal*

*midperiphery was present.*

*Three months postoperatively, the retina was attached posteriorly*

*with a minimal epiretinal membrane (▶Fig. 54.3). Temporally,*

*at the base of the buckle, the subretinal hemorrhage*

*had organized; this traction was self-limited, counteracted by*

*the scleral buckling effect (▶Fig. 54.4). Visual acuity was 20/*

*100 (with aphakic correction).*

*54.2 Diagnosis*

*Ruptured globe, OS.*

*Fig. 54.1 Clinical appearance of patient 2 days after blunt trauma.*

*Vision was hand motions and pressure was 10mm Hg. There is*

*subconjunctival hemorrhage and temporal and superior chemosis. The*

*anterior chamber is deep and the patient has an aphakic pupillary*

*space where a dense vitreous hemorrhage posteriorly.*

*Fig. 54.2 The chemosis is much more evident and a dehiscence of the*

*cataract wound is in evidence. The intraocular lens (as evidenced by*

*the blue-colored haptic visible toward the bottom part of the slit) is in*

*the subconjunctival space.*

*Trauma*

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*Differential Diagnosis—Key Points*

*1. The most important key point is to be suspicious of what*

*might be an occult rupture from the clinical history, and to*

*detect the defect. In this case, the referring physician had*

*not been aware of the anterior rupture. A valuable clinical*

*sign in detecting occult rupture is chemosis. Another clinical*

*sign is substantial subconjunctival hemorrhage which may*

*obscure the rupture site. In an eye with previous cataract*

*surgery, the previous incision line is a common site of*

*dehiscence and should be carefully inspected. In eyes*

*without previous surgery, more variable patterns of corneal*

*and scleral laceration occur (whether they be from sharp or*

*blunt objects). The sclera is thinnest behind the insertion*

*site of the rectus muscles, and should be evaluated for an*

*occult rupture location. Since prognosis is related to the*

*most posterior extent and size of the rupture, there is some*

*value in attempting to assess this extent preoperatively but*

*balancing this against avoiding extensive diagnostic*

*manipulations. Another important clinical sign of occult*

*scleral rupture may be visible by slit-lamp transillumination*

*to blood-highlighted vitreous streaming to the rupture site.*

*2. Another important prognostic factor is the presence or*

*absence of an afferent pupillary defect (APD). This patient*

*did not have an APD, and accordingly, even without being*

*able to visualize the posterior pole, the prognosis was better*

*since substantial retinal trauma or detachment was less*

*likely. An APD can also be a sign of traumatic optic*

*neuropathy which could limit the final outcome.*

*3. Because of the nature of the circumstances and patient*

*population involved in ocular trauma, a clear history of the*

*events leading to the trauma is frequently not forthcoming.*

*While a majority of trauma occurs in a relatively young male*

*population, it occurs in substantial numbers of elderly*

*patients, as epitomized by this patient. A high index of*

*suspicion must be maintained for a rupture in such cases.*

*54.3 Test Interpretation*

*The clinical history (as available) and clinical examination typically*

*yield the most important information determining the*

*necessary management of the patient, especially given the time*

*constraints that the need for prompt repair usually dictates.*

*Based on the clinical findings, the general extent of the dehiscence*

*can often be determined (i.e., anterior to the limbus or*

*posterior to the limbus, or large and likely posterior to the ora*

*serrata). The integrity of the lens should also be established.*

*Rhegmatogenous retinal detachment is uncommon in the acute*

*phase, but hemorrhagic retinal detachment is not uncommon.*

*Often, the first examination offers the best view to assess*

*extent of injury; corneal edema, hemorrhage, and inflammation*

*often deteriorate the view subsequently.*

*Care must be taken not to generate additional forces on an*

*open globe that might prolapse vitreous or other intraocular*

*contents, compounding the injury. Still, gentle, screening Bscan*

*ultrasonography (through the lids) may yield valuable information*

*regarding the presence of vitreous, subretinal, or*

*choroidal hemorrhages and estimating the posterior extent of*

*the corneoscleral laceration.*

*A computed tomography (CT) scan may be useful in further*

*delineating the integrity of the globe. However, these scans are*

*most valuable when there is suspicion of periorbital trauma,*

*optic nerve damage, or intraocular foreign body. Magnetic resonance*

*imaging (MRI) scan is contraindicated if there is any suspicion*

*of a metallic intraocular foreign body.*

*54.4 Medical Management*

*Primary medical management involves parenteral administration*

*of broad-spectrum antibiotics to lessen the chance of*

*endophthalmitis. Endophthalmitis occurs in up to 10% of globe*

*injuries (a higher percentage in rural, farm settings), although*

*many culture-positive cases are not clinically significant.*

*Fig. 54.3 Three months postoperatively the view to the posterior pole*

*is clear. There is mild residual intraretinal hemorrhage superiorly, but*

*no sign of epiretinal membrane or retinal detachment. The vision is 20/*

*100.*

*Fig. 54.4 Superiorly and nasally there is evidence of subretinal traction*

*leading to the posterior aspect of the scleral buckle. There is no*

*rhegmatogenous retinal detachment and this was nonprogressive.*

*Ruptured Globe*

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*The acute management of the patient usually involves placing*

*a protective shield over the eye to protect it from further*

*trauma and pressure.*

*The patient’s vaccination history should be taken; if a tetanus*

*shot has not been delivered within the last 5 years, then it*

*should be administered.*

*54.5 Surgical Management*

*The single most important feature directing initial management*

*may be the patient’s visual acuity. If there is no light perception*

*(NLP) in the context of extreme ocular trauma (such as extensive,*

*posterior, or multiple chorioretinal rupture sites with*

*obvious major compromise of the globe integrity), primary*

*enucleation should be considered to avoid the risk of sympathetic*

*ophthalmia. This option is reserved only for the most*

*exceptional and unequivocal cases since determination of visual*

*function can be notoriously inaccurate in the acute phase of*

*severe trauma. Also, rare trauma cases have been reported in*

*which vision returned despite initial presentation with NLP. If*

*there is any question, primary repair with careful follow-up*

*monitoring is recommended.*

*Most commonly, cases with a ruptured globe are repaired*

*under general anesthesia, but some cases with limited and*

*anterior injuries only might be considered for monitored anesthesia*

*care and peribulbar anesthesia. Except in cases of*

*retained intraocular foreign body, the most common strategy is*

*to perform a primary closure of the corneoscleral laceration,*

*although some advocate simultaneous or early vitreoretinal*

*repair. Primary closure alone is generally performed regardless*

*of the presence of severe vitreous hemorrhage, retinal detachment,*

*or disruption of the lens capsule. Surgical repair includes*

*closure of the corneal portion of the rupture site. Typically, 10–*

*0 nylon should be used for the cornea, with shorter suture bites*

*in the central cornea and longer suture bites more peripherally*

*to minimize irregular astigmatism. Slightly larger nylon or polyglactin*

*sutures are recommended for the scleral wound. The*

*suture that is placed at the limbus is critical to effect proper lateral*

*realignment of the wound edges. After placing the limbal*

*suture, the wound is usually best closed in the cornea and then*

*front-to-back in the sclera. Consecutively placing adjacent*

*sutures is recommended for best closure and to avoid making*

*adjacent, intervening sutures too loose (and having to replace*

*them). A viscoelastic substance may help to maintain the anterior*

*chamber, to exclude iris or vitreous elements from the internal*

*aspect of the wound, and to facilitate intraoperative visibility of*

*anterior structures. The conjunctiva should be opened as necessary*

*to allow exploration of the complete extent of the scleral*

*rupture. A common location for scleral rupture is through the*

*muscle insertion, since this is where the sclera is thinnest. In*

*such cases, it may be necessary to disinsert the rectus muscle*

*temporarily to close the scleral wound. Generally, the posterior*

*extent of the laceration should be identified and closed. This*

*may not be possible in lacerations extending extremely posteriorly,*

*such as those approaching the optic nerve head.*

*Intravenous antibiotics are typically continued for approximately*

*36 hours after initial presentation. If there is no sign of*

*infection, and clinical progress is evident, these are discontinued*

*and the patient is discharged and followed as an outpatient.*

*The patient is monitored for the following week or 10 days. If*

*light perception is maintained, then a secondary (vitreoretinal)*

*repair is considered. At this point, the posterior vitreous is usually*

*separated and may be removed more readily. However, it*

*may be incarcerated or adherent at the area of the laceration*

*site. It should be amputated there as effectively as possible. In*

*cases with rupture involving the vitreous base or substantial*

*vitreous loss, prophylactic scleral buckling may be combined*

*with vitrectomy and, as necessary, lensectomy. Typically, endolaser*

*photocoagulation is applied around the edges of the laceration,*

*since subsequent contraction may cause retinal tears and*

*traction at this site. Primary silicone oil infusion may be considered*

*in cases with extreme traction or numerous, large retinal*

*breaks.*

*Delaying the secondary repair longer than 2 weeks after the*

*injury may allow formation of aggressive fibrous proliferation*

*such that subsequent surgical efforts are less likely to be effective*

*(▶Fig. 54.5). This is especially important to consider in*

*cases with what may appear to have vitreous hemorrhage; not*

*infrequently, other ocular injuries coexist that result in vitreous*

*base contracture leading to retinal detachment.*

*54.6 Rehabilitation and Follow-up*

*As long as anatomic and visual stabilization is observed, followup*

*intervals are lengthened following surgical repair. Usually,*

*the cicatricial response determining anatomic success is completed*

*by 6 weeks following surgery. Occasionally, additional*

*surgery such as removal of an epiretinal membrane or implantation*

*of an intraocular lens is considered approximately 3*

*months following surgery for visual rehabilitation. Rigid contact*

*lenses may be effective to neutralize aphakia or residual irregular*

*corneal astigmatism, and may obviate the need for a secondary*

*intraocular lens. However, a large fraction of patients are*

*unable to tolerate aphakic contact lenses.*

*Fig. 54.5 Gross photograph of a different patient whose eye was*

*enucleated because of trauma. Internalized retinal detachment can be*

*seen, but most prominent is the posterior to anterior band of*

*organized vitreous and fibrous proliferation streaming to the more*

*interior rupture site.*

*Trauma*

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*Shatter-proof safety glasses are strongly recommended, even*

*if the other eye is emmetropic, to lessen the risk of a similar*

*process occurring in the other eye.*

*Vocational rehabilitation may be necessary in patients with*

*limited vision in this one eye, since unilateral visual loss may*

*disqualify the patient from certain occupations. These efforts*

*must be coordinated with social workers and vocational rehabilitation*

*specialists.*

~~~~~CASE 55 Intraocular Foreign Body~~~~~

*55 Intraocular Foreign Body*

*Jonathan H. Tzu and William E. Smiddy*

*Abstract*

*Intraocular foreign body (IOFB) is most commonly encountered*

*in the context of industrial trauma, classically a consequence of*

*metal-to-metal impact in a workplace with the victim not*

*wearing appropriate protective eyewear. However, other*

*unusual or traumatic circumstances may result in the same.*

*Important aspects that determine management include the*

*location and nature of the IOFB, and the extent of ocular tissue*

*involvement. Certain substances are toxic to ocular structures*

*and require timely removal, for example, metallic IOFBs. Others*

*are not toxic and may be retained, as long as they have not*

*induced or are in the context of other damaged structures, for*

*example glass. Diagnosis is optimized when the clinical historical*

*context is well understood, with a healthy dose of proper*

*suspicion and awareness of the clinician. Clinical features*

*include looking for entrance sites or extrapolating from patterns*

*of injury. Because of concern about movement of magnetic*

*IOFB during MRI study, this should be avoided unless or*

*until it can be established to be nonmagnetic. Plane film X-rays*

*with multiple angles or, when available in a timely fashion,*

*computed tomography (CT) scanning are preferred. Echography*

*can be an important modality in circumstances with good*

*globe integrity and certain centers. IOFBs also carry substantial*

*risk of endophthalmitis, so prophylactic antibiotics and prompt*

*removal are recommended in the acute phase.*

*Keywords: intraocular foreign body, vitrectomy, ocular trauma,*

*siderosis, magnetic, retinal detachment*

*55.1 History*

*A 32-year-old man was working aboard a docked marine biology*

*research ship repairing a metal banister. While striking the*

*metal rail with a metal hammer, he experienced a minor pain*

*in his left eye. Over the ensuing 2 hours, he noticed a subtle but*

*definite decrease in vision. On presentation, his visual acuity*

*was 20/30. Slit-lamp examination showed a deep anterior*

*chamber with minimal cell and flare. There was a defect in the*

*temporal iris approximately 1mm from the limbus. Corresponding*

*to this site was a slitlike corneal defect that was not*

*leaking aqueous fluid by Seidel testing. Posterior to the iris,*

*there was a sectoral, white opacity in the peripheral lens*

*(▶Fig. 55.1). Examination of the posterior pole disclosed a*

*small intraocular foreign body (IOFB) embedded in the retinal*

*midperiphery. There was a collar of retinal edema surrounding*

*it, but no hemorrhage (▶Fig. 55.2).*

*The patient was taken to the operating room where, under a*

*local anesthesia, vitrectomy with lensectomy and intraocular*

*lens (IOL) implantation was combined with magnetic extraction*

*of the IOFB. A low, encircling scleral buckle was also placed. The*

*IOL power was estimated using measurements of the fellow*

*eye. Laser photocoagulation was applied surrounding the*

*retinal defect after removal of the foreign body; there was mild*

*bleeding at the site of removal from the retina. There was not a*

*previous posterior vitreous detachment, but one was introduced*

*intraoperatively with the vitrectomy instrument using*

*controlled aspiration. Postoperatively, the retina remained*

*attached and the patient regained vision of 20/20 which has*

*maintained throughout 25 years of follow-up examinations.*

*Differential Diagnosis—Key Points*

*1. The history in a patient sustaining an IOFB is commonly less*

*remarkable than one might expect. If the patient was aware*

*of the foreign body entry incident at all, it is usually*

*perceived to be something like a piece of dust going onto*

*the eye. Commonly, a few hours pass before pain or*

*decreased vision from inflammatory components prompt*

*the patient to seek consultation.*

*2. The most commonly encountered IOFBs are metallic and*

*magnetic, classically occurring in the context of metal being*

*hammered upon metal in the absence of protective eye*

*wear.*

*3. The time-honored teaching that the heat generated by the*

*launching of the small metallic IOFB sterilizes the foreign*

*body and eliminates the risk of endophthalmitis is not true;*

*studies have documented a 7% incidence of*

*endophthalmitis with metallic IOFBs. Also, a more rapidly*

*progressive and aggressive organism, Bacillus cereus, has*

*been described in such cases. Catastrophic visual results,*

*especially with delayed treatment, may result in irreversible*

*blindness.*

*4. It is easier to make the diagnosis when the history is clearcut*

*and clear media allow direct visualization of the IOFB in*

*the anterior or posterior segment. When the media are not*

*clear, but the history is suspicious, other imaging studies*

*may be necessary.*

*5. The clinician may need to deduce the IOFB location based*

*on the history of the nature of the injury and the angle of*

*entry site. Usually, the track of a posterior segment foreign*

*body is apparent in the cornea, iris, and lens, or there is a*

*superficial tract visible in the conjunctiva and sclera. In the*

*latter cases, the foreign body may come to rest at the ora*

*serrata and indirect ophthalmoscopy with careful scleral*

*indentation may allow or even be necessary to visualize the*

*foreign body. An apparent oblique corneal entry site may*

*suggest that the possibility of IOFB retained in the anterior*

*chamber angle must be considered. This would be readily*

*apparent with gonioscopic evaluation (▶Fig. 55.3).*

*6. Self-sealing, small-entry wounds usually allow sufficient*

*globe integrity to permit surgical repair without the need*

*for general anesthesia. However, if the wound is large or*

*leaking, general anesthesia must be considered to lessen*

*the risk of expulsing intraocular contents in the event of a*

*retrobulbar hemorrhage during the block.*

*Trauma*

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*55.2 Diagnosis*

*Retained magnetic intraocular foreign body, OS.*

*55.3 Test Interpretation*

*When direct visualization is possible, no further diagnostic testing*

*is indicated. When the history suggests the possibility of*

*multiple IOFBs, more comprehensive imaging might be indicated,*

*but this is usually apparent from the nature of the injury.*

*In eyes with opaque media or suspected occult IOFB, a screening*

*test is the plain film X-ray. Frequently, a combination of*

*anteroposterior and lateral views allows localization to the eye*

*or orbit. Of critical importance is detecting whether the foreign*

*body is intraocular or extraocular. Nonmetallic intraocular*

*foreign bodies may not appear on plain film. Frequently, glass*

*foreign bodies do appear, since drinking glasses or bottles usually*

*have a high lead content.*

*The second test that usually allows detection of an IOFB is the*

*combined A- and B-scan ultrasound (▶Fig. 55.4). This is feasible*

*for foreign bodies of all compositions and is most effective*

*when done with probe contact on the cornea. This may be contraindicated*

*depending on the condition of the entry site.*

*A third, useful diagnostic test is a computed tomography (CT)*

*scan (▶Fig. 55.5). For metallic and usually for glass foreign*

*bodies, this is usually definitive. However, foreign bodies of vegetable*

*matter will usually not manifest on radiologic evaluation.*

*Also, the CT scan in suspected cases may localize the foreign*

*body anteriorly, prompting reexamination using maneuvers*

*such as gonioscopy (▶Fig. 55.6).*

*Magnetic resonance imaging (MRI) is contraindicated when*

*magnetic IOFBs are suspected.*

*Fig. 55.1 External appearance approximately 6 hours after a metallic*

*IOFB traversed the temporal peripheral cornea, iris, and lens.*

*Fig. 55.2 The IOFB is embedded in the midperipheral retina*

*temporally. It appears to be metallic and is likely magnetic. There is a*

*collarette of retinal edema at the impact site.*

*Fig. 55.3 Echogram of a different patient with an IOFB that is*

*suspended approximately 2mm anterior to the retinal surface. Other*

*echograms demonstrate vitreous blood above, suggesting the*

*possibility that the foreign body bounced off the retina and came to*

*rest in the posterior vitreous.*

*Fig. 55.4 CT image of a patient with IOFB. The radiopacity at the*

*posterior and temporal eye wall of the patient’s right eye depicts the*

*IOFB.*

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*55.4 Medical Management*

*Medical management is confined initially to an efficient and*

*prompt diagnostic evaluation. Prompt institution of prophylactic*

*antibiotics is probably indicated in most cases and may be*

*tailored depending on the nature of the IOFB or the setting of*

*the injury. Although a metallic IOFB causes endophthalmitis*

*with only a 7% incidence, the devastating consequences merit*

*broad-spectrum antibiotic use. One study has shown a much*

*higher incidence of infection in rural injuries. Accordingly,*

*farm- or field-related injuries, which are at increased risk of*

*harboring B. cereus organisms, should receive antibiotic coverage*

*for anaerobic organisms. Usually, the patient is treated with*

*systemic antibiotics while being readied for surgical repair;*

*intravitreal antibiotics may be administered in especially suspicious*

*cases. If surgery can commence promptly systemic antibiotics*

*may be deferred until after surgery, allowing a culture that*

*would not be potentially falsely negative. The initial examination*

*may be of critical importance since subsequent corneal*

*edema commonly hinders the view to the posterior pole. This*

*should not be truncated in the interest of arranging ancillary*

*evaluations.*

*Patients presenting with a chronic IOFB may be managed*

*more electively if there is no sign of infection. Such cases are*

*not treated with prophylactic antibiotics since the risk of*

*endophthalmitis occurring more than a couple of days after the*

*injury is minimal.*

*55.5 Surgical Management*

*Occasionally, intraocular foreign bodies confined to the anterior*

*segment may be managed from a limbal incision. Most IOFBs*

*present in the posterior segment and a pars plana approach is*

*preferable. Foreign bodies lodged under the retina may be*

*approached with an external magnet and removed via a sclerotomy,*

*but most are approached internally.*

*The first surgical objective is to reestablish the tectonic integrity*

*of the eye. Often, the entry site is small enough that few or*

*no 10–0 nylon sutures are necessary. The second objective is to*

*remove media opacities, which may include lens opacity, disrupted*

*lens material, or hemorrhage. Accordingly, a lensectomy*

*and vitrectomy are often necessary. Frequently, enough capsular*

*support may be preserved to allow simultaneous or subsequent*

*implantation of a posterior chamber IOL in the ciliary*

*sulcus (as was done in the described case). The third objective*

*is to identify, mobilize, and remove the foreign body. A pick, forceps,*

*or intraocular magnet may be used to release embedded*

*foreign bodies. Nonmetallic foreign bodies usually require intraocular*

*forceps. A variety of forceps designs including the basketlike*

*Wilson forceps may be useful for grasping and removing*

*the IOFB once it is mobilized. A foreign body can be removed*

*through either a sclerotomy or the entry wound, although it*

*may be necessary to enlarge the site. An extremely large foreign*

*body may be brought into the anterior chamber and removed*

*via a separate limbal incision. Commonly, the foreign body is*

*mobilized, brought anteriorly with the magnet, and transferred*

*to forceps for extraction, since it often disengages from the*

*magnet if withdrawn through the sclerotomy.*

*The final surgical objectives involve closure of retinal holes*

*and prophylaxis against future retinal breaks. As a general rule,*

*a low encircling scleral buckling band is considered if the foreign*

*body traverses the vitreous base. Cases with IOFBs that traverse*

*the lens without passing through vitreous base usually do*

*not require scleral buckling. Endolaser photocoagulation at the*

*impact site may not be necessary since the inflammatory reaction*

*initiated by the impact may create an adequate adhesion;*

*however, one row of light laser surrounding the site with fluid–*

*gas exchange (air only) is usually performed.*

*Certain glass intraocular foreign bodies may be safely*

*retained since they are inert and do not carry the risk of siderosis*

*as for metallic intraocular foreign bodies. This option is especially*

*attractive for glass IOFBs that are deeply embedded,*

*especially if perforating the posterior sclera.*

*Fig. 55.5 Gonioscopic appearance of a metallic foreign body resting in*

*the inferior anterior chamber angle. An oblique corneal entry site led to*

*the suspicion of the foreign body being in the anterior segment.*

*Fig. 55.6 CT scan shows a radiopacity in an anterior location. This*

*foreign body was not clinically visible due to its peripheral location.*

*Intraoperatively, it was ultimately detected in the vitreous base of the*

*left eye temporally.*

*Trauma*

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*The timing of surgery for cases of suspected retained intraocular*

*foreign bodies is of critical importance. IOFB removal*

*within 6 to 12 hours is generally recommended when possible*

*because of the substantial risk of aggressive endophthalmitis.*

*55.6 Rehabilitation and Follow-up*

*The patient is monitored postoperatively with intravenous antibiotics*

*and topical corticosteroids, antibiotics, and/or cycloplegic*

*agents, as indicated. If there is no sign of endophthalmitis*

*within 24 to 48 hours and good clinical progress is in evidence,*

*systemic antibiotics are discontinued.*

*Patients are observed at approximately 1- to 2-week intervals*

*in the first month following surgery and less frequently thereafter.*

*The patient is monitored for recurrent retinal detachment*

*and/or epiretinal membrane formation that is of visual significance.*

*If the patient has been rendered aphakic, then a second*

*IOL implantation or aphakic contact lens is considered.*

~~~~~CASE 56 Optic Neuritis~~~~~

*56 Optic Neuritis*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*Sudden vision loss in a young patient with an afferent pupillary*

*defect, decreased color vision, no disc edema, and pain on eye*

*movement consistent with retrobulbar optic neuritis confirmed*

*on magnetic resonance imaging (MRI) to check for demyelinating*

*lesions and treated as per the optic neuritis treatment trial*

*with intravenous steroids. Optic neuritis refers optic neuropathy*

*due to inflammation, demyelination, or infection. Typical*

*cases generally only need an MRI to evaluate for demyelinating*

*disease but atypical cases might require further evaluation for*

*infectious and inflammatory etiologies including neuromyelitis*

*optica (NMO) and myelin oligodendrocytic glycoprotein (MOG)*

*antibodies.*

*Keywords: optic neuritis, eye pain on movement, multiple sclerosis,*

*neuromyelitis optica, vision loss in the young, optic neuritis*

*treatment trial*

*56.1 History*

*A 35-year-old woman noted the acute onset of blurred vision in*

*her right eye 12 days ago. She complained of moderately severe*

*retro-orbital pain on the right that was made worse by eye*

*movements. The vision had deteriorated over the first 3 or 4*

*days but had since stabilized. She noted that when she*

*attempted to perform aerobic exercises, her vision became*

*worse. She denied any precipitating factors for her visual loss or*

*any history of neurologic symptoms, except for rare diffuse*

*headaches for many years. She has been otherwise healthy and*

*denies any family history of visual impairment.*

*Examination revealed the visual acuity to be 20/80 on the*

*right and 20/20 on the left. The patient identified 3 of 10*

*Hardy–Rand–Rittler pseudoisochromatic plates on the right*

*and 10 of 10 plates on the left. Visual field examination*

*revealed a superior arcuate field defect on the right and the visual*

*field was normal on the left. The pupils were 5mm bilaterally*

*and reacted well to light and near, but there was a*

*significant relative afferent pupillary defect (RAPD) on the right.*

*Examination of the efferent system was normal. Slit-lamp*

*examination was normal. The right optic disc was hyperemic*

*without hemorrhages or exudates (▶Fig. 56.1). There were no*

*vitreous cells. The left fundus was normal.*

*Differential Diagnosis—Key Points*

*1. The differential diagnosis in this case includes*

*demyelinating, infectious, inflammatory, ischemic,*

*infiltrative, compressive, and heredofamilial (e.g., Leber’s*

*disease) optic neuropathy. The patient’s young age, lack of*

*atherosclerotic risk factors, retro-orbital pain, and lack of*

*pallid disc swelling make ischemic optic neuropathy less*

*likely. The acute, painful onset makes a compressive or*

*infiltrative lesion unlikely. Leber’s hereditary optic*

*neuropathy is usually painless, not common in women*

*(although it can occur in either gender), and associated with*

*a dense central scotoma, and patients may have a family*

*history of optic neuropathy. The most likely diagnosis in this*

*case is optic neuritis (ON), a general term for an optic*

*neuropathy resulting from idiopathic, inflammatory,*

*infectious, or demyelinating etiology. As the optic nerve is*

*swollen, the term papillitis or anterior ON is used (if the*

*optic nerve is normal, then it is called retrobulbar ON). Most*

*cases of idiopathic or demyelinating ON are retrobulbar.*

*2. Idiopathic or demyelinating ON usually presents with a*

*“typical” profile as outlined in the list below.*

*3. The deterioration of vision with exercise or heat exposure*

*(e.g., a hot shower, sauna, exercise) is referred to as*

*Uhthoff’s symptom. Although this symptom is*

*characteristically seen with demyelinating ON, it is not*

*specific, and may occur with other optic neuropathies (e.g.,*

*Leber’s hereditary optic neuropathy).*

*The disc swelling that occurs in approximately 35% of typical*

*ON patients is usually of mild to moderate degree and may be*

*associated with minimal (but usually no hemorrhages) and no*

*or only trace vitreous cells. Demyelinating ON is not associated*

*with marked disc edema, subretinal fluid, retinal exudates,*

*cotton wool patches, macular edema, or macular star.*

*Demyelinating ON is typically unilateral, retrobulbar, and*

*resolves over time spontaneously. Thus, consider an alternate*

*diagnosis to “typical” demyelinating ON if bilateral,*

*nonrecovering, progressive, or in cases of ON with severe disc*

*edema, marked hemorrhages, cotton wool spots, lipid*

*maculopathy more than trace vitreous cells, pallid disc edema,*

*or retinal arteriolar narrowing is present. Neuromyelitis optica*

*(NMO) can present with a clinical picture of ON and NMO*

*should especially be considered in cases which present*

*bilaterally, with optic disc edema, or without improvement*

*over time. NMO is an inflammatory central nervous system*

*syndrome that is distinct from multiple sclerosis (MS). NMO is*

*associated with serum aquaporin-4 immunoglobulin G*

*antibodies (AQP4-IgG). A recent International Panel for NMO*

*Diagnosis developed revised diagnostic criteria for NMO. The*

*Fig. 56.1 Fundus photograph of the right eye reveals a moderately*

*swollen and hyperemic optic disc without hemorrhages or exudates.*

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*new nomenclature defines a unifying term “NMO spectrum*

*disorder” (NMOSD) and can occur with or without positive*

*AQP4-IgG. The core clinical characteristics, however, are*

*clinical syndromes or magnetic resonance imaging (MRI)*

*findings related to optic nerve, spinal cord, area postrema,*

*other brainstem, diencephalic, or cerebral presentations. In*

*addition, in contrast to MS where immunomodulatory therapy*

*is used (e.g., interferons), NMO often requires*

*immunosuppressive therapy and immunomodulatory MS*

*treatments may in fact worsen NMO.*

*4. The Optic Neuritis Treatment Trial (ONTT), a randomized,*

*controlled trial that enrolled 457 patients with ON at 15*

*centers in the United States between the years 1988 and*

*1991, has generated significant useful data concerning the*

*treatment and natural history of demyelinating ON.*

*56.1.1 Features of Typical Optic Neuritis*

*● Acute, usually unilateral loss of visual acuity and/or visual*

*field.*

*● An RAPD in unilateral or bilateral but asymmetric cases.*

*● Periocular pain (90%), especially with eye movement.*

*● Normal (65%) or swollen (35%) optic nerve head.*

*● Young adult (< 40 years).*

*● Eventual visual improvement.*

*● 88% improve at least one line by day 15.*

*● 95% improve by at least one line by day 30.*

*● Visual improvement may continue for months.*

*(Adapted from Lee AG, Brazis PW. Clinical Pathways in Neuro-*

*Ophthalmology: An Evidence-Based Approach. New York, NY:*

*Thieme; 1998:25, with permission.)*

*56.2 Test Interpretation*

*The ONTT determined that chest radiograph, laboratory studies*

*(e.g., syphilis serology, antinuclear antibody [ANA] titers, serum*

*chemistries, and complete blood count), and lumbar puncture*

*are not necessary for typical ON but should be considered in*

*atypical cases. See list below. Serologic testing for Lyme disease*

*should be considered in patients with ON, especially with a history*

*of the typical rash of erythema migrans, who live in or*

*have visited Lyme-endemic areas. Testing should be performed,*

*including consideration for NMO IgG aquaporin-4 antibody in*

*atypical cases of ON.*

*MRI of the brain is of limited value in disclosing an alternate*

*diagnosis in patients with typical ON. In the ONTT, an alternate*

*etiology for visual loss was noted in only two patients: one with*

*a pituitary tumor and one with an ophthalmic artery aneurysm.*

*MRI is, however, a valuable predictor of the future development*

*of MS. In the ONTT, the 15-year overall cumulative probability*

*for the development of clinically definite MS was 50%, but this*

*probability was 72% for patients who had one or more lesions*

*suggesting demyelination on MRI. Patients with longitudinally*

*extensive enhancement of one or both optic nerves or chiasm*

*on MRI should be considered for additional evaluation for*

*inflammatory ON and NMO.*

*In patients with clinical features of atypical ON (see list*

*below), further studies are indicated. These include MRI, blood*

*studies (e.g., syphilis serology, Lyme titers, ANA, Bartonella henselae*

*titers, angiotensin converting enzyme (ACE), anti-neutrophilic*

*cytoplasmic antibody (ANCA), NMO), or lumbar puncture*

*to investigate for other infectious, inflammatory, and infiltrative*

*processes.*

*56.2.1 Features of Atypical Optic*

*Neuritis*

*● Bilateral simultaneous onset of ON in an adult patient.*

*● Lack of pain.*

*● Ocular findings suggestive of an inflammatory process.*

*● Anterior uveitis.*

*● Posterior chamber inflammation more than a trace.*

*● Macular exudate or star figure.*

*● Retinal infiltrate or retinal inflammation.*

*● Severe disc swelling.*

*● Lack of improvement of visual functioning or worsening of*

*visual function after 30 days.*

*● Lack of at least one line of visual acuity improvement within*

*the first 3 weeks after onset of symptoms.*

*● Age more than 50 years.*

*● Diagnosis or evidence of other systemic condition (e.g.,*

*inflammatory or infectious diseases, including AIDS) other*

*than MS that might cause optic neuropathy.*

*● Exquisitely steroid-sensitive or steroid-dependent optic*

*neuropathy.*

*(Adapted from Lee AG, Brazis PW. Clinical Pathways in Neuro-*

*Ophthalmology: An Evidence-Based Approach. New York, NY:*

*Thieme; 1998:26, with permission.)*

*56.3 Diagnosis*

*Typical optic neuritis (idiopathic or demyelinating)—papillitis.*

*56.4 Medical Management*

*The ONTT randomly assigned patients to one of three treatment*

*arms: (1) intravenous (IV) methylprednisolone sodium succinate*

*(250mg every 6 hours for 3 days) followed by oral prednisone*

*(1 mg/kg per day for 11 days); (2) oral prednisone (1 mg/*

*kg per day for 14 days); (3) oral placebo for 14 days followed by*

*a short oral taper.*

*Treatment with high-dose IV steroids followed by oral steroids*

*accelerated visual recovery but provided no long-term*

*benefit to vision. Treatment with “standard-dose” oral prednisone*

*alone did not improve the visual outcome and was associated*

*with an increased rate of new attacks of ON. Treatment*

*with the IV followed by oral steroid regimen reduced the rate of*

*development of clinically definite MS during the first 2 years,*

*particularly in patients with three or more lesions consistent*

*with demyelination on MRI at time of study entry. By 3 years,*

*however, this treatment effect had subsided.*

*Based on the ONTT results, it is recommended that treatment*

*with oral prednisone in standard doses be avoided in ON.*

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*Treatment with IV methylprednisolone should be considered in*

*patients with an abnormal MRI (may possibly reduce the subsequent*

*risk of development of MS) or a particular need (e.g.,*

*monocular patient or occupational requirement) to recover visual*

*function more rapidly. High-dose oral steroids (e.g., 500mg*

*methylprednisolone), however, have not been associated with*

*the same risks as standard dose (e.g., oral prednisone 1 mg/kg)*

*for ON and may be considered as an acceptable alternative for*

*the treatment of typical ON.*

*However, in the past, the results of the ONTT suggested that*

*either no treatment or IV steroids could be used for ON. The*

*possibility of NMO, which has a much worse prognosis and*

*often requires longer term corticosteroid and other immunosuppressive*

*treatment, might tip the balance toward IV steroid*

*treatment in some cases of ON. As noted in the ONTT, the risk*

*of MS was less in patients with ON who had a negative MRI for*

*demyelinating white matter lesions of MS. Unfortunately,*

*patients with NMO often have brain MR studies that do not*

*show typical demyelinating white matter lesions of MS or are*

*normal. Thus, there might be a rationale for considering IV steroids*

*in patients with ON and negative or atypical MRI scans for*

*MS until the NMO titer returns. In addition, some patients with*

*atypical optic neuritis (e.g., bilateral, optic disc edema) may*

*harbor myeling oligodendrocytic glycoprotein (MOG) antibodies.*

*The role of MOG antibody testing in optic neuritis remains*

*to be determined.*

*56.5 Surgical Management*

*No surgical management is indicated.*

*56.6 Rehabilitation and Follow-up*

*In the ONTT, 88% of patients improved at least one Snellen line*

*by day 15 after study entry and 96% improved at least one*

*Snellen line by 30 days. For most patients, recovery of visual*

*acuity was nearly complete by 30 days after study entry. Among*

*the patients with incomplete recovery by 30 days, most showed*

*slow gradual improvement for up to 1 year. The only predictor*

*of poor visual outcome in patients enrolled in the ONTT was*

*poor visual acuity at time of study entry. Even so, of 160*

*patients starting with visual acuity 20/200 or worse, all had at*

*least some improvement and only 8 (5%) had visual acuities*

*that were still 20/200 or worse at 6 months. In contrast to*

*demyelinating ON, NMO does not have as good a visual prognosis*

*and patients who do not recover vision should be evaluated*

*for NMO as well as other etiologies for ON.*

*As noted above, there is significant risk of developing MS in*

*patients with isolated ON. This risk is greater in patients with*

*an abnormal MRI (three or more lesions), with a history of nonspecific*

*neurologic symptoms, with a history of previous ON, or*

*with increased cerebrospinal fluid IgG. Factors that decrease*

*the subsequent risk of MS include a normal MRI, bilateral*

*simultaneous ON, childhood onset, or marked disc edema. NMO*

*should be considered in these settings.*

~~~~~CASE 57 Optic Disc Edema with Macular Star (Neuroretinitis)~~~~~

*57 Optic Disc Edema with Macular Star (Neuroretinitis)*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*Vision loss in a young adult with three cats at home and a preceding*

*flulike illness found to have disc edema, a macular star,*

*and positive lab work for Bartonella immunoglobulin G (IgG)*

*and IgM treated with antibiotics. Other causes for optic disc*

*edema with a macular star (ODEMS) should be considered*

*including papilledema (in bilateral cases) as well as other infectious*

*(e.g., Lyme disease, toxoplasmosis, tuberculosis, syphilis)*

*or inflammatory disease (e.g., sarcoid).*

*Keywords: neuroretinitis, cat scratch disease, disc edema, macular*

*star, vision loss, Bartonella henselae*

*57.1 History*

*A 22-year-old woman noted the onset of blurred vision in her*

*right eye 3 weeks ago. She noted minimal right periorbital pain.*

*She denied any history of previous medical, ophthalmologic, or*

*neurologic illnesses, but she did complain of recent occasional*

*headaches of mild and diffuse nature and noted that the visual*

*blurring seemed to have started a week or so after a nonspecific*

*“flulike” illness. She has three cats at home.*

*Examination revealed visual acuity to be 20/60 on the right*

*and 20/15 on the left. She identified 4 of 10 pseudoisochromatic*

*plates on the right and 10 of 10 on the left. Visual field*

*examination revealed a cecocentral scotoma on the right and*

*was normal on the left. Pupils were 5mm bilaterally and*

*equally reactive to light and near, but there was a right relative*

*afferent pupillary defect. Motility examination was normal. The*

*right fundus exam revealed significant optic disc edema with*

*peripapillary and macular exudates, the latter in a star configuration*

*(▶Fig. 57.1). There were 1 + vitreous cells on the right.*

*The left fundus examination was normal.*

*Differential Diagnosis—Key Points*

*1. The differential diagnosis of optic disc edema with a*

*macular star (ODEMS) includes infectious or idiopathic*

*neuroretinitis, vascular disease (anterior ischemic optic*

*neuropathy, branch or central retinal vein occlusion,*

*hypertensive optic neuropathy, diabetic papillopathy,*

*polyarteritis nodosa, and Eales’ disease), papilledema, optic*

*nerve head tumor or infiltrate, diffuse unilateral subacute*

*neuroretinitis, and acute neuroretinopathy associated with*

*progressive hemifacial atrophy (Parry–Romberg syndrome).*

*The unilateral nature of the condition in this patient argues*

*against papilledema, hypertensive or diabetic retinopathy,*

*or polyarteritis nodosa as an etiology of her disease. Her*

*young age, presence of vitreous cells, and lack of vascular*

*risk factors are strongly against nonarteritic anterior*

*ischemic optic neuropathy. The most likely diagnosis in our*

*case is idiopathic or infectious ODEMS (neuroretinitis).*

*2. ODEMS usually occurs in children or young adults, with the*

*average age of onset between 20 and 40 years. Men and*

*women are equally affected. Most cases are unilateral but*

*bilateral involvement has been noted in up to a third of*

*patients. The condition may be painless, but retrobulbar*

*pain, pain on eye movement, or associated headache may*

*occur. A nonspecific prodromal “viral” illness may precede*

*or accompany the visual loss in up to half of the cases.*

*Visual acuity ranges from 20/20 to light perception,*

*dyschromatopsia is often present, and perimetry reveals*

*optic neuropathy defects (e.g., arcuate, altitudinal, central,*

*or cecocentral scotomas).*

*3. Optic disc edema is the earliest sign of ODEMS and, unlike*

*typical optic neuritis, may be severe. This disc edema is*

*associated with leakage of disc capillaries, with the fluid*

*spreading from the disc through the outer plexiform layer of*

*the retina. The serous component of the fluid accumulation*

*in the Henle layer is resorbed, and the lipid precipitate*

*forms a macular star. The macular star may even occur after*

*the disc swelling is starting to resolve. Vitreous cells are*

*commonly observed.*

*4. Many cases of ODEMS are idiopathic and thought to be the*

*result of a nonspecific viral infection or some immunemediated*

*process (i.e., Leber’s stellate neuroretinitis).*

*Although ODEMS has been described with multiple*

*infectious processes, the most important associations have*

*included syphilis, cat-scratch disease, Lyme disease, and*

*toxoplasmosis.*

*57.2 Test Interpretation*

*It is important to look for funduscopic changes of toxoplasmosis*

*as a clue to this etiology as a cause for ODEMS. Syphilis serology,*

*Bartonella henselae (the infectious agent of cat-scratch disease;*

*Fig. 57.1 Fundus photograph of the right eye reveals significant optic*

*disc edema with peripapillary and macular exudates, the latter finding*

*in a star configuration. There were 1 + vitreous cells in the right eye.*

*Optic Disc Edema with Macular Star (Neuroretinitis)*

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*positive in this case) titers, toxoplasmosis titers, tuberculosis*

*testing, and Lyme serology should be considered. Syphilis serology*

*requires both treponemal (e.g., fluorescent treponemal*

*antibody (FTA), microhemagglutination for treponema pallidum*

*(MHA-TP) and nontreponemal testing (e.g., rapid plasma*

*reagin (RPR), veneral disease research laboratory (VDRL)) in*

*order to reduce false-positive nontreponemal testing which has*

*less specificity than the treponemal testing. Tuberculin skin*

*testing (e.g., Mantoux’s test) or more recently QuantiFERON*

*gamma assays for TB can be considered especially in endemic*

*populations (e.g., immigrants, prisoners, homeless, health care*

*workers, HIV positive, or immunosuppressed patients). The skin*

*testing and QuantiFERON testing for TB, however, do not differentiate*

*between latent TB and active TB and additional history,*

*exam, and testing (e.g., chest radiography) are necessary to confirm*

*the diagnosis. Lyme testing is a two-tiered strategy involving*

*a screening enzyme-linked immunosorbent assay (ELISA)*

*followed by a confirmatory western blot for Lyme disease. B.*

*henselae immunoglobulin M (IgM) and IgG testing should be*

*performed for both the acute and convalescent period especially*

*in cases where the initial acute titer is indeterminate. In*

*this case, the B. henselae IgM and IgG were both markedly positive*

*at high titers.*

*57.3 Diagnosis*

*ODEMS or neuroretinitis secondary to cat-scratch disease.*

*57.4 Medical Management*

*ODEMS is usually a benign disorder that resolves spontaneously*

*over a period of months without treatment. Steroids have been*

*used in some cases with unclear effect. If a specific infectious*

*agent is discovered, appropriate antibiotics should be instituted.*

*57.5 Surgical Management*

*No surgical management is indicated.*

*57.6 Rehabilitation and Follow-up*

*The prognosis for visual recovery is usually good, but significant*

*residual visual disability may occasionally occur. Optic atrophy*

*and macular retinal pigment epithelial changes may be residuals.*

*Recurrences of ODEMS in the same or fellow eye have been*

*described in idiopathic as well as infectious cases, especially in*

*patients with toxoplasmosis.*

*Although optic neuritis is a risk factor for the development of*

*multiple sclerosis, ODEMS is not. Because a macular exudate*

*may not develop in cases of ODEMS until 2 weeks after presentation,*

*patients who demonstrate acute papillitis with a normal*

*macula should be reevaluated within 2 weeks for the development*

*of a macular star. The finding of ODEMS makes the subsequent*

*development of multiple sclerosis extremely unlikely.*

~~~~~CASE 58 Anterior Ischemic Optic Neuropathy—Nonarteritic~~~~~

*58 Anterior Ischemic Optic Neuropathy—Nonarteritic*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*Sudden painless vision loss upon awakening in an elderly patient*

*with hypertension, diabetes mellitus, and hyperlipidemia*

*with sectoral disc edema, a contralateral small cup-to-disc*

*ratio, afferent pupillary defect, color dyschromatopsia, and altitudinal*

*visual field defect is consistent with nonarteritic anterior*

*ischemic optic neuropathy. (NAION). The differential*

*diagnosis should include arteritic (i.e., giant cell arteritis) AION*

*and in atypical cases (e.g., younger patient, lacking vasculopathic*

*risk factors, bilateral) evaluation for alternative etiologies*

*should be considered.*

*Keywords: NAION, sudden vision loss, altitudinal visual field*

*defect, small cup-to-disc ratio, contralateral eye, sectoral disc*

*edema*

*58.1 History*

*A 65-year-old woman states that on awakening from sleep 3*

*days ago she noted severe visual loss in the left eye. She denied*

*any headache, eye pain, jaw claudications, episodes of transient*

*visual loss, or any other neurologic or ophthalmologic complaints.*

*She related a past history of hypertension, increased*

*cholesterol, and diabetes mellitus.*

*Examination revealed visual acuity to be 20/20 on the right*

*and 20/200 on the left. She identified 10 of 10 pseudoisochromatic*

*plates on the right but only 2 of 10 plates on the left. Visual*

*fields were normal on the right but revealed a dense*

*inferior altitudinal defect on the left. Pupils were 3mm bilaterally,*

*reacted well to light on the right and poorly to light on the*

*left, and there was a left relative afferent pupillary defect.*

*Extraocular motility was normal. Fundus examination was normal*

*on the right with the cup-to-disc ratio of 0.1 (▶Fig. 58.1).*

*The left optic disc was diffusely swollen and there were peripapillary*

*hemorrhages (▶Fig. 58.2).*

*58.1.1 Clinical Features Atypical for*

*Nonarteritic Anterior Ischemic Optic*

*Neuropathy*

*● Age younger than 40 years.*

*● Bilateral simultaneous onset.*

*● Visual field defect not consistent with an optic neuropathy*

*(e.g., bitemporal hemianopia).*

*● Lack of optic disc edema in acute phase.*

*● Lack of relative afferent pupillary defect in unilateral cases.*

*● Large cup-to-disc ratio in the fellow eye.*

*● Lack of vasculopathic risk factors.*

*● Presence of premonitory symptoms of transient visual loss.*

*● Progression of visual loss beyond 2 to 4 weeks.*

*● Recurrent episodes in the same eye.*

*● Anterior or posterior segment inflammation (e.g., vitreous*

*cells).*

*(Adapted from Lee AG, Brazis PW. Clinical Pathways in Neuro-*

*Ophthalmology: An Evidence-Based Approach. New York, NY:*

*Thieme; 1998:53, with permission.)*

*58.2 Test Interpretation*

*A sedimentation rate and C-reactive protein should be obtained*

*to investigate the possibility of giant cell arteritis (i.e., arteritic*

*AION). If the sedimentation rate and C-reactive protein are elevated,*

*if there are other clinical symptoms of giant cell arteritis*

*(e.g., headache, jaw claudications), or if there are atypical features*

*for NAION (e.g., a large cup-to-disc ratio), temporal artery*

*Differential Diagnosis—Key Points*

*1. The patient has a left optic neuropathy that may be*

*ischemic, compressive, infectious, inflammatory, or*

*infiltrative. The older age of the patient, lack of pain, and*

*presence of optic disc edema argue strongly against optic*

*neuritis. The acute onset makes a compressive lesion*

*unlikely. The acute onset, lack of pain, altitudinal visual field*

*defect, optic disc swelling, and vascular risk factors are all*

*compatible with anterior ischemic optic neuropathy (AION).*

*2. AION is characterized clinically by the acute onset of usually*

*painless (pain may occur in up to 8–30% in some series)*

*unilateral visual loss in a middle age or older patient (usually*

*greater than age 50 years); an ipsilateral relative afferent*

*pupillary defect (if unilateral or bilateral and asymmetric);*

*and edema of the optic nerve head with or without*

*peripapillary hemorrhages. Later, the optic disc often*

*develops sector or diffuse pallor.*

*3. A small cup-to-disc ratio (less than 0.2) is an important*

*predisposing structural factor for the development of AION*

*(“disc at risk”). If a patient with AION has a large cup-to-disc*

*ratio, giant cell arteritis should be strongly considered. The*

*most important risk factors for nonarteritic AION (NAION)*

*are hypertension, hypotension, and diabetes mellitus.*

*4. Giant cell arteritis should be considered in all patients*

*presenting with AION. This patient had no symptoms*

*suggestive of this disease but a sedimentation rate and Creactive*

*protein should be considered in patients with this*

*presentation.*

*5. Findings atypical for NAION are outlined in the list below. If*

*any of these findings are present, other etiologies for the*

*optic neuropathy should be considered.*

*6. Visual loss with AION often is noted on awakening from*

*sleep in the morning, perhaps due to nocturnal hypotension*

*(although unproven) contributing to optic nerve ischemia.*

*The visual loss in AION is usually acute but some worsening*

*of vision may occur for 2 to 4 weeks after onset. Other*

*important predisposing factors to AION include hypotension*

*or anemia due to surgery, severe hypotension or blood loss,*

*and collagen vascular diseases.*

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*biopsy should be considered. Otherwise, laboratory studies are*

*mainly aimed at control of vascular risk factors (e.g., hypertension,*

*avoiding iatrogenic hypotension, diabetes, increased cholesterol,*

*discontinue smoking). Carotid Doppler flow studies*

*and cardiac investigations for embolic disease are not warranted*

*in typical AION because NAION is very rarely an embolic*

*disease.*

*58.3 Diagnosis*

*Nonarteritic AION, OS.*

*58.4 Medical Management*

*Vascular risk factors must be controlled. Although many agents*

*have been tried (e.g., phenytoin, erythropoietin, intravitreal*

*anti-vascular endothelial growth factor therapies, topical brimonidine,*

*levodopa), there is no proven therapy for NAION.*

*Aspirin therapy may reduce the risk of AION in the fellow eye*

*and may decrease the risk of stroke and myocardial infarction.*

*Corticosteroids for NAION remain controversial but could be*

*considered.*

*58.5 Surgical Management*

*Initial reports of visual improvement following optic nerve*

*sheath fenestration for NAION were encouraging but anecdotal.*

*A well-designed, masked, prospective, randomized study at*

*25 clinical centers (Ischemic Optic Neuropathy Decompression*

*Trial Research Group or IONDT) showed that optic nerve sheath*

*fenestration is not effective and may be harmful in NAION.*

*58.6 Rehabilitation and Follow-up*

*The risk of AION in the fellow eye is approximately 12% in the*

*patient’s lifetime. Aspirin and control of stroke risk factors may*

*decrease this risk but is unproven. According to the IONDT*

*study, 42.7% of patients will experience spontaneous (three or*

*more lines of Snellen acuity) improvement from baseline at 6*

*months.*

~~~~~CASE 59 Anterior Ischemic Optic Neuropathy—Arteritic~~~~~

*59 Anterior Ischemic Optic Neuropathy—Arteritic*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*Sudden vision loss, headaches, jaw claudication, history of polymyalgia*

*rheumatica, and pallid disc edema in an elderly woman*

*with anterior ischemic optic neuropathy found to have an elevated*

*sedimentation rate and C-reactive protein and treated*

*with steroids. Giant cell arteritis, a medium to large vessel vasculitis*

*of elderly patients can present with visual loss due to*

*arteritic anterior ischemic optic neuropathy. Prompt evaluation*

*(e.g., laboratory studies and a temporal artery biopsy) and*

*treatment with high dose corticosteroids can be vision saving.*

*Keywords: AION, ischemic optic neuropathy, sudden vision loss,*

*giant cell arteritis, pallid disc edema*

*59.1 History*

*A 68-year-old woman complained of severe visual loss in the*

*left eye. Over a period of hours, the vision became markedly*

*blurry. Over the last 2 weeks, she had noted two or three episodes*

*of painless, transient visual loss lasting minutes in the left*

*eye. She denied any periocular or orbital pain, but noted that*

*over the last several months she had diffuse, dull headaches*

*with occasional superimposed “ice pick–like” pains affecting*

*her left or right temples. She had a past history of hypertension.*

*She reported jaw claudication and polymyalgia rheumatica*

*(PMR)-like symptoms.*

*Examination revealed visual acuity to be 20/20 on the right*

*and 20/400 on the left. She could identify 10 of 10 pseudoisochromatic*

*plates on the right but identified 0 of 10 on the left*

*and could not name colors grossly on the left. The right visual*

*field was normal and the left visual acuity was diffusely*

*depressed more inferiorly than superiorly. The pupils were*

*5mm bilaterally; the right pupil reacted well to light but the left*

*pupil was minimally reactive. There was a left relative afferent*

*pupillary defect. Motility was normal. Fundus exam was normal*

*on the right. The cup-to-disc ratio on the right was 0.5. The left*

*optic disc was swollen and pale, and there were several peripapillary*

*hemorrhages (▶Fig. 59.1).*

*Differential Diagnosis—Key Points*

*1. The acute onset of visual loss in an elderly individual with*

*evidence of pale optic disc swelling strongly suggests a*

*diagnosis of anterior ischemic optic neuropathy (AION). The*

*major question to be addressed is whether this is*

*nonarteritic AION or arteritic AION (secondary to giant cell*

*arteritis [GCA]).*

*2. Features that are suggestive of arteritic AION instead of*

*nonarteritic AION are given in the list below. In this patient,*

*the episodes of transient visual loss preceding the onset of*

*AION, the recent onset of headache, the jaw pain, the cupto-*

*disc ratio greater than 0.2 (i.e., not the structural “disc at*

*risk” for nonarteritic AION), and the chalky white, pallid disc*

*swelling are all strongly suggestive of a diagnosis of arteritic*

*rather than nonarteritic AION.*

*3. Arteritic AION occurs in patients older than 50 years and*

*presents with acute, often severe, visual loss that may be*

*unilateral or bilateral (bilateral visual loss more common*

*with arteritic AION than nonarteritic AION). Constitutional*

*symptoms are common and may include headache, scalp or*

*temporal artery tenderness, weight loss, jaw claudication,*

*anorexia, fever, malaise, and PMR.*

*4. Approximately 20% of patients with GCA present with only*

*ophthalmic changes (“occult” GCA).*

*5. Causes of visual loss in GCAs include AION, posterior*

*ischemic optic neuropathy (PION), central retinal artery*

*occlusion (CRAO), branch retinal artery occlusion, the ocular*

*ischemic syndrome, choroidal ischemia, and, rarely,*

*intracranial (e.g., occipital lobe) ischemia. GCA should be*

*strongly considered in a patient over the age of 50 who*

*presents with a bilateral AION, pallid disc edema, PION, or*

*CRAO with no visible emboli, or with prior transient visual*

*loss episodes before the permanent visual loss.*

*59.1.1 Features Suggestive of Arteritic*

*AION Instead of Nonarteritic AION*

*● Elderly patient with constitutional symptoms (especially*

*scalp tenderness or jaw claudication).*

*● PMR.*

*● Elevated sedimentation rate (ESR) or C-reactive protein.*

*● Transient visual loss (amaurosis fugax) preceding constant*

*visual loss.*

*● Ocular findings.*

*● PION (retrobulbar optic neuropathy).*

*● Cup-to-disc ratio greater than 0.2 in fellow eye.*

*● Early massive (no light perception to count fingers) or*

*bilateral simultaneous visual loss.*

*● Markedly pallid optic disc edema (chalk white).*

*● Fluorescein angiogram or clinical findings of simultaneous*

*choroidal nonperfusion and AION.*

*Fig. 59.1 Fundus photograph reveals that the left optic disc is swollen*

*and pale and there were several peripapillary hemorrhages.*

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*● AION associated with choroidal nonfilling.*

*● Simultaneous nonembolic CRAO or cilioretinal artery*

*occlusion and AION.*

*● Simultaneous choroidal or retinal infarction and AION.*

*(Adapted from Lee AG, Brazis PW. Clinical Pathways in Neuro-*

*Ophthalmology: An Evidence-Based Approach. New York:*

*Thieme; 1998:70, with permission.)*

*59.2 Test Interpretation*

*An ESR and/or CRP occurs in most cases of GCA but a normal*

*ESR or CRP does not rule out GCA.*

*The CRP is more sensitive (up to 100%) than the ESR (92%) for*

*detection of GCA but the combination of tests gives the best*

*specificity (97%). Temporal artery biopsy should be considered*

*in all patients who are suspected of having GCA to confirm the*

*diagnosis and provide rationale for continued high-dose corticosteroid*

*treatment especially when side effects of treatment*

*occur.*

*59.3 Diagnosis*

*Arteritic AION. The ESR was elevated at 70 mm/h, the CRP was*

*elevated at 20 mg/dL, and the temporal artery biopsy showed*

*transmural lymphocytic infiltration, multinucleated giant cells,*

*and disruption of the internal elastic lamina consistent with*

*GCA.*

*59.4 Medical Management*

*When a diagnosis of GCA s is considered, the patient should be*

*started immediately on high-dose corticosteroids in order to*

*prevent further visual loss. Treatment should not be delayed*

*until after temporal artery biopsy as corticosteroids do not alter*

*the histopathological findings acutely. Most authors recommend*

*an initial dose of oral prednisone of 1.0 to 1.5 mg/kg per*

*day. Some authors favor intravenous steroids (e.g., methylprednisolone*

*1,000 mg/day) in patients with severe visual loss of*

*less than 48 hours duration due to GCA, especially if there is*

*bilateral involvement, if the patient is monocular, or if the patient*

*has lost vision during oral steroid therapy. Every other day*

*steroid therapy does not seem to sufficiently control disease*

*activity. Most patients can be tapered off steroids within 1 year,*

*but some patients may require prolonged or even indefinite*

*therapy.*

*59.5 Surgical Management*

*No surgical management is indicated but histopathologic confirmation*

*of the diagnosis of GCA with a temporal artery biopsy*

*is recommended*

*59.6 Rehabilitation and Follow-up*

*Untreated, there is a high risk of further visual loss in the*

*involved or fellow eye in patients with GCA. Patients must be*

*carefully monitored for visual impairment, constitutional*

*symptoms, and ill effects of the steroid therapy, with some*

*guidance provided by serial ESR/CRP studies. Consultation with*

*an internist and/or rheumatologist is recommended and some*

*patients require consideration for steroid sparing regimens*

*(e.g., methotrexate) if serious dose limiting side effects occur.*

~~~~~CASE 60 Progressive Optic Neuropathy—Tumor~~~~~

*60 Progressive Optic Neuropathy—Tumor*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A patient with painless progressive visual loss over years with*

*an afferent pupillary defect, decreased color vision, and optic*

*atrophy is found to have an optic nerve sheath meningioma on*

*magnetic resonance imaging (MRI). Compressive optic neuropathy*

*(CON) should be suspected in any unexplained optic neuropathy*

*but especially in progressive cases. MRI of the head and*

*orbit with gadolinium is the preferred initial imaging modality*

*for CON. Common etiologies for CON include meningioma,*

*pituitary adenoma, craniopharyngioma, and glioma.*

*Keywords: progressive optic neuropathy, tumor, optic atrophy,*

*progressive vision loss, compressive optic neuropathy, optic*

*nerve sheath meningioma*

*60.1 History*

*A 64-year-old woman complained of painless progressive visual*

*loss in her right eye. Three years previously, she had noted mild*

*visual blurring in her right eye and visual acuity had been found*

*to be 20/40 on the right and 20/20 on the left. Her visual difficulty*

*had been attributed to “nuclear sclerotic cataract” and*

*observation was recommended. One year later, however, her*

*vision continued to deteriorate to 20/60 on the right and 20/20*

*on the left, and right cataract surgery was performed. She felt*

*that her “vision was no better after the surgery” and she continued*

*to worsen. She denied any headache or eye pain.*

*Examination revealed visual acuity to be 20/100 on the right*

*and 20/20 on the left. She was able to identify 2 of 10 pseudoisochromatic*

*plates on the right and 9 of 10 on the left. Visual*

*field exam revealed diffuse depression of the visual field on the*

*right with a normal visual field on the left. The pupils were*

*5mm bilaterally poorly reactive to light on the right and briskly*

*reactive on the left, and there was a right relative afferent*

*pupillary defect. Motility was normal. Hertel measurements at*

*a base of 95 were 22mm on the right and 19mm on the left.*

*Slit-lamp exam revealed a posterior chamber intraocular lens*

*on the right and a mild nuclear sclerotic cataract on the left.*

*Fundus exam revealed a pale, atrophic nerve on the right*

*(▶Fig. 60.1). The left optic disc was normal.*

*Differential Diagnosis—Key Points*

*1. The patient’s history of painless progressive visual loss is not*

*consistent with typical optic neuritis or anterior ischemic*

*optic neuropathy. Compressive or infiltrative optic*

*neuropathies cause painless, progressive, gradual loss of*

*visual function (e.g., loss of visual acuity, visual field, and*

*color vision), a relative afferent pupillary defect (in unilateral*

*or asymmetric cases), and optic disc edema or atrophy (the*

*disc may be normal initially). Mild proptosis in this case*

*raises the possibility of an orbital process causing her*

*ipsilateral progressive optic neuropathy.*

*2. Compressive optic neuropathy that is due to an orbital or*

*intracanalicular lesions may result in ipsilateral optic disc*

*edema followed by atrophy and may also be associated with*

*the development of abnormal blood vessels on the disc*

*head called “optociliary shunt vessels.” These vessels*

*probably represent collateral circulation between the retinal*

*and choroidal venous circulation that allows blood to bypass*

*the compression at the level of the optic nerve and thus are*

*probably more accurately termed retinochoroidal venous*

*collateral vessels.*

*3. The presence of an unexplained relative afferent pupillary*

*defect or unexplained optic atrophy should prompt*

*evaluation including consideration for appropriate*

*neuroimaging studies. Lesions causing compressive optic*

*neuropathy include benign and malignant tumors (e.g.,*

*meningioma, glioma, craniopharyngioma, lymphoma,*

*metastasis), orbital fracture (traumatic optic neuropathy),*

*inflammatory or infectious diseases (e.g., syphilis,*

*tuberculosis, Lyme disease, sinus mucocele), primary bone*

*diseases (e.g., osteopetrosis, fibrous dysplasia), vascular*

*masses (e.g., orbital hemorrhage, aneurysms, orbital venous*

*anomalies), thyroid ophthalmopathy (compressive orbital*

*apex optic neuropathy), and iatrogenic causes (e.g.,*

*intracranial catheters, intraorbital or intracranial*

*postoperative changes).*

*60.2 Test Interpretation*

*Perimetry and color vision testing are helpful in differentiating*

*visual loss due to optic neuropathy from media problems. All*

*patients should have neuroimaging studies, preferably magnetic*

*resonance imaging (MRI), of the brain and orbit with and*

*without gadolinium contrast material to investigate the cause*

*of the optic nerve compression. In patients who cannot undergo*

*Fig. 60.1 Fundus photograph revealing a pale, atrophic optic nerve on*

*the right.*

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*an MRI, computed tomography (CT) scan of the brain and orbit*

*with and without contrast may be necessary.*

*60.3 Diagnosis*

*Compressive optic neuropathy on the right. MRI revealed optic*

*nerve sheath enhancement on T1 postcontrast images consistent*

*with an optic nerve sheath meningioma on the right*

*(▶Fig. 60.2).*

*60.4 Medical Management*

*The management of lesions causing optic nerve compression*

*depends on the nature of the lesion. For optic nerve sheath*

*meningiomas, close observation may be all that is necessary. If*

*progressive visual deterioration occurs, stereotactic, conformal,*

*radiation therapy may be appropriate.*

*60.5 Surgical Management*

*Surgical intervention for primary sheath meningiomas is usually*

*not recommended. Some authors consider surgery for debulking*

*exophytic lesions or if there is progressive intracranial extension*

*of the lesion through the optic canal, which might have theoretic*

*risk to the felloweye. Most authors, however, recommend observation*

*or radiation therapy over surgery for primary optic nerve*

*sheath meningiomas. In contrast, intracranial meningiomas with*

*secondary optic nerve sheath involvement causing optic nerve*

*compression may require surgical treatment with a gross total*

*resection if feasible or subtotal excision if the tumor surrounds*

*vital structures. Postoperative radiation therapy for a nonresectable*

*tumor should be considered, although some authors reserve*

*postoperative radiation for cases in which there is clinical progression*

*or in higher grade or atypical meningiomas.*

*60.6 Rehabilitation and Follow-up*

*Patients with tumors such as meningiomas should have serial*

*clinical reevaluation (e.g., every 6 months) including visual*

*fields and repeat MRIs (e.g., every 6 months for 2 years, and*

*then yearly if no growth is indicated clinically or by imaging).*

*More malignant processes require more frequent follow-up and*

*more aggressive treatment measures.*

~~~~~CASE 61 Papilledema–Pseudotumor Cerebri~~~~~

*61 Papilledema–Pseudotumor Cerebri*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A young obese woman with headaches, tinnitus, transient visual*

*obscurations, and bilateral disc edema was found to have*

*normal neuroimaging studies (magnetic resonance imaging/*

*magnetic resonance venography [MRI/MRV]) and an elevated*

*opening pressure on lumbar puncture with normal cerebral*

*spinal fluid consistent with pseudotumor cerebri (idiopathic*

*intracranial hypertension).*

*Keywords: papilledema, pseudotumor cerebri, idiopathic intracranial*

*hypertension, disc edema, obesity, headaches, elevated*

*opening pressure, transient visual obscurations*

*61.1 History*

*A 22-year-old woman had an 8-month history of headache. The*

*headaches occurred almost daily, were diffuse, and were rarely*

*associated with nausea. Over the last 2 months, she had noted a*

*“pulsating sound” in her head (i.e., pulse synchronous tinnitus).*

*It was most noticeable when changing posture, especially when*

*going from a lying to a standing posture. Over the last 2 weeks,*

*she had noted episodes lasting seconds at a time of transient visual*

*loss in the left or right eye. She denied any other neurologic*

*complaints or diplopia. She was not pregnant and was not taking*

*any medications that cause increased intracranial pressure.*

*Examination revealed an obese woman weighing 250*

*pounds. Blood pressure was 135/85mm Hg. Visual acuity was*

*20/20 bilaterally, color vision was normal, and visual fields*

*were normal except for enlarged blind spots bilaterally. Pupils*

*were 5mm bilaterally, reacted well to light, and there was no*

*relative afferent pupillary defect (RAPD). Motility was normal.*

*Fundus examination revealed bilateral severe optic disc swelling*

*(▶Fig. 61.1).*

*Differential Diagnosis—Key Points*

*1. Although bilateral disc swelling can be seen in a number of*

*different bilateral optic neuropathies, the patient has no*

*visual loss, color impairment, or visual field defects*

*suggestive of an optic neuropathy. Bilateral disc edema with*

*normal visual function may be seen with hypertension, but*

*her blood pressure was normal and there were no other*

*signs of hypertensive retinopathy. Thus, the patient’s disc*

*swelling is likely due to increased intracranial pressure (i.e.,*

*papilledema).*

*2. Patients with papilledema should have measurement of*

*their blood pressure and then be assessed for spaceoccupying*

*lesions of the brain, such as hydrocephalus,*

*masses (e.g., tumor, hemorrhage, abscess), encephalitis/*

*meningitis, and subarachnoid hemorrhage. If the patient*

*has no cause for increased intracranial pressure,*

*neuroimaging studies (e.g., magnetic resonance imaging*

*[MRI] head and MR venography [MRV] with contrast) are*

*normal, cerebrospinal fluid (CSF) contents are normal, and*

*the lumbar puncture opening pressure is elevated (> 25 cm*

*of water), the patient, by definition, has idiopathic*

*intracranial hypertension (IIH) or pseudotumor cerebri*

*(PTC).*

*3. PTC is often idiopathic but may occur in association with*

*certain systemic conditions (e.g., drugs, pregnancy [weight*

*gain], and intracranial or extracranial venous thrombosis or*

*obstruction). Obstruction or impairment of intracranial*

*cerebral venous sinus drainage may result in cerebral edema*

*with increased intracranial pressure and papilledema.*

*Tumors that occlude the posterior portion of the superior*

*sagittal sinus or other cerebral venous sinuses may cause*

*increased intracranial pressure as may septic or aseptic*

*thrombosis or ligation of the cavernous sinus, lateral sinus,*

*sigmoid sinus, or superior sagittal sinus. Venous sinus*

*thrombosis may be the mechanism of PTC reported with*

*systemic lupus erythematosus, protein S deficiency,*

*antithrombin III deficiency, the antiphospholipid antibody*

*syndrome, and other blood dyscrasias. In fact, elevated*

*intracranial venous pressure is thought by some authors to*

*be the “universal mechanism” of PTC of varying etiologies.*

*4. Many systemic diseases, drugs, vitamin deficiencies and*

*excesses, pregnancy (weight gain), and hereditary*

*conditions have been associated with PTC. The drugs most*

*firmly associated with PTC include hypervitaminosis A,*

*steroid withdrawal, anabolic steroids, lithium, nalidixic acid,*

*all-trans-retinoic acid (ATRA) or tretinoin, cyclosporine,*

*exogenous growth hormone, and tetracyclines (especially*

*minocycline). Other cases have been reported including the*

*insecticide chlordecone (Kepone), isotretinoin, ketoprofen*

*(Orudis) or indomethacin in Bartter’s syndrome, thyroid*

*replacement in hypothyroid children, and danazol. The*

*systemic diseases most closely linked to PTC include*

*Behçet’s syndrome, renal failure, Addison’s disease,*

*hypoparathyroidism, systemic lupus erythematosus, and*

*sarcoidosis. Although sometimes implicated in IIH, oral and*

*Fig. 61.1 Fundus examination revealed marked bilateral disc swelling*

*with diffuse exudates, hemorrhages, and dilated vessels.*

*Papilledema–Pseudotumor Cerebri*

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*other contraceptives have not been shown to be causal in*

*case–control studies.*

*5. Idiopathic PTC (IIH) is typically a disease of obese women in*

*the childbearing years. The occurrence of PTC in a man, the*

*elderly, or thin patients should raise the possibility of*

*venous occlusive disease or a secondary cause. The*

*diagnostic criteria for PTC are listed below. The most*

*common symptoms of PTC include headache, transient*

*visual obscurations, pulsatile tinnitus, and diplopia. The*

*headaches in patients with PTC may be constant or*

*intermittent. Transient visual obscurations last seconds,*

*may be unilateral or bilateral, may be related to changes in*

*posture, do not correlate with the degree of intracranial*

*hypertension or the extent of disc swelling, and are not*

*considered to be harbingers of permanent visual loss.*

*Intracranial noises are common with PTC and are perhaps*

*due to transmission of intensified vascular pulsations via CSF*

*under high pressure to the walls of the venous sinuses.*

*6. Visual field and, eventually, visual acuity loss are the major*

*causes of morbidity in PTC. Complete blindness and*

*permanent optic atrophy may occur. Often, the patient is*

*initially unaware of peripheral visual field dysfunction and*

*Snellen acuity testing is a poor indicator of early visual*

*deficit in PTC. The papilledema causes optic nerve fiber*

*attrition, which results in field constriction and nerve fiber*

*bundle defects. Blind spot enlargement is commonly*

*encountered but is more a reflection of the disc swelling*

*itself, rather than optic nerve damage, and is improved with*

*refraction.*

*61.1.1 Criteria for the Diagnosis of*

*Idiopathic Pseudotumor Cerebri*

*1. Increased intracranial pressure must be documented in an*

*alert and oriented patient without localizing neurologic*

*findings (except for cranial nerve VI palsy). It should be*

*noted that spinal fluid pressures between 200 and 250mm*

*H20 may occur normally in obese patients, and that when*

*elevated spinal fluid pressure is suspected, confirmation*

*requires values greater than 250mm H20.*

*2. The CSF should have normal contents (including protein and*

*glucose) with no cytologic abnormalities. Occasionally, the*

*CSF protein level may be low.*

*3. Neuroimaging (preferably MRI with and without contrast,*

*and possibly MRV) should be normal with no evidence of*

*hydrocephalus, mass lesion, meningeal enhancement, or*

*venous occlusive disease. Neuroimaging may show enlarged*

*optic nerve sheaths, empty sellae, and reversal of the optic*

*nerve head in some patients with PTC.*

*4. No secondary cause should be present.*

*61.2 Test Interpretation*

*In all patients with bilateral optic disc swelling, blood pressure*

*should be checked to evaluate for possible hypertensive emergency*

*(i.e., malignant hypertension). Neuroimaging is recommended*

*for all patients. Cranial computed tomography (CT)*

*imaging with CT venography may be the study of choice in the*

*acute setting (e.g., emergency room) in evaluating the patient*

*with possible acute vascular processes (e.g., subarachnoid, epidural,*

*subdural, or intracerebral hemorrhage, acute infarction,*

*cerebral venous thrombosis) or after head trauma. Otherwise,*

*MRI, with and without contrast, is the imaging modality of*

*choice. Most authors also recommend that MRV be obtained at*

*the same time to evaluate the patient for venous sinus thrombosis.*

*If neuroimaging shows no structural lesion or hydrocephalus,*

*then a lumbar puncture is generally recommended.*

*Studies should include an accurate opening pressure, to evaluate*

*for intracranial hypertension, as well as CSF cell count and*

*differential, glucose, protein, cytology, and appropriate cultures.*

*61.3 Diagnosis*

*Papilledema. The MRI showed only radiographic findings suggestive*

*of increased intracranial pressure (i.e., CSF fluid signal*

*in the optic nerve sheaths bilaterally and an empty sella) and*

*MRV findings were normal in this patient. Spinal tap revealed*

*an opening pressure of 350mm H2O and normal CSF contents*

*consistent with the diagnosis of IIH.*

*61.4 Medical Management*

*Some patients require no treatment as long as symptoms are*

*minimal and visual function is normal, but all require serial*

*monitoring of visual function, especially visual fields, to observe*

*closely for signs of visual impairment. Weight reduction,*

*including surgically induced weight reduction in morbidly*

*obese patients, may improve the papilledema and reduce intracranial*

*pressure. Medical treatments for PTC include carbonic*

*anhydrase inhibitors, loop diuretics, corticosteroids, and repeat*

*lumbar punctures. Acetazolamide in doses of 1 to 2 grams per*

*day has proven effective in most patients with PTC. A recent*

*randomized, controlled clinical trial supports the efficacy and*

*safety of diet and acetazolamide in patients with IIH and mild*

*visual loss. Acetazolamide (prior FDA category C) should probably*

*be avoided during pregnancy but may still be used if*

*needed. The decision for medical treatment, however, requires*

*consultation with the obstetrician and the patient. In general,*

*we recommend avoiding acetazolamide during the first 20*

*weeks, because of potential teratogenic effects. The use of caloric*

*restriction and other diuretics (e.g., furosemide) may also be*

*relatively contraindicated during pregnancy.*

*Other carbonic anhydrase inhibitors, such as methazolamide*

*(Neptazane), can be used in acetazolamide-intolerant patients*

*but their efficacy has not been proven. Furosemide (Lasix)*

*inhibits CSF production and may have an additive effect with*

*acetazolamide, but the use of this agent alone has not been systematically*

*studied. Corticosteroids may be efficacious in the*

*short run, but the complications of this medication, especially*

*in the chronic treatment of an already obese individual, have*

*resulted in most clinicians suggesting that their use probably*

*should be avoided.*

*Repeated lumbar punctures have never been systematically*

*studied for the treatment of PTC. As these procedures are*

*uncomfortable, are of questionable benefit, and are potentially*

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*associated with complications (e.g., infection, intraspinal epidermoid*

*tumors), they should not be performed as a primary*

*therapy. Finally, if acetazolamide does not control the headache*

*associated with PTC, symptomatic headache treatments are*

*warranted.*

*61.5 Surgical Management*

*When medical therapy fails for headache or visual dysfunction,*

*surgical therapies for PTC should be considered.*

*The two main procedures performed include CSF shunting*

*(e.g., ventriculoperitoneal (VP) or lumboperitoneal shunt) and*

*optic nerve sheath fenestration (ONSF). Stenting for cerebral*

*venous sinus stenosis remains controversial.*

*Various authorities have vehemently advocated one or the*

*other procedure. There has been no prospective study comparing*

*the efficacy of the two procedures. Both ONSF and VP shunt*

*may improve vision and prevent deterioration of vision in*

*patients with PTC. Both procedures have their advantages and*

*disadvantages and either may fail with time. Patients who fail*

*VP shunt may benefit from ONSF and vice versa. Until a prospective,*

*randomized study comparing ONSF with VP shunt for*

*PTC is performed, the question of which surgical procedure is*

*best for the treatment of PTC remains unanswered.*

*61.6 Rehabilitation and Follow-up*

*Patients should generally return monthly for 6 to 12 months*

*with careful evaluation of formal visual fields, stereo-optic disc*

*photos, OCT nerves, visual acuity, color vision, and RAPD testing.*

*The time between visits can be lengthened depending on the*

*stability of the ophthalmologic findings. Regression of symptoms*

*and papilledema are the end point. However, patients should*

*continue to be closely followed, even after successful surgery,*

*because of the possibility of late recurrences, failed shunts, etc.*

~~~~~CASE 62 Visual Field Defect—Junctional Scotoma~~~~~

*62 Visual Field Defect—Junctional Scotoma*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A patient presented with painless progressive vision loss in the*

*right eye, a right afferent pupillary defect, a right central scotoma,*

*right optic atrophy, and a contralateral superior temporal*

*defect (junctional scotoma). The findings suggested a lesion in*

*the junction between the optic nerve and the chiasm on the*

*side with the central scotoma, and magnetic resonance imaging*

*showed a pituitary adenoma.*

*Keywords: junctional scotoma, visual field defect, tumor, compressive*

*optic neuropathy, optic atrophy*

*62.1 History*

*A 55-year-old man complained of progressive painless visual*

*impairment in his right eye over a period of 1 and 1/2 years. He*

*denied any visual difficulty in his left eye and denied any other*

*history of neurologic or ophthalmologic impairment.*

*Examination revealed visual acuity of 20/80 on the right and*

*20/20 on the left. He could identify 4 of 10 pseudoisochromatic*

*plates on the right and 10 of 10 on the left. Pupils were 4mm*

*bilaterally and both reacted well to light and near, but there*

*was a right relative afferent pupillary defect. Visual fields*

*revealed generalized diffuse depression on the right*

*(▶Fig. 62.1) and a superotemporal field defect respecting the*

*vertical meridian on the left (▶Fig. 62.2). Motility exam was*

*normal. Slit-lamp examination was normal. The right optic disc*

*was diffusely pale. The left optic disc, vessels, and macula were*

*normal.*

*62.2 Test Interpretation*

*Patients with junctional scotoma of Traquair or junctional scotoma*

*should be considered to have a compressive lesion at the*

*junction of the optic nerve and chiasm until proven otherwise.*

*Neuroimaging studies (preferably magnetic resonance imaging*

*[MRI]) should be directed to this location. Patients with junctional*

*scotomas (as the described patient) may be unaware of a*

*small superotemporal visual field defect. Therefore, in any patient*

*with presumed unilateral visual loss, careful testing*

*should be performed even in the contralateral asymptomatic*

*eye (▶Fig. 62.1).*

*62.3 Diagnosis*

*Right optic neuropathy with junctional scotoma secondary to*

*compressive lesion of the junction of the right optic nerve with*

*the chiasm (pituitary adenoma) (▶Fig. 62.3).*

*62.4 Medical Management*

*Hormone replacement for pituitary and chiasmal lesions is*

*recommended. Prolactin-secreting pituitary tumors are*

*sometimes treated with dopamine agonists. In general, surgical*

*decompression is recommended for suprasellar compressive*

*lesions.*

*62.5 Surgical Management*

*The treatment is surgical removal, if possible, of the underlying*

*structural lesion responsible for the visual field defect. In this*

*case, the patient underwent decompressive surgery. Depending*

*on the final histopathology, chemotherapy or radiation therapy*

*might be necessary for subtotal resection.*

*Differential Diagnosis—Key Points*

*1. The visual acuity, color vision, and field impairment on the*

*right, with a relative afferent pupillary defect and optic*

*atrophy, all suggest a right optic neuropathy but the*

*superotemporal visual field loss in the fellow eye places the*

*lesion at the junction of the optic nerve and chiasm. The*

*progressive, painless visual loss raises the possibility of a*

*compressive optic nerve lesion.*

*2. Lesions at the junction of the optic nerve and chiasm may*

*produce specific types of visual field defects that allow*

*topographical localization. Selective compression of the*

*crossed or uncrossed visual fibers at the junction may result*

*in a unilateral temporal or nasal hemianopic defect,*

*respectively (junctional scotoma of Traquair). In addition,*

*involvement of the inferonasal fibers of the anterior knee*

*(the supposed Wilbrand’s knee) results in a superotemporal*

*visual field defect contralateral to the lesion (junctional*

*scotoma).*

*3. The patient therefore has a lesion of the optic nerve at the*

*junction of the right nerve with the chiasm causing an*

*ipsilateral optic neuropathy and a contralateral superior*

*temporal defect (junctional scotoma).*

*4. Recently, the existence of Wilbrand’s knee has come into*

*question. It has been hypothesized that Wilbrand’s knee*

*may be an artifact of enucleation caused by atrophy of the*

*optic nerve and not a normal anatomic finding.*

*Nevertheless, whether Wilbrand’s knee exists anatomically,*

*the localizing value of junctional visual field loss to the*

*junction of the optic nerve and chiasm remains*

*undiminished since chiasmal compression alone may*

*result in a contralateral superotemporal visual field*

*defect.*

*5. Junctional field loss is usually due to a mass lesion, with a*

*differential diagnosis including pituitary tumors, suprasellar*

*meningiomas, supraclinoid aneurysms,*

*craniopharyngiomas, and gliomas. Chiasmal neuritis (e.g.,*

*due to multiple sclerosis), pachymeningitis, and trauma are*

*rare etiologies of the junctional syndrome.*

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*62.6 Rehabilitation and Follow-up*

*Follow-up of this patient’s ophthalmologic examination, including*

*visual field testing, was performed every 4 months for 1*

*year, and every 6 months thereafter, with periodic MRIs to*

*monitor for tumor growth.*

~~~~~CASE 63 Visual Field Defect—Pituitary Lesion~~~~~

*63 Visual Field Defect—Pituitary Lesion*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A patient with vision loss, multiple car accidents, and headaches*

*is found to have a bitemporal hemianopia on visual field*

*testing, and magnetic resonance imaging revealed a pituitary*

*adenoma in the chiasm. Painless and progressive bitemporal*

*visual field loss should be suspected to be a chiasmal lesion*

*until proven otherwise. Neuroimaging (preferably MRI of the*

*sella) is recommended. Common etiologies include pituitary*

*adenoma, craniopharyngioma, meningioma, and glioma.*

*Keywords: pituitary tumor, visual field defect, bitemporal hemianopia,*

*vision loss, chiasmal lesion*

*63.1 History*

*A 45-year-old woman complained of blurred vision bilaterally*

*and a poor driving performance with multiple accidents due to*

*“poor vision.” The visual difficulty had been present for the last*

*year and was slowly deteriorating. She also complained of occasional*

*frontal headaches over the last 6 months. She denied any*

*past history of neurologic or ophthalmologic illnesses and took*

*no medicines except acetaminophen for her headaches.*

*Examination revealed visual acuity to be 20/25 on the right*

*and 20/20 on the left. She identified 10 of 10 pseudoisochromatic*

*color plates bilaterally. The pupils were 4mm bilaterally*

*and were equally reactive to light and near, and there was no*

*relative afferent pupillary defect. Motility examination was normal.*

*Slit-lamp examination and fundus exam were normal. Visual*

*field testing showed bitemporal hemianopic defects*

*(▶Fig. 63.1a, b).*

*63.2 Test Interpretation*

*Visual field testing characteristically reveals a bitemporal visual*

*field impairment with chiasmal compression due to pituitary*

*lesions. Because a mass lesion is likely, magnetic resonance*

*imaging (MRI) with and without gadolinium with attention to*

*the sellar region is warranted. If a pituitary adenoma is found,*

*endocrinologic evaluation is warranted. Computed tomography*

*(CT) scan may be the initial study in the acute or emergent setting*

*(e.g., suspected pituitary apoplexy) or in cases where an*

*MRI cannot be performed.*

*63.3 Diagnosis*

*Bitemporal visual field defect secondary to pituitary macroadenoma*

*(▶Fig. 63.2).*

*63.4 Medical Management*

*Prolactinomas may respond to therapy with medications, such*

*as bromocriptine.*

*63.5 Surgical Management*

*Pituitary adenomas or other masses causing chiasmal compression*

*usually are treated surgically. Postoperatively, endocrinologic*

*follow-up and hormonal replacement may be required.*

*Some patients may require postoperative radiation therapy.*

*63.6 Rehabilitation and Follow-up*

*Postoperatively, visual field and ophthalmologic examination*

*should be performed as soon as the patient is able to tolerate*

*the procedure. Visual fields and serial ophthalmologic examination*

*should then be performed (e.g., in 3 months, then at 6-*

*month intervals for 2 years, yearly for 5 years, and every 2 years*

*thereafter) to monitor for recurrence. MRI studies should be*

*repeated at regular intervals (e.g., 6 months, 1 year, and then*

*yearly for several years).*

*Differential Diagnosis—Key Points*

*1. The visual field exam reveals a bitemporal field defect*

*indicating a lesion of the optic chiasm. Bitemporal*

*hemianopias may be peripheral, paracentral, or central and*

*are most often due to a compressive lesion of the optic*

*chiasm.*

*2. Clinically, three optic chiasm syndromes may be recognized:*

*(1) the anterior chiasm or junctional syndrome, in which a*

*unilateral optic nerve defect is associated with a superior*

*defect in the other eye; (2) the body of the chiasm*

*syndrome, in which patients demonstrate bitemporal field*

*abnormalities; visual acuity is often normal and the optic*

*discs may be normal or pale; (3) the posterior chiasm*

*syndrome, in which visual field testing reveals bitemporal*

*paracentral scotomas from the crossing macular fibers.*

*Visual acuity and the optic discs are normal.*

*3. Superior bitemporal field defects may also occur with tilted*

*discs, but in these cases the field defects do not respect the*

*vertical meridian.*

*4. The most common cause of bitemporal visual field*

*impairment is a parasellar mass, most often pituitary*

*adenomas, meningiomas, or craniopharyngiomas. Other*

*mass lesions include dysgerminomas, chiasmal gliomas,*

*metastases, and suprasellar aneurysms. Nonmass lesions*

*that may cause a chiasmal syndrome include demyelinating*

*disease (multiple sclerosis), ischemia, meningitis or*

*encephalitis, syphilis, inflammatory diseases (e.g.,*

*neuromyelitis optica, collagen vascular disease, sarcoidosis),*

*radiation necrosis, trauma, and some toxins (e.g., Placidyl).*

*5. Pituitary masses may occasionally cause an optic*

*neuropathy without evidence for chiasmal damage,*

*especially if the chiasm is postfixed, or may cause an optic*

*tract syndrome (homonymous hemianopsia) if the chiasm is*

*prefixed.*

~~~~~CASE 64 Visual Field Defect—Homonymous Hemianopia~~~~~

*64 Visual Field Defect—Homonymous Hemianopia*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A patient with a past history of hypertension, diabetes mellitus,*

*and hyperlipidemia after bypass surgery notices that he is*

*unable to read well because he “lose his place” or “miss lines”*

*and has bumped his left front fender on several occasions when*

*attempting to park his car in the garage. Visual field testing*

*showed a left homonymous hemianopia indicating a retrochiasmal*

*lesion of the visual pathways and this patient had a right*

*occipital lobe stroke.*

*Keywords: homonymous hemianopia, visual field defect, stroke,*

*vision loss, visual field cut, occipital lobe stroke, retrochiasmal*

*lesion*

*64.1 History*

*A 57-year-old man underwent coronary bypass surgery 6*

*weeks prior to evaluation. His recovery was apparently*

*uneventful, and within several weeks he returned to his usual*

*duties. However, since surgery he noted that he would often*

*“lose his place” or “miss lines” when reading. He had also noted*

*that he bumped his left front fender on several occasions when*

*attempting to park his car in the garage. He had a past history*

*of hypertension, diabetes, and increased cholesterol. He had no*

*other neurologic symptoms.*

*Examination revealed visual acuity to be 20/20 in both eyes.*

*He identified 9 of 10 pseudoisochromatic plates bilaterally, but*

*often had difficulty with the figures in the left part of the diagrams.*

*The pupils were 4mm bilaterally, reacted well to light*

*and near, and there was no relative afferent pupillary defect.*

*Motility exam was normal. Slit-lamp exam revealed mild bilateral*

*nuclear sclerotic cataracts. Fundus exam revealed mild*

*hypertensive changes (arteriovenous nicking, arteriolar sclerosis)*

*with normal discs. There were no hemorrhages or exudates.*

*The general neurologic examination was otherwise normal. Visual*

*field testing showed a left homonymous hemianopia*

*(▶Fig. 64.1).*

*Differential Diagnosis—Key Points*

*1. The visual field exam reveals a complete left homonymous*

*hemianopia indicating a retrochiasmal lesion of the visual*

*pathways. In general, visual field defects with lesions*

*affecting the optic tract or lateral geniculate body (LGB)*

*tend to be incongruous, while more posteriorly located*

*lesions (e.g., occipital lobe) result in more congruous field*

*defects. In general, tumors produce sloping field defects,*

*while vascular lesions produce sharp field defects.*

*2. Complete homonymous hemianopias are lateralizing and*

*indicate a retrochiasmal lesion but are otherwise not further*

*localizing and may occur with any lesion of the*

*retrochiasmal visual pathways.*

*3. Optic tract lesions usually cause macular-splitting,*

*incongruous homonymous hemianopia, usually without*

*impaired visual acuity unless the lesion extends to involve*

*the optic chiasm or nerve. Optic tract lesions may be*

*associated with a relative afferent pupillary defect in the eye*

*with the temporal field loss (contralateral to the side of the*

*lesion) because within the tract there are more crossed than*

*uncrossed fibers and the temporal visual field is larger than*

*the nasal visual field. Chronic optic tract lesions may*

*eventually cause bilateral optic atrophy with a characteristic*

*“band” or “bowtie” pallor in the contralateral eye and a*

*more generalized pallor in the ipsilateral optic nerve, with*

*loss of nerve fiber layer in the superior and inferior arcuate*

*regions corresponding to the bulk of temporal fibers*

*subserving the nasal visual fields (hemianopic optic*

*atrophy). Etiologies for optic tract lesions include spaceoccupying*

*lesions, especially tumors, aneurysms,*

*arteriovenous malformations, demyelinating disease, and*

*trauma.*

*4. LGB lesions may also cause a complete macular-splitting*

*homonymous hemianopia. LGB lesions result in an*

*incongruous homonymous field defect. Hemianopic optic*

*atrophy may develop and no relative afferent pupillary*

*defect is evident. Although lesions of the LGB often cause*

*incongruous field defects, two somewhat specific patterns*

*of congruous homonymous field defects with abruptly*

*sloping borders, associated with sectorial optic atrophy,*

*have been attributed to focal lesions of the LGB caused by*

*infarction in the territory of specific arteries. Occlusion of*

*the anterior choroidal artery may cause a homonymous*

*defect in the upper and lower quadrants with sparing of a*

*horizontal sector (quadruple sectoranopia). Interruption of*

*the posterior lateral choroidal artery, which perfuses the*

*central portion of the lateral geniculate, causes a horizontal*

*homonymous sector defect (wedge shaped). Etiologies for*

*lateral geniculate damage include infarction, arteriovenous*

*malformation, trauma, tumor, inflammatory disorders,*

*demyelinating disease, and toxic exposure (e.g., methanol).*

*5. Lesions of the proximal portion of the optic radiations may*

*result in a complete homonymous hemianopia with macular*

*splitting. Superior homonymous quadrantic defects (“pie-inthe-*

*sky” field defects) may result from a lesion in the*

*temporal (Meyer’s loop) lobe involving the optic radiations*

*or in the inferior bank of the calcarine fissure. Although*

*visual field defects may occur in isolation with temporal lobe*

*lesions, other signs of neurologic impairment are often*

*evident. Involvement of the optic radiations in the depth of*

*the parietal lobe gives rise to a congruous contralateral*

*homonymous hemianopia, denser inferiorly (“pie on the*

*floor”). Such defects are usually more congruous than those*

*produced by lesions of the temporal lobe and since the*

*entire optic radiation passes through the parietal lobe, large*

*lesions may produce complete homonymous hemianopia*

*with macular splitting. Patients may often be unaware of*

*their visual field defects. Visual field defects may occur in*

*relative isolation, but often parietal lobe lesions betray*

*themselves by other signs of neurologic dysfunction.*

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*6. Homonymous quadrantic visual field defects may occur*

*with unilateral occipital lesions. Superior quadrantic defects*

*may be seen with inferior calcarine lesions and inferior*

*quadrantic defects may occur with superior calcarine*

*lesions. Medial occipital lesions cause highly congruous*

*homonymous field defects. When both the upper and the*

*lower calcarine cortices are affected, a complete*

*homonymous hemianopia, usually with macular sparing,*

*develops. Sparing of the central 5 degrees of vision*

*(macular sparing) is common with occipital lesions,*

*probably due to a large macular representation in the*

*occipital pole. The central 10 to 15 degrees of vision fill a*

*majority of the total surface area of the occipital cortex (as*

*much as 50–60%). Patients with purely occipital lesions may*

*be unaware of their deficit. The most common cause of*

*unilateral occipital disease is infarction in the distribution of*

*the posterior cerebral artery. Other etiologies include*

*venous infarction, hemorrhage, arteriovenous*

*malformations, tumors, abscess, and trauma.*

*64.2 Test Interpretation*

*The congruous nature of the visual field abnormality, the*

*absence of a relative afferent pupillary defect, and the absence*

*of other neurologic findings suggest an optic radiation or occipital*

*localization for the patient’s visual field impairment. In all*

*patients with a retrochiasmal visual field defect, neuroimaging*

*is warranted. In the acute setting, computed tomography (CT)*

*scanning is appropriate, but in most other settings, magnetic*

*resonance imaging (MRI) is indicated.*

*64.3 Diagnosis*

*Right occipital lobe infarction causing a dense, congruous left*

*homonymous hemianopia (▶Fig. 64.2).*

*64.4 Medical and Surgical*

*Management*

*Management depends on the underlying cause of the retrochiasmal*

*visual field impairment. In this case, there is little to*

*offer except control of stroke risk factors and probably aspirin*

*for stroke prophylaxis.*

*64.5 Rehabilitation and Follow-up*

*Patients should have repeat visual fields and ophthalmologic*

*examination approximately 6 months after the onset of the*

*defect to see if there is any improvement.*

*Reading problems are common in patients with homonymous*

*field defects. Patients with right homonymous hemianopias*

*have difficulty seeing which letters or words follow those*

*they have already read and patients with left hemianopias often*

*lose their place when reading, often beginning again on an*

*unrelated line. Use of a ruler to guide the patient’s vision is*

*often useful. Hemianopic patients may also be trained to perform*

*large saccades into the blind field and to search their*

*entire field in various patterns resulting in some visual*

*improvement. Optical aids such as monocular prism glasses can*

*be used to reduce the apparent visual field loss by shifting visual*

*stimuli from the blind field into the patient’s seeing field. A*

*computerized therapy called vision restoration therapy (VRT)*

*also reportedly has produced subjective improvement in visual*

*Fig. 64.1 Visual field testing revealed a dense,*

*congruous left homonymous hemianopia*

*indicating a retrochiasmal lesion of the visual*

*pathways.*

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*field but independent automated perimetry studies after VRT*

*have failed to conclusively demonstrate proven visual field*

*improvement objectively and thus VRT remains controversial.*

~~~~~CASE 65 Transient Monocular Visual Loss~~~~~

*65 Transient Monocular Visual Loss*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A patient with a past history of hypertension and hyperlipidemia*

*with transient monocular vision loss and an intravascular*

*embolic debris (Hollenhorst’s plaque) in the right eye needs to*

*be evaluated for carotid and aortic vascular disease, cardiac*

*valvular disease, stroke, giant cell arteritis, and retinal vascular*

*occlusion.*

*Keywords: transient monocular vision loss, Hollenhorst’s*

*plaque, Stroke, giant cell arteritis, retinal vascular occlusion,*

*embolic debris*

*65.1 History*

*A 65-year-old woman noted three episodes of transient visual*

*loss (TVL) in her right eye over the last 3 weeks. She noted no*

*precipitating factors for the episodes but the vision would*

*“gray-out” in the right eye for a period of 5 or 6 minutes. She*

*denied any associated headaches, jaw claudication, persistent*

*visual loss, or any transient neurologic dysfunction. She had a*

*past medical history of hypertension and increased cholesterol,*

*both being controlled by medications.*

*Examination revealed visual acuity of 20/25 on the right and*

*20/20 on the left. She identified 9 of 10 pseudoisochromatic*

*plates bilaterally. Pupils were 4mm bilaterally and both reacted*

*well to light and near. There was no relative afferent pupillary*

*defect. Visual fields were normal. Motility exam was normal.*

*Slit-lamp exam revealed mild bilateral nuclear sclerotic cataracts.*

*Fundus exam revealed an intravascular embolic debris*

*(Hollenhorst’s plaque) in the right eye (▶Fig. 65.1).*

*Differential Diagnosis—Key Points*

*1. The most important questions that need to be addressed*

*in the assessment of the patient with TVL include the*

*following:*

*a) Is the visual loss monocular or binocular? Monocular TVL*

*implies disease of the eye, retina, optic nerve, orbit,*

*circulation to the eye (heart, aorta, carotid artery,*

*ophthalmic artery central retinal artery, etc.), or*

*migraine. Binocular TVL implies bilateral eye disease,*

*disease affecting the circulation to both eyes (e.g.,*

*bilateral carotid stenosis), increased intracranial pressure*

*with papilledema, or, most often, disease of the*

*vertebrobasilar circulation (especially vertebrobasilar*

*transient ischemic attacks) or migraine.*

*b) What is the temporal profile of the transient loss of*

*vision? For example, TVL in one eye lasting seconds is*

*characteristic of transient obscurations of vision due to*

*optic nerve ischemia or papilledema, while monocular*

*TVL lasting 2 to 30 minutes is characteristic of TVL*

*associated with ischemia of the retina.*

*c) What are the precipitants of the visual loss? For*

*example, patients with an intraorbital mass may develop*

*TVL only in certain eye positions due to the mass*

*compressing the ipsilateral optic nerve or optic nerve*

*circulation (i.e., gaze-evoked amaurosis). Monocular or*

*binocular TVL due to carotid disease or giant cell arteritis*

*may occur following exposure to bright light.*

*d) Are any optic nerve or retinal vessel abnormalities*

*evident on fundus examination? For example, fundus*

*exam may well reveal papilledema in a patient with*

*transient obscurations of vision, retinal emboli in a*

*patient with carotid or cardiac disease, and disc*

*anomalies in a patient with monocular TVL.*

*2. Episodes of TVL lasting less than 60 seconds may occur in*

*patients with papilledema. These transient obscurations of*

*vision may occur in one or both eyes (individually or*

*simultaneously) and typically last only a few seconds.*

*Rarely, they may last for hours. The episodes may be*

*precipitated by changes in position and are thought to be*

*related to the effects of increased intracranial pressure on*

*the flow of blood to the eye, perhaps where the central*

*retinal artery penetrates the optic nerve sheath to enter*

*the substance of the nerve. Similar monocular episodes of*

*TVL lasting seconds may occur in patients with optic nerve*

*sheath meningiomas and are probably unrelated to*

*increased intracranial pressure. Transient obscurations of*

*vision may also occur in an eye with congenital*

*abnormalities of the optic disc, such as peripapillary*

*staphyloma (see below) or optic disc drusen. Finally,*

*carotid atherosclerotic disease may rarely cause very brief Fig. 65.1 Fundus photograph of right eye showing retinal emboli.*

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*episodes of TVL, but more often attacks of TVL with carotid*

*disease last 2 to 15 minutes.*

*3. Monocular TVL lasting 5 to 60 minutes (usually 2–*

*30 minutes) is strongly suggestive of thromboembolic*

*disease. These episodes are most often due to emboli,*

*involving the retinal arterial system, which may arise from*

*aorta or carotid artery atherosclerotic disease or a*

*cardiogenic source. Patients often describe a veil or shade*

*descending or ascending (i.e., altitudinal visual field loss)*

*over a portion or the whole of their visual field. Other*

*patients complain of patchy visual loss (“Swiss cheese”*

*pattern) or peripheral constriction with central visual*

*sparing. Patients with TVL from thromboembolic disease*

*may demonstrate emboli lodged within the retinal vessels.*

*In general, emboli may be composed of clotted blood,*

*fibrin, platelets, atheromatous tissue, white cells, calcium,*

*infectious organisms (septic emboli), air, fat, tumor cells,*

*amniotic fluid, or foreign materials (e.g., talc, artificial valve*

*material, catheters, silicone, cornstarch, mercury,*

*corticosteroids). The most common types of emboli seen*

*in patients with atherosclerotic disease of the aorta/carotid*

*arteries or cardiac disease include the following:*

*a) Cholesterol emboli (Hollenhorst’s plaques) are bright,*

*glistening, yellow or copper-colored fragments, most*

*often seen in peripheral arterioles in the temporal*

*fundus. These emboli most often arise from*

*atheromatous plaques in the aorta or carotid*

*bifurcation.*

*b) Platelet-fibrin emboli are dull, white, gray, often*

*elongated, and subject to fragmentation and distal*

*movement. These emboli most often lodge at*

*bifurcations of retinal vessels and arise from the walls of*

*atherosclerotic arteries or from the heart, especially*

*from heart valves. They may also be seen in patients*

*with coagulopathies.*

*c) Calcific emboli tend to be large, ovoid or rectangular, and*

*chalky-white. These emboli often occur over or adjacent*

*to the optic disc and usually arise from cardiac (aortic or*

*mitral) valves, less often from the aorta or carotid*

*artery. Unlike cholesterol emboli, which often disappear*

*in a few days, calcific emboli may remain permanently*

*visible.*

*4. TVL may also occur from ocular hypoperfusion rather than*

*embolization. In some patients, monocular TVL may occur*

*when the patient is exposed to bright light. These patients*

*usually have severe ipsilateral carotid occlusive disease.*

*Venous stasis retinopathy (hypotensive retinopathy),*

*associated with severe carotid or ophthalmic artery*

*occlusive disease, may also be associated with TVL. This*

*syndrome is characterized by visual loss and ischemic*

*retinal infarction often accompanied by signs of ciliary*

*artery obstruction, pallor of the disc, and hypotony.*

*5. Giant cell arteritis may produce attacks of TVL lasting*

*minutes to hours indistinguishable from those produced by*

*atheromatous disease. TVL probably results from*

*intermittent inflammatory occlusion of the ophthalmic,*

*posterior ciliary, or central retinal arteries.*

*6. TVL may also occur in association with increased*

*antiphospholipid antibodies, hyperviscosity and*

*hypercoagulable states, polycythemia vera, systemic lupus*

*erythematosus, and arteriovenous malformations that*

*divert blood flow from or reduce blood flow in the*

*ophthalmic artery (ophthalmic steal syndrome).*

*7. Vasospasm, especially associated with migraine, may also*

*produce TVL without any of the visual phenomena typically*

*seen during a migraine attack. Vasospasm of the retinal*

*vessels has been documented by ophthalmoscopy during*

*some attacks of monocular TVL.*

*8. TVL lasting 15 to 20 minutes (occasionally up to 7 hours)*

*may occur during episodes of spontaneous anterior*

*chamber hemorrhage (hyphema). In these patients TVL*

*may be associated with erythropsia (seeing red) and color*

*desaturation. Such hemorrhages are most likely to occur in*

*patients who have undergone cataract extraction and are*

*particularly apt to occur after placement of an iris fixation*

*lens implant. Intermittent angle-closure glaucoma may*

*also cause brief episodes of monocular TVL that are usually,*

*but not always, associated with ipsilateral eye pain and*

*occasionally simultaneous dilation of the pupil. Finally, TVL*

*may also be associated with the congenital anomalies*

*peripapillary staphyloma and morning glory syndrome.*

*Episodes of TVL with these anomalies may last 15 to 20*

*seconds (obscurations of vision) or up to 20 minutes, the*

*latter mimicking TVL with thromboembolic disease. The*

*episodes of TVL in patients with peripapillary staphyloma*

*may be associated with intermittent dilation of the retinal*

*veins and may be orthostatic.*

*9. Episodes of monocular TVL lasting hours are rare. However,*

*such spells may occur with thromboembolic disease, as a*

*postprandial phenomenon associated with critical carotid*

*stenosis, and with migraine.*

*10. In the patient described, the episodes of monocular TVL*

*lasted minutes and on examination there was evidence of*

*plaque in the retinal arterioles. Thus, thromboembolic*

*disease is the most likely etiology of the episodes.*

*65.2 Test Interpretation*

*All patients with monocular TVL lasting minutes should have a*

*complete ophthalmoscopic examination to investigate for such*

*conditions as intermittent angle-closure glaucoma, morning*

*glory syndrome, and peripapillary staphyloma. Spontaneous*

*anterior chamber hemorrhage (hyphema) should also be considered,*

*especially in patients with associated erythropsia and*

*in patients who have undergone cataract extraction (unstable*

*intraocular lens, haptic chafing iris).*

*Patients with monocular TVL lasting minutes associated*

*with visible retinal emboli need to be evaluated for carotid and*

*aortic vascular disease and cardiac valvular disease. Stroke risk*

*factors (smoking, hypertension, diabetes mellitus, hyperlipidemia,*

*etc.) should be evaluated and controlled. Studies to evaluate*

*the carotid arteries might include carotid Doppler and*

*ultrasound, magnetic resonance (MR) angiography, and conventional*

*angiography. Cardiac investigations might include transthoracic*

*and transesophageal echocardiography and cardiac MR*

*imaging.*

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*In patients older than 55 years with a history of monocular*

*TVL lasting minutes without visible retinal emboli, giant cell*

*arteritis should be considered and an erythrocyte sedimentation*

*rate (ESR) and/or C-reactive protein (CRP) should be performed.*

*If this is significantly elevated or the patient has other*

*symptoms of giant cell arteritis, such as recent headaches, jaw*

*claudication, or polymyalgia rheumatica–like symptoms, the*

*patient should probably undergo temporal artery biopsy. If the*

*ESR and CRP are negative and there are no clinical symptoms*

*suggestive of giant cell arteritis, then evaluation for carotid or*

*cardiac thromboembolic disease is warranted.*

*Patients with evidence of monocular TVL due to ocular hypoperfusion*

*(venous stasis retinopathy and the ocular ischemic*

*syndrome) may have decreased retinal artery pressure documented*

*by ophthalmodynamometry. The patient should be*

*investigated for hemodynamically significant carotid stenosis.*

*If no thromboembolic source for the episodes of TVL is documented,*

*then further studies could be performed. These include*

*MR imaging of the brain with MR angiography to investigate for*

*possible vascular malformation, and laboratory studies, including*

*sedimentation rate, complete blood count, antiphospholipid antibodies,*

*antinuclear antibodies, collagen vascular disease profile,*

*and studies to investigate the presence of dysproteinemia.*

*Younger patients (younger than 45 years) with monocular TVL*

*are unlikely to have significant carotid disease. A cardiac embolic*

*source as well as a vasculitis or coagulopathy must be sought.*

*65.3 Diagnosis*

*Retinal emboli secondary to right carotid stenosis causing transient*

*monocular visual loss.*

*65.4 Medical Management*

*In the patient with no carotid embolic source and no hemodynamically*

*significant carotid stenosis, a cardiac or aortic*

*embolic source, hypercoagulable state, or vasculitic etiology*

*should be sought and, if none is found, the treatment is aspirin*

*or other antiplatelet therapy plus control of stroke risk factors.*

*65.5 Surgical Management*

*In patients with monocular TVL and ipsilateral carotid stenosis*

*of 70 to 99%, carotid endarterectomy may be indicated if the patient*

*is a suitable stenting or surgical candidate and if the perioperative*

*morbidity and mortality rate of the surgeon is in the*

*2% or less range. Carotid endarterectomy in this group reduces*

*the 2-year ipsilateral stroke rate from 26 to 9% and decreases*

*the major or fatal ipsilateral stroke rate from 13.1 to 2.5%. Carotid*

*stenting also is another option. In a patient with 30 to 69%*

*stenosis, it remains to be seen whether stenting or endarterectomy*

*would be beneficial. In patients with emboli from a*

*cardiac valvular source, especially patients with cardiac dysrhythmias*

*such as atrial fibrillation, anticoagulation may be*

*warranted if the patient is an appropriate medical candidate.*

*65.6 Rehabilitation and Follow-up*

*Medical supervision of stroke risk factors is warranted. Periodic*

*reevaluation of the carotid artery for restenosis is warranted by*

*noninvasive studies (e.g., carotid Doppler or MR angiography).*

~~~~~CASE 66 Third Nerve Palsy—Ischemic~~~~~

*66 Third Nerve Palsy—Ischemic*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 70-year-old patient with a history of hypertension and diabetes*

*mellitus presented with 4 weeks of binocular diplopia, normal*

*pupils, ptosis of his right upper lid, mild bilateral diabetic*

*nonproliferative retinopathy, and no adduction, elevation, or*

*depression with intact abduction consistent with a pupil-sparing,*

*complete ischemic third nerve palsy.*

*Keywords: ischemic third nerve palsy, ptosis, abnormal eye*

*movement, diplopia, lid drooping, pupil-sparing third nerve*

*palsy*

*66.1 History*

*A 70-year-old man had a 4-week history of binocular diplopia.*

*The diplopia developed and worsened over a 5-day period, but*

*it then “stabilized” and in fact had “improved” since his right*

*eye “drooped.” In the first 2 weeks, he had also noticed severe*

*retro-orbital pain on the right but this pain became minimal.*

*He had a history of bilateral cataract extraction but his vision*

*had otherwise been “stable.” He had a past history of hypertension*

*and diabetes. He smoked one pack of cigarettes daily. He*

*denied any facial numbness, recent headache, jaw claudications,*

*or other neurologic deficits.*

*Examination revealed visual acuity of 20/30 on the right and*

*20/25 on the left. Pupils were 3mm bilaterally and both reacted*

*well to light and near. There was no relative afferent pupillary*

*defect. Visual fields were normal. He had complete ptosis of his*

*right lid (▶Fig. 66.1) with markedly impaired levator function.*

*He could not adduct (▶Fig. 66.2), elevate, or depress*

*(▶Fig. 66.3) the right eye but he could fully abduct the eye.*

*Attempts at depression of the right eye resulted in mild incyclodeviation*

*of the eye (consistent with an intact ipsilateral fourth*

*nerve). Motility was normal in the left eye. There was no proptosis,*

*facial sensation was normal, and general neurologic exam*

*was otherwise normal. Slit-lamp exam revealed bilateral posterior*

*chamber intraocular lenses. Fundus exam revealed mild*

*bilateral diabetic nonproliferative retinopathy without optic*

*disc pathology.*

*Differential Diagnosis—Key Points*

*1. The severe ptosis and marked impairment of elevation,*

*adduction, and depression in the right eye are compatible*

*with a pupil-sparing, complete motor third nerve palsy*

*(TNP). Full abduction and the incyclodeviation on downward*

*gaze suggest that sixth nerve and fourth nerve functions,*

*respectively, are spared.*

*2. TNPs are divided into nonisolated and isolated TNP. The*

*isolated TNP were defined as TNP without associated*

*neurologic findings (e.g., other cranial neuropathies). The*

*types of TNPs are outlined in the list below.*

*3. Isolated TNP with a normal pupillary sphincter and*

*completely palsied extraocular muscles is almost never due*

*to an intracranial aneurysm. This type of TNP is most*

*commonly caused by ischemia, especially diabetes mellitus.*

*In patients with isolated atraumatic TNP, diabetes mellitus is*

*the most common etiology accounting for 46% of all the*

*cases with pupil-sparing documented in 68 to 86% of the*

*cases. The probable explanation for pupillary sparing in*

*diabetic TNP is the lack of damage to the periphery of the*

*nerve where the majority of pupillomotor fibers are thought*

*to pass. This type of TNP involvement may rarely occur with*

*pituitary adenoma or other compressive lesions.*

*66.2 Definitions of the Five Types*

*of Third Nerve Palsy*

*1. Type 1: Nonisolated TNP—TNP is considered nonisolated in*

*the presence of the following features:*

*2. Other neurologic or neuro-ophthalmologic signs (e.g., other*

*cranial nerve palsies, brainstem signs, orbital signs),*

*evidence to suggest myasthenia gravis such as fatigability of*

*the motility defect.*

*3. Type 2: Traumatic isolated TNP—Isolated unilateral TNPs that*

*have a clearly established temporal relationship to*

*significant previous head trauma and do not progress are*

*considered traumatic in origin.*

*4. Type 3: Congenital isolated TNP—TNP that a patient is born*

*with or is noted to have within the first 3 months of life.*

*5. Type 4: Acquired, nontraumatic isolated TNP*

*a) Type 4A: TNP with a normal pupillary sphincter with*

*completely palsied extraocular muscles.*

*b) Type 4B: TNP with normal pupillary sphincter and*

*incomplete palsied extraocular muscles.*

*c) Type 4C: TNP with subnormal pupillary sphincter*

*dysfunction and partial or complete extraocular muscle*

*palsies.*

*6. Type 5: TNP with signs of aberrant regeneration.*

*Fig. 66.1 External photography reveals a complete ptosis of the right*

*upper eyelid with markedly impaired levator function.*

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*(Adapted from Lee AG, Brazis PW. Clinical Pathways in Neuro-*

*Ophthalmology: An Evidence-Based Approach. New York, NY:*

*Thieme; 1998, with permission.)*

*66.3 Test Interpretation*

*Patients who develop an isolated TNP with completely palsied*

*extraocular muscles but with pupillary sparing do not need*

*catheter angiography. Some authors have suggested that a neuroimaging*

*studies (e.g., cranial computed tomography[CT]/*

*computed tomography angiography [CTA] or magnetic resonance*

*imaging [MRI]/magnetic resonance angiography [MRA])*

*in this setting need not be performed initially, as the yield for*

*detecting a compressive lesion is very low. Other authors, however,*

*recommend neuroimaging for all ocular motor cranial*

*neuropathies regardless of vasculopathic risk factors because of*

*the small but real chance of underlying treatable etiology being*

*discovered on the imaging study. Neuroimaging should, however,*

*be performed in patients with no vasculopathic risk factors*

*or in patients who do not improve by 12 weeks of followup.*

*Patients who are seen within 1 week of onset of this type of*

*TNP should be observed at 24- to 48-hour intervals during the*

*first week because some patients with aneurysms may develop*

*delayed pupil involvement. Patients who develop pupil involvement*

*should be reevaluated for the possibility of a compressive*

*lesion, such as an aneurysm.*

*Patients older than 55 years, especially those with other*

*symptoms suggestive of giant cell arteritis (e.g., headache, jaw*

*or tongue claudication, polymyalgia rheumatica symptoms),*

*should have an erythrocyte sedimentation rate (ESR) and Creactive*

*protein (CRP). Temporal artery biopsy should be considered*

*if the ESR or CRP is elevated or other systemic symptoms*

*of GCA are present.*

*Myasthenia gravis may rarely mimic this type of TNP, so a*

*Tensilon test should be considered, primarily in patients with*

*fluctuating or fatiguing ptosis or ophthalmoplegia. If the complete,*

*pupil-spared TNP improves following a period of observation,*

*no neuroimaging is required.*

*66.4 Diagnosis*

*Ischemic isolated TNP.*

*66.5 Medical Management*

*Vasculopathic risk factors, especially diabetes mellitus, hypertension,*

*and increased cholesterol, should be sought and*

*controlled.*

*66.6 Surgical Management*

*Strabismus surgery or lid surgery may be helpful in selected*

*patients with unresolved ophthalmoplegia, diplopia, or ptosis.*

*66.7 Rehabilitation and Follow-up*

*The patient should be followed at 1- to 2-month intervals to see*

*if the TNP improves. Complete resolution for ischemic TNP is*

*expected to occur in 3 to 6 months. If no improvement is evident*

*by 3 months after onset, neuroimaging for a compressive*

*lesion is warranted.*

~~~~~CASE 67 Third Nerve Palsy—Aneurysm~~~~~

*67 Third Nerve Palsy—Aneurysm*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 45-year-old man presented with acute binocular diplopia,*

*left-sided frontal-periorbital pain, left-sided lid droop, anisocoria*

*(left pupil larger than the right), and partial paresis of elevation,*

*adduction, and depression in the left eye consistent with a*

*pupil involving third nerve palsy secondary to a posterior communicating*

*artery aneurysm found on computed tomography/*

*computed tomography angiography (CT/CTA).*

*Keywords: third nerve palsy, posterior communicating artery*

*aneurysm, pupil involving third nerve palsy, diplopia, lid droop,*

*ptosis, anisocoria*

*67.1 History*

*A 45-year-old man noted the acute onset of binocular diplopia*

*8 days prior to evaluation. He noted the acute onset of leftsided*

*frontal-periorbital pain and then noted the onset of diplopia*

*with a left-sided lid droop. He was previously well with no*

*history of significant illnesses.*

*Examination revealed visual acuity of 20/20 bilaterally. He*

*identified 10 of 10 pseudoisochromatic plates bilaterally. Pupils*

*were 3mm on the right and 5mm on the left in the light and*

*measured 4mm on the right and 5mm on the left in the dark.*

*The left pupil reacted minimally to light and near, and there*

*was no relative afferent pupillary defect. Visual fields were full*

*to confrontation. The patient had a mild left hypotropia and a*

*moderate exotropia. Duction testing was normal on the right*

*but revealed partial paresis of elevation, adduction, and depression*

*in the left eye. There were 3mm of ptosis on the left with*

*mildly impaired levator function. Facial sensitivity and strength*

*were normal with normal corneal reflexes bilaterally. Slit-lamp*

*exam and fundus exam were normal. General neurologic*

*examination was otherwise normal.*

*67.2 Test Interpretation*

*In this patient, CT/CTA and MRI and MRA showed an ipsilateral*

*posterior communicating artery aneurysm. Cerebral angiography*

*confirmed the aneurysm.*

*67.3 Diagnosis*

*Partial TNP due to cerebral aneurysm of the posterior communicating*

*artery (▶Fig. 67.1).*

*67.4 Medical Management*

*Not applicable.*

*67.5 Surgical Management*

*Surgery or endovascular therapy to repair the aneurysm is necessary*

*to prevent aneurysmal rupture, which carries a high*

*morbidity and mortality.*

*Differential Diagnosis—Key Points*

*1. The patient has evidence of an isolated, partial third nerve*

*palsy (TNP) on the left with pupillary involvement.*

*2. Isolated TNP may occur with lesions localized anywhere*

*along the course of the third nerve from the fascicle in the*

*mesencephalon to the orbit.*

*3. Patients with a “relative pupil-sparing” TNP probably should*

*have consideration for magnetic resonance imaging (MRI)*

*and MR angiography (MRA), CT or CTA, and possible*

*catheter-based cerebral digital subtraction angiography*

*(DSA), to rule out the possibility of a compressive lesion,*

*especially a cerebral aneurysm.*

*4. Because 10 to 20% of patients with ischemic TNP have*

*pupillary dysfunction, there will be a certain percentage of*

*normal angiograms in patients with partial TNP. In a series*

*of 26 consecutive patients with diabetes-associated TNP,*

*internal ophthalmoplegia occurred in 10 of 26 patients*

*(38%), and the degree of anisocoria was 1mm or less in*

*most patients. None of these cases had a fully dilated,*

*nonreactive pupil. It was concluded that anisocoria rather*

*than pupil reactivity to light should be the defining criterion*

*for pupil involvement.*

*5. Patients with an incomplete motor TNP with no pupillary*

*involvement require an MRI and MRA to rule out a mass*

*lesion. If the MRI is normal, cerebral angiography could be*

*considered to investigate the presence of an aneurysm,*

*dural-cavernous sinus fistula, or high-grade carotid stenosis.*

*Computed tomography angiography (CTA) or MRA may*

*eventually take the place of arteriography; however, at this*

*time, cerebral angiography is the “gold standard” for the*

*diagnosis of cerebral aneurysms. Although CTA/MRA may*

*be able to detect up to 95% of cerebral aneurysms that will*

*bleed, it cannot completely exclude aneurysm as the*

*etiology of a pupil-involved TNP.*

*6. Complete TNP with pupil involvement occurring in isolation*

*is often due to compressive lesions or meningeal infiltration;*

*thus, a CT/CTA followed by an MRI and MRA may still be*

*warranted. If these less invasive neuroimaging studies are*

*negative, a cerebral DSA may still be necessary to*

*investigate for aneurysm or less likely a dural-cavernous*

*sinus fistula. If meningeal signs are present, spinal fluid*

*evaluation is generally warranted. A fully dilated and*

*nonreactive pupil occurs in up to 71% of patients with*

*aneurysmal compression and TNP. Aneurysms impair the*

*pupil in 96% of TNP, and the remaining 4% in which the*

*pupil is spared have only partial TNP.*

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*67.6 Rehabilitation and Follow-up*

*Patching the eye to relieve the diplopia is often required.*

~~~~~CASE 68 Fourth Nerve Palsy—Congenital~~~~~

*68 Fourth Nerve Palsy—Congenital*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 10-year-old patient experienced acute onset of vertical binocular*

*diplopia with a right hypertropia, worse on gaze to the left*

*and right head tilt, consistent with a right fourth cranial nerve*

*palsy. Vertical fusional amplitudes were 10 PD characteristic of*

*congenital cases.*

*Keywords: congenital fourth nerve palsy, vertical diplopia, abnormal*

*eye movements, head tilt, large vertical fusional amplitudes,*

*hypertropia*

*68.1 History*

*A 10-year-old boy noted the acute onset of vertical binocular*

*diplopia for 2 weeks. He stated that one image was “below and*

*to the side of the other” and denied any subjective torsion of the*

*images. He denied any clear precipitants for the diplopia and*

*denied any associated headaches, facial numbness, ptosis, or any*

*other complaints. He had no significant past medical history.*

*Exam revealed visual acuity to be 20/20 bilaterally with normal*

*color vision. Pupils were 5mm bilaterally and equally reactive*

*to light and near, and there was no relative afferent*

*pupillary defect. The patient tended to tilt his head to the left*

*(▶Fig. 68.1). There was a 4 prism diopter (PD) right hypertropia*

*(RHT) at distance, 8 PD RHT on left gaze, 1 PD RHT on right gaze,*

*2 PD RHT on upward gaze, and 7 PD RHT on downward gaze.*

*Head tilt to the right caused an 8 PD RHT and head tilt to the*

*left was associated with a 2 PD RHT. Double Maddox rod testing*

*revealed 4 degrees of right excyclodeviation. Vertical fusional*

*amplitudes were 10 PD. Ductions, versions, saccades, and pursuit*

*eye movements were intact. There were no ptosis, facial*

*paresis, or abnormalities of facial sensation. Slit-lamp exam and*

*fundus exam were normal but indirect ophthalmoscopy*

*revealed some degree of excyclotropia in the right eye.*

*Differential Diagnosis—Key Points*

*1. The RHT, worse on gaze to the left and right head tilt, is*

*compatible with a right isolated superior oblique paresis,*

*most often due to a fourth cranial nerve palsy. Other*

*entities to be considered include myasthenia gravis and*

*thyroid eye disease.*

*2. Fourth nerve palsies (FNPs) may cause the following:*

*a) Noncomitant hypertropia demonstrated with the threestep*

*maneuver. The hypertropia increases on head tilt*

*toward paralyzed side (positive Bielschowsky’s test).*

*Hypotropia may occur in the normal eye if the affected*

*eye is fixating; if the unaffected eye is fixating,*

*hypertropia occurs in the involved eye. This hypertropia is*

*usually most prominent in the field of gaze of the*

*involved superior oblique muscle, especially in cases of*

*acute or recent onset. The hypertropia may also be most*

*prominent in the field of gaze of the ipsilateral overacting*

*inferior oblique muscle in subacute or chronic cases or*

*may be evident in the entire paretic field (spread of*

*comitance).*

*b) Underaction of the ipsilateral superior oblique muscle,*

*overaction of the ipsilateral inferior oblique muscle, or*

*overaction of the contralateral superior oblique muscle.*

*Pseudo-overaction of the superior oblique in the*

*uninvolved eye occurs with spread of comitance, and*

*secondary pseudoparesis (and contracture) of the*

*superior rectus muscle in the contralateral eye may*

*occur. In a patient with a superior oblique muscle*

*paralysis who habitually fixates with the paretic eye and*

*in whom overaction of the ipsilateral inferior oblique*

*muscle has developed, less than the normal amount of*

*innervation will be required when the patient looks up*

*and to the contralateral side. Since the innervation*

*flowing to the opposite superior rectus is “determined”*

*by the overacting ipsilateral inferior oblique (Hering’s*

*law), the opposite superior rectus muscle will seem*

*paretic (inhibitional palsy of the contralateral antagonist).*

*In these cases, the head tilt test will correctly determine*

*which of the two eyes is paretic.*

*c) Excyclotropia, which is usually evident on fundus exam*

*and double Maddox rod testing. This cyclotropia is*

*usually symptomatic only in acquired (vs. congenital)*

*cases.*

*d) A head tilt. This is present in approximately 70% of*

*patients with FNP and is usually away from the involved*

*side but may be paradoxical (toward the involved side) in*

*about 3% of patients.*

*3. It is important to differentiate patients with*

*decompensation of a congenital FNP from patients with an*

*acquired FNP. In patients with congenital FNP:*

*a) Old photos may show a long-standing head tilt.*

*b) Patients usually are noted to have cyclotropia on*

*examination but do not complain of cyclotropia*

*(subjective image tilting) as do some patients with*

*acquired FNP.*

*c) Large vertical fusional amplitudes (greater than 6–8 PD)*

*in primary gaze are characteristic of congenital cases.*

*d) Facial asymmetry (hypoplasia on side of head turn)*

*suggests a congenital FNP.*

*4. Bilateral FNPs are suggested by*

*a) An RHT in left gaze and left hypertropia in right gaze.*

*b) A positive Bielschowsky’s test on tilt to either shoulder*

*(“double Bielschowsky’s test”).*

*c) Large excyclotropia (greater than 10 degrees).*

*d) V-pattern esotropia (15 PD or more difference in*

*esotropia between upward and downward gaze). The “V”*

*pattern is caused by a decrease of the abducting effect of*

*the superior oblique(s) in depression and overaction of*

*the inferior oblique muscle(s).*

*e) Underaction of both superior oblique muscles and/or*

*overaction of both inferior oblique muscles.*

*f) In general, bilateral FNPs tend to have a smaller*

*hypertropia in primary position than do unilateral*

*FNPs.*

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*68.2 Test Interpretation*

*The large fusional amplitudes and lack of subjective image tilting*

*are compatible with congenital right FNP. The recent onset*

*of symptoms is due to decompensation of a chronic phoria. Old*

*photographs reveal a head tilt present for years.*

*68.3 Diagnosis*

*Decompensation of old right FNP.*

*68.4 Medical Management*

*Observation or the use of prisms may be all that is required.*

*68.5 Surgical Management*

*Many patients may benefit from strabismus surgery.*

*68.6 Rehabilitation and Follow-up*

*No rehabilitation and follow-up are required if the problem is*

*Resolved.*

~~~~~CASE 69 Sixth Nerve Palsy~~~~~

*69 Sixth Nerve Palsy*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 56-year-old patient with a history of type II diabetes mellitus*

*with a 3-month history of binocular horizontal diplopia primarily*

*at distance and worse on left gaze was found to have a 4*

*prism diopter of esotropia and limitation on abduction, consistent*

*with a left sixth nerve palsy. A magnetic resonance imaging*

*(MRI) showed a meningioma of the cavernous sinus.*

*Keywords: sixth nerve palsy, horizontal diplopia, limitation on*

*abduction, esotropia, cavernous sinus, meningioma*

*69.1 History*

*A 56-year-old man complained of a 3-month history of binocular*

*diplopia. The diplopia was primarily present at distance but*

*was absent at near and was worse on gaze to the left. He had*

*also noted some numbness and tingling in the left forehead and*

*mild left frontotemporal headaches. He denied any recent head*

*trauma, visual loss, or history of previous neurologic or ophthalmologic*

*symptoms. He was a diabetic using oral agents to*

*control his blood sugar.*

*Exam revealed visual acuity to be 20/20 bilaterally. He identified*

*10 of 10 pseudoisochromatic plates bilaterally. Pupils were*

*4mm bilaterally and equally reactive to light and near, and*

*there was no relative afferent pupillary defect. Visual fields*

*were full to confrontation. He had a 4 prism diopter (PD) esotropia*

*(ET) at distance, with no ET at near. The ET was nil on*

*gaze to the right, 8 PD ET on gaze to the left, and 4 PD ET on gaze*

*up and down. Duction testing revealed underaction of abduction*

*in the left eye. There was no ptosis. No facial weakness was*

*noted but sensory testing revealed decreased sensation to soft*

*touch over the left forehead, and the left corneal reflex was*

*slightly depressed. Slit-lamp exam and fundus exam were*

*normal. No papilledema was evident. The rest of the general*

*neurologic examination was normal.*

*69.2 Test Interpretation*

*Nonisolated sixth nerve palsies should undergo neuroimaging,*

*preferably by magnetic resonance imaging (MRI) with contrast,*

*and further evaluation, including laboratory and lumbar puncture*

*in some cases. If a patient with a sixth nerve palsy has papilledema,*

*neuroimaging is mandatory, as a unilateral or*

*bilateral sixth nerve palsy may be a nonlocalizing sign of*

*increased intracranial pressure. If the MRI is normal, a spinal*

*tap may be warranted to investigate meningeal infectious,*

*inflammatory, and neoplastic processes and idiopathic causes*

*such as pseudotumor cerebri. Many authors recommend that*

*an isolated sixth nerve palsy in a vasculopathic patient may be*

*observed without neuroimaging, but if no improvement occurs*

*in 3 months, neuroimaging is recommended. Other authors,*

*however, have reported neuroimaging abnormalities in patients*

*with presumed isolated and vasculopathic sixth nerve palsies*

*and thus recommend imaging all patients. In contrast, nonvasculopathic*

*isolated sixth nerve palsies should undergo neuroimaging*

*(typically MRI with contrast) to rule out a treatable*

*lesion. Younger patients and those without vascular risk factors*

*should undergo more extensive evaluation including complete*

*blood count, fasting blood glucose, blood pressure evaluation,*

*and lumbar puncture. In patients with an isolated sixth nerve*

*palsy with variable ET, fatigue of eye movements, or ptosis,*

*myasthenia gravis should be considered. Any patient with*

*progressive or unresolved sixth nerve palsy should undergo*

*neuroimaging.*

*69.3 Diagnosis*

*Left sixth nerve palsy and damage to the left ophthalmic branch*

*of the trigeminal nerve secondary to meningioma of the cavernous*

*sinus (▶Fig. 69.1).*

*Differential Diagnosis—Key Points*

*1. Causes of acquired ET include sixth nerve palsy, orbital*

*myositis, myasthenia gravis, thyroid eye disease, trauma,*

*ocular neuromyotonia, cyclic ET, divergence insufficiency or*

*paralysis, spasm of the near reflex, pseudo–sixth nerve*

*palsies due to thalamic or midbrain lesions, acquired motor*

*fusion deficiency, and the hemifield slide phenomena (seen*

*with chiasmal lesions). In this patient, there is evidence of*

*paresis of the left lateral rectus muscle, and a left sixth*

*nerve palsy is likely. This paresis has not occurred in*

*isolation, however, as there is also evidence of left facial*

*numbness and sensory changes in the distribution of the*

*ophthalmic branch (V1) of the trigeminal nerve, as well as*

*left-sided headache. Thus, purely motor syndromes, such as*

*myasthenia gravis, are excluded. The sixth nerve is near the*

*ophthalmic branch of the trigeminal nerve in the cavernous*

*sinus. A lesion in these locations must strongly be*

*considered and neuroimaging should be performed.*

*2. Isolated, vasculopathic sixth nerve palsies are common and*

*can be observed without neuroimaging for 4 to 12 weeks.*

*Some authors, however, recommend neuroimaging even in*

*these cases because of the small chance of a treatable*

*lesion being missed. Even though the patient is diabetic,*

*ischemic sixth nerve palsy is not a likely consideration in this*

*case because of the trigeminal neuropathy.*

*3. Compressive lesions in the cavernous sinus may cause a*

*sixth nerve palsy and include tumors (e.g., meningiomas,*

*trigeminal nerve tumors, schwannomas, metastases, skull*

*base tumors, lymphoma/leukemia, nasopharyngeal*

*carcinoma), cavernous sinus fistulas or thrombosis,*

*intracavernous aneurysms, and inflammatory or infectious*

*diseases (e.g., herpes zoster, mucormycosis).*

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*69.4 Medical Management*

*Treatment is aimed at the responsible underlying lesion and*

*may include surgery, radiation therapy, or even simple observation.*

*The diplopia is controlled by patching, prisms, or, if chronic*

*and stable and depending on the etiology, surgery. Early botulinum*

*injection into the ipsilateral medial rectus may improve*

*diplopia and increase the likelihood of subsequent improvement.*

*69.5 Surgical Management*

*Strabismus surgery may be necessary for residual ophthalmoplegia*

*or diplopia.*

*69.6 Rehabilitation and Follow-up*

*Patients must be observed for recurrence of further neurologic*

*and ophthalmologic deficits depending on the etiology of the*

*sixth nerve palsy. Symptomatic diplopia treatment is warranted.*

~~~~~CASE 70 Internuclear Ophthalmoplegia~~~~~

*70 Internuclear Ophthalmoplegia*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 27-year-old woman with a past medical history of multiple*

*sclerosis and right optic neuritis not currently on medications*

*presents with “difficulty focusing” her eyes. She has a mild*

*adduction deficit in the left eye, right abducting nystagmus,*

*slow saccades in adduction in the left eye, and intact convergence*

*consistent with a left internuclear ophthalmoplegia.*

*Keywords: internuclear ophthalmoplegia, multiple sclerosis, abducting*

*nystagmus, limitation of adduction, horizontal diplopia,*

*intact convergence, optic neuritis, slowed saccades*

*70.1 History*

*A 27-year-old woman with a history of multiple sclerosis (MS)*

*complained of “difficulty focusing” her eyes. Her previous MS*

*course included a history of optic neuritis in the right eye. She*

*did have mild gait instability, bladder disturbance, and leg*

*numbness. Her eye difficulty started several months prior to*

*ophthalmologic evaluation. She was taking no medications.*

*Ophthalmologic examination revealed visual acuity to be 20/*

*20 bilaterally. She identified 7 of 10 pseudoisochromatic plates*

*on the right and 10 of 10 on the left. Visual fields showed a*

*small paracentral scotoma on the right. Pupils were 5mm bilaterally*

*and equally reactive to light and near, but there was a*

*mild right afferent pupillary defect. The patient had a 2 prism*

*diopter left hypertropia that was comitant in left, right, up, and*

*down gaze. There was mild paresis of adduction in the left eye*

*but otherwise ductions were full. On gaze to the right, the*

*adducting saccade in the left eye was quite slow compared to*

*the abducting saccade in the right eye. Saccades to the left and*

*vertically were normal. On attempting to hold her gaze to the*

*right, monocular dissociated horizontal nystagmus was noted*

*in the right eye in the direction of abduction. Convergence was*

*normal and was able to overcome the adduction deficit in the*

*left eye. There was no ptosis. Facial sensation and movement*

*were normal. Slit-lamp examination was normal. Fundus exam*

*revealed mild temporal pallor in the right eye but was otherwise*

*normal.*

*Differential Diagnosis—Key Points*

*1. The impaired color vision, relative afferent pupillary defect,*

*and mild optic nerve pallor on the right are likely the*

*residual of a previous episode of optic neuritis in this patient*

*with known MS.*

*2. The adduction weakness in the left eye, slow saccades in*

*adduction in the left eye, and dissociated monocular*

*nystagmus in abduction in the right eye with preserved*

*convergence all indicate the presence of a left internuclear*

*ophthalmoplegia (INO). The comitant hypertropia is likely a*

*skew deviation due to the medial longitudinal fasciculus*

*(MLF) lesion.*

*3. The abducens nucleus has two types of intermingled*

*neurons: motor neurons and internuclear neurons. The*

*axons of the internuclear neurons cross to the contralateral*

*side in the lower pons and ascend in the MLF to synapse in*

*the portion of the oculomotor nucleus that innervates the*

*medial rectus muscle. Lesions of the MLF result in INO.*

*4. Clinically, INO is characterized by adduction weakness on*

*the side of the MLF lesion and monocular nystagmus of the*

*opposite abducting eye. Convergence may be preserved.*

*Often, patients with INO have no visual symptoms but some*

*complain of diplopia (due to skew deviation with the higher*

*eye on the side of the lesion) or oscillopsia.*

*5. An INO can be brought out best during horizontal saccadic*

*eye movement testing. The “adduction lag” might be seen*

*during optokinetic testing using a rotating tape or drum.*

*For example, with a right INO when the drum is rotated to*

*the right, the amplitude and velocity of the adducting quick*

*phase of the right eye is smaller and slower than that of the*

*abducting saccades in the left eye. The pathogenesis of the*

*nystagmus in the abducting eye is unclear but is likely a*

*normal adaptive process that helps overcome the adducting*

*weakness of the fellow eye. Unilateral INO may rarely be*

*associated with exotropia (wall-eyed monocular INO, also*

*called WEMINO syndrome).*

*6. Bilateral INO results in bilateral adduction paresis or lag with*

*the eyes generally aligned in primary gaze. Occasionally,*

*exotropia will occur, with both eyes deviated laterally (wall*

*eyed-bilateral internuclear ophthalmoplegia, or WEBINO*

*syndrome). These patients will often also demonstrate*

*vertical gaze evoked nystagmus, impaired vestibular and*

*pursuit vertical eye movements, and impaired vertical gaze*

*holding.*

*7. INO is due to pathologic processes affecting the MLF in the*

*medial pontine or midbrain parenchyma. Often, there are*

*associated brainstem symptoms and signs although*

*occasionally unilateral or bilateral INO may occur in*

*isolation. The nature of the responsible pathologic process*

*is suggested by the temporal mode of onset of the INO, the*

*general clinical circumstances, and associated signs on*

*neurologic and neuro-ophthalmologic examination. INO is*

*most often due to MS or brainstem infarction. Other*

*etiologies include brainstem infections and masses,*

*degenerative extrapyramidal diseases, drug intoxications,*

*and certain nutritional and metabolic disorders (e.g.,*

*Wernicke’s encephalopathy and pernicious anemia). The*

*pattern of extraocular muscle weakness with myasthenia*

*gravis can mimic INO (pseudo-INO); myasthenic pseudo-*

*INO is not uncommon.*

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*70.2 Test Interpretation*

*In general, the investigation of a patient with INO depends on*

*the clinical circumstances. For example, in the patient presented,*

*MS is evident. INO in isolation or with associated unexplained*

*brainstem signs and symptoms requires neuroimaging. If there is*

*variability of the adduction deficit, associated fluctuating ptosis,*

*or other variable ocular motor signs suggestive of myasthenia*

*gravis, a myasthenic pseudo-INO should be considered.*

*Magnetic resonance imaging (MRI) is superior to computed*

*tomography (CT) in evaluating patients with INO. MRI may give*

*useful diagnostic data by also giving information about supratentorial*

*processes likely to be involved in the etiology of the*

*INO, such as MS and multiple cerebral infarcts. If an infarct is*

*detected as the cause of INO in a patient greater than 50 years*

*of age, giant cell arteritis should be considered as an etiology,*

*especially if other stroke risk factors are not evident.*

*If MRI in nontraumatic cases is normal, then rarer etiologies*

*for the INO should be considered. If the INO is bilateral, drug*

*intoxication should be suspected. As pernicious anemia has*

*rarely been reported to cause INO, a B12 level is also indicated*

*but of low yield. Syphilis may rarely cause INO, so serology for*

*syphilis (e.g., rapid plasma reagin (RPR), fluorescent treponemal*

*antibody (FTA), syphilis immunoglobulin G (IgG)) is also suggested.*

*If MRI reveals meningeal enhancement or if meningeal*

*signs or symptoms are present, spinal fluid examination is warranted*

*to investigate for infectious or carcinomatous meningitis.*

*70.3 Diagnosis*

*Optic neuropathy on the right and INO on the left due to MS.*

*70.4 Medical Management*

*Treatment is directed at the underlying etiology of the INO. If*

*associated skew deviation or exotropia is symptomatic, prisms*

*may be required to relieve diplopia.*

*70.5 Surgical Management*

*Usually, no surgical treatment is required but some patients*

*may require strabismus surgery for residual diplopia if unresolved.*

*70.6 Rehabilitation and Follow-up*

*Follow-up for resolution of the INO is important.*

~~~~~CASE 71 Diplopia—Ocular Myasthenia Gravis~~~~~

*71 Diplopia—Ocular Myasthenia Gravis*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 57-year-old woman patient presented with intermittent diplopia*

*for 6 months, which worsened “as the day goes on,” and*

*intermittent left or right eyelid droop. On exam, she had paresis*

*of both lateral rectus muscles, bilateral ptosis, increased ptosis*

*with elevation of the opposite eyelid (enhanced ptosis), a positive*

*Tensilon test, and negative acetylcholine receptor antibodies,*

*consistent with ocular myasthenia gravis.*

*Keywords: diplopia, myasthenia gravis, ptosis, orbicularis oculi*

*weakness, enhanced ptosis, acetylcholine receptor antibodies,*

*single fiber EMG, lid droop*

*71.1 History*

*A 57-year-old woman complained of intermittent diplopia over*

*the last 6 months. The diplopia was often not present on awakening*

*in the morning but tended to occur and worsen “as the*

*day goes on.” She especially had difficulty driving, often seeing*

*“two lines instead of one” in the middle of the road. Her spouse*

*also had noted that at times her left or right eyelid would droop.*

*She denied significant past medical problems except for a history*

*of pernicious anemia for which she takes monthly B12*

*shots. She denied any headache, facial numbness or pain, dysphagia,*

*dysarthria, breathing difficulty, generalized muscle*

*weakness, or extremity paresis or sensory symptoms.*

*Examination of the afferent visual system was normal. Pupils*

*were 5mm and equally reactive to light and near. No relative*

*afferent pupillary defect was evident. She had an esotropia of*

*10 prism diopters (PD) in primary position that increased to 15*

*PD on left gaze, 18 PD on right gaze, and 12 PD on up and down*

*gaze. When she attempted to hold her gaze to the left or the*

*right, the separation of images worsened subjectively and her*

*esotropia increased. Although she had no obvious vertical misalignment*

*in primary gaze, on holding her gaze upward she*

*eventually developed a left hypertropia. Duction testing suggested*

*paresis of both lateral rectus muscles. She had bilateral*

*ptosis. The ptosis worsened in each eye when the opposite lid*

*was held upward. Levator function was mildly weak bilaterally.*

*Facial sensation was normal but she had mild paresis of eye closure*

*bilaterally. Slit-lamp and fundus exams were normal. General*

*neurologic examination was otherwise normal.*

*A Tensilon test resulted in improvement of the patient’s esotropia*

*and ptosis. Acetylcholine receptor (AChR) antibodies*

*were not present, thyroid-stimulating hormone (TSH) was normal,*

*and computed tomography (CT) scan of the chest was negative*

*for thymoma.*

*Differential Diagnosis—Key Points*

*1. Although the esotropia was worse on gaze to the left, and*

*gaze to the right may suggest bilateral sixth nerve palsies,*

*the patient also has bilateral ptosis. The fatigability of the*

*esotropia on attempted lateral gaze holding, the*

*development of a hypertropia on prolonged upward gaze*

*(fatigue), and the increased ptosis with elevation of the*

*opposite eyelid (enhanced ptosis) are all strongly suggestive*

*of myasthenia gravis (MG).*

*2. MG is a chronic disorder of neuromuscular transmission*

*characterized clinically by varying degrees of weakness and*

*fatigue of voluntary muscles. MG is caused by an acquired*

*autoimmunity to the motor end plate and is associated with*

*antibodies that block or cause increased degradation of*

*AChR. There is abnormal weakness in some or all voluntary*

*muscles. The weakness increases with repeated or sustained*

*exertion and increases over the course of the day, but is*

*improved by rest; it also may be worsened by elevation of*

*body temperature and is often improved by cold.*

*3. The levator palpebrae superioris and extraocular muscles*

*are involved initially in approximately 50 to 70% of cases,*

*and these muscles are eventually affected in about 90% of*

*patients. Ocular myasthenia (OM) is a form of MG confined*

*to the extraocular, levator palpebrae superioris, and/or*

*orbicularis oculi muscles. Approximately 50% of patients*

*initially present with OM, but only 12 to 50% of these*

*remain ocular. Of the 50 to 80% of patients with purely*

*ocular symptoms and signs at onset that go on to develop*

*generalized MG, most, but not all, develop generalized*

*symptoms within 2 to 3 years of onset of the disorder.*

*4. Ptosis in MG may occur as an isolated sign or in association*

*with extraocular muscle involvement. The ptosis may be*

*unilateral or bilateral and, when bilateral, is usually*

*asymmetric. The ptosis may be absent when the patient*

*awakens, but appears later in the day, becoming more*

*pronounced as the day progresses. Prolonged upward gaze*

*may increase the ptosis. Enhanced or seesaw ptosis may be*

*demonstrated (ie, a worsening of ptosis on one side when*

*the opposite eyelid is elevated and held in a fixed position),*

*but this sign is not specific for MG as it may rarely be seen*

*with age-related ptosis, ocular myopathy, Lambert-Eaton*

*myasthenic syndrome, Fisher’s syndrome, and even third*

*nerve palsy. During refixation (a vertical saccade) from*

*down to the primary position, the upper eyelid may*

*either slowly begin to droop or else twitch several*

*times before settling in a stable position (Cogan’s lid-twitch*

*sign).*

*5. Involvement of extraocular muscles with MG usually occurs*

*in association with ptosis; however, cases without clinical*

*involvement of the levator muscles occur. MG should be*

*considered in any case of ocular motor weakness without*

*pupil involvement because MG may mimic any pattern of*

*neurogenic paresis. Any extraocular muscle may be*

*selectively impaired, especially the medial rectus, and*

*weakness characteristically increases with sustained effort.*

*Myasthenia can mimic pupil-sparing third nerve palsies,*

*superior division third nerve palsies, abducens nerve palsies,*

*or trochlear nerve palsies and internuclear*

*ophthalmoplegia.*

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*71.2 Test Interpretation*

*The diagnosis of OM is based on the clinical history, the physical*

*findings, pharmacological testing, and, in selected individuals,*

*sleep test, electromyography (EMG) investigations including*

*study of the decremental response, conventional needle EMG,*

*and single-fiber recordings, and determination of the serum*

*anti-AChR antibody titers. The diagnosis of OM should be considered*

*in any patient with ptosis and/or ocular motor weakness*

*without pupillary involvement. Weakness and fatigue*

*confined to the extraocular muscles or lids combined with orbicularis*

*oculi paresis is especially suggestive of OM. Significant*

*clinical involvement of the pupil, eye pain or headaches, proptosis,*

*visual loss, or involvement of trigeminal sensation essentially*

*negate this diagnosis.*

*A positive Tensilon (edrophonium hydrochloride) or Prostigmin*

*(neostigmine methyl-sulfate) test is usually, but not always,*

*indicative of OM. The improvement of extraocular muscle function*

*should be quantified with prisms, a Hess screen, or the*

*Lancaster red-green test. A negative Tensilon or Prostigmin test*

*in no way rules out MG. The “sleep test” may also be incorporated*

*to demonstrate objective improvement in myasthenic*

*symptoms after rest. The patient is kept in a quiet, darkened*

*room and instructed to close the eyes and rest for 30 minutes;*

*ptosis and ocular motility are quantified before and after the*

*rest period. This study may be positive in some Tensilon-negative*

*myasthenic patients but may also be negative in Tensilonpositive*

*patients. Another noninvasive test is the ice pack test,*

*which may be useful in the diagnosis of OM in the patient with*

*ptosis. Ice in a surgical glove is placed over one lightly closed*

*eye for 2 minutes or to the limit of patient tolerance. In cases of*

*bilateral ptosis, the opposite (un-cooled) eye serves as control.*

*AChR antibody titers are quite useful in the diagnosis of MG.*

*In one large and representative study, the percentages of positive*

*tests in different clinical forms of MG were as follows:*

*remission, 24%; ocular, 50%; mild generalized, 80%; moderately*

*severe or acutely severe, 100%; chronic severe, 89%. Overall,*

*AChR antibodies are positive in 80 to 95% of patients with generalized*

*MG and 34 to 56% of patients with OM. Testing for*

*AChR binding, blocking, and modulating antibodies increases*

*the assay yield in patients with generalized MG and OM. In OM,*

*the antibody titer tends to be low and the serum antibody titer*

*correlates poorly with the severity of MG when a group of*

*patients is studied.*

*As there is an increased risk of thymoma in patients with*

*MG, all patients with the diagnosis of MG should undergo CT or*

*magnetic resonance imaging (MRI) of the mediastinum. Thymoma*

*occurs in 5 to 20% of myasthenic patients overall and*

*about one-third to one-half of patients with thymoma have*

*MG. The risk of thymoma in patients with OM is probably lower.*

*Thymoma is more common in older patients and in patients*

*with high AChR antibody titers. Because thyroid disease may be*

*associated with MG, all patients should also have sensitive TSH*

*levels measured.*

*71.3 Diagnosis*

*Ocular myasthenia gravis.*

*71.4 Medical Management*

*About 10 to 20% of patients with OM will undergo spontaneous*

*remission, which may be temporary or permanent. Corticosteroids*

*produce favorable response in OM in 66 to 85% of patients.*

*At 2 years, prednisone treatment appears to reduce the incidence*

*of generalized MG to 7% in contrast to 36% of patients*

*who did not receive prednisone. Generalized MG may be a lifethreatening*

*disease requiring aggressive treatment with anticholinesterase*

*drugs, corticosteroids, other immunosuppressive*

*agents, plasmapheresis, intravenous gamma globulin, and possible*

*thymectomy.*

*For patients with OM, if the diplopia or ptosis is mild, then*

*observation or patching one eye may be sufficient. Ptosis may*

*be eliminated in some patients by having a crutch attachment*

*placed on a spectacle frame for one or both eyes, although this*

*often causes irritation of the eyes from exposure.*

*71.5 Surgical Management*

*Ptosis surgery may be performed in patients with stable disease,*

*particularly those who are refractory to medical therapy*

*or in whom ptosis is a predominant finding. For more severe*

*ocular motor weakness, anticholinesterase agents, such as pyridostigmine*

*bromide (Mestinon), are warranted, although these*

*agents often do not succeed in correcting the diplopia. Diplopia*

*is often more refractory to treatment than is ptosis. If moderate*

*or large doses of anticholinesterase drugs fail or cannot be tolerated*

*and symptoms are troublesome, then corticosteroids,*

*often at relatively low alternate-day doses, are usually effective*

*in correcting the diplopia. Although some authors have suggested*

*the use of azathioprine for patients who are inadequately*

*controlled on low-dose steroids or who are*

*experiencing steroid side effects, this agent, cyclophosphamide,*

*cyclosporine, intravenous immunoglobulin, and plasmapheresis*

*are not usually used in patient with purely OM because their*

*benefit–risk ratios have not been adequately studied.*

*The presence of a thymoma in any patient with MG is an absolute*

*indication for thymectomy and, thus, all patients with OM*

*should be evaluated with mediastinal CT or MRI. Although thymectomy*

*can be effective in ocular MGwithout thymoma andmay prevent*

*generalization of the disease, most clinicians are reluctant to*

*recommend this procedure for purely ocular symptoms.*

*71.6 Rehabilitation and Follow-up*

*Patients need close supervision of medications used to control*

*symptoms. Patients with purely OM must be warned of the possibility*

*of generalization of the disease process and should specifically*

*be instructed to inform their physician immediately if*

*symptoms such as dysphagia, respiratory involvement, or*

*extremity weakness develop.*

~~~~~CASE 72 Thyroid Ophthalmopathy~~~~~

*72 Thyroid Ophthalmopathy*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 35-year-old woman with a past medical history of hyperthyroidism*

*treated with radioactive iodine 1 year ago presents with*

*a 2-month history of mild to moderate “eye irritation” or “foreign*

*body–type” sensation, diplopia, and eyes bulging. On*

*exam, she has limitation of elevation and depression in both*

*eyes, limitation of abduction in both eyes, lid retraction, lid lag,*

*proptosis, and mild punctate keratopathy consistent with thyroid*

*eye disease.*

*Keywords: thyroid ophthalmopathy, proptosis, dry eye, lid lag,*

*lid retraction, diplopia, extraocular muscle abnormalities,*

*scleral show*

*72.1 History*

*A 35-year-old woman complained of a 2-month history of eye*

*discomfort and diplopia. The eye pain was a mild to moderate*

*“eye irritation” or “foreign body–type” sensation that was constant*

*but fluctuated in severity. She also complained of vertical*

*diplopia that was binocular and constant. She often patched*

*one eye in order to read or drive. Her husband noted that over*

*the last few weeks her eyes appeared to be “bulging.” She had a*

*past medical history of hyperthyroidism treated with radioactive*

*iodine 1 year ago. She was taking thyroid supplements. She*

*denied any other medical problems.*

*Examination revealed visual acuity of 20/25 bilaterally. She*

*identified 10 of 10 Hardy–Rand–Rittler pseudoisochromatic*

*plates bilaterally. Pupils were 4mm bilaterally and equally reactive*

*to light and near, and there was no relative afferent pupillary*

*defect. Visual fields were full on static perimetry. She had a*

*left hypertropia of 4 prism diopters (PD) in primary gaze. This*

*increased to 8 PD in upward gaze, 10 PD in downward gaze, and*

*was 4 to 5 PD in left and right gaze. There was also an esotropia*

*of 5 PD in primary gaze that was relatively comitant in up,*

*down, left, and right gaze. Duction testing revealed limitation of*

*elevation and depression in both eyes and limitation of abduction*

*in both eyes, worse on the left. Adduction was relatively*

*normal. She had no ptosis but had definite lid retraction and lid*

*lag bilaterally. Proptosis was present with Hertel measurements*

*at a base of 95mm that were 22mm on the right and 24mm on*

*the left, respectively (▶Fig. 72.1). Facial sensation and movements*

*were normal. Slit-lamp examination revealed mild punctate keratopathy*

*bilaterally. Funduscopic examination was normal.*

*Differential Diagnosis—Key Points*

*1. The motility impairment noted could be related to*

*myasthenia gravis, but lid lag and retraction, rather than*

*ptosis, makes this diagnosis unlikely. Bilateral orbital*

*pseudotumor or other infiltrative orbitopathies are also a*

*possibility, but the pain noted is mild and superficial, rather*

*than severe and deep, and the lid lag and retraction are not*

*easily explained by an infiltrative process. The constellation*

*of impaired motility, lid lag and retraction, and proptosis,*

*especially in the light of a history of previous*

*hyperthyroidism treated with radioactive iodine, all make*

*thyroid orbitopathy the most likely diagnosis in this patient.*

*2. The ophthalmopathy of thyroid disease (thyroid eye disease,*

*thyroid orbitopathy, or Graves’ disease) is an autoimmune*

*process with a progressive but self-limited variable course*

*extending over 1 to 3 years. It is a common cause of*

*acquired diplopia or exophthalmos in adults. The*

*ophthalmopathy spans a clinical spectrum from minor eye*

*symptoms and signs to severe, disabling, vision-threatening*

*problems. Thyroid ophthalmopathy is considered to be*

*present if eyelid retraction occurs in association with*

*objective evidence of thyroid dysfunction or abnormal*

*regulation, exophthalmos, optic nerve dysfunction, or*

*extraocular muscle (EOM) involvement.*

*3. The median age at the time of diagnosis of Graves’*

*ophthalmopathy is 43 years (range, 8–88 years).*

*Approximately 90% of patients have Graves’*

*hyperthyroidism, 1% have primary hypothyroidism, 3% have*

*Hashimoto’s thyroiditis, and 5% are euthyroid. Among*

*patients with hyperthyroidism, Graves’ ophthalmopathy*

*develops in 61% within 1 year of the onset of thyrotoxicosis.*

*4. Eyelid retraction is the most common ophthalmic feature of*

*autoimmune thyroid disease, present either unilaterally or*

*bilaterally in more than 90% of patients at some point in the*

*clinical course. Exophthalmos of one or both eyes affects*

*approximately 60% of patients, restrictive extraocular*

*myopathy is apparent in about 40% of patients, and optic*

*nerve dysfunction occurs in either one or both eyes in 6% of*

*cases. The restrictive myopathy especially affects the*

*inferior, medial, and superior recti and rarely affects the*

*lateral rectus muscle: therefore, exotropia in a patient with*

*thyroid orbitopathy should raise the possibility of*

*concomitant ocular myasthenia gravis. Only 5% of patients*

*have a complete constellation of classic findings: eyelid*

*retraction, exophthalmos, optic nerve dysfunction, EOM*

*involvement, and hyperthyroidism. At the time of diagnosis*

*of Graves’ ophthalmopathy, the most frequent ocular*

*symptom is pain or discomfort, which affects 30% of*

*patients. Some degree of diplopia is noted by 17% of*

*patients, lacrimation or photophobia is present in about 15*

*to 20%, and 7.5% of patients have blurred vision. Decreased*

*vision attributable to optic neuropathy is present in less*

*than 2% of patients by the time of diagnosis of Graves’*

*disease.*

*5. Thyroid ophthalmopathy may be quite asymmetric between*

*the two orbits and the disease process often undergoes*

*spontaneous exacerbations and remissions of clinical*

*activity. The disorder often starts with an acute, active*

*inflammatory phase, lasting 6 to 18 months, which is*

*mediated by lymphocytic and fibroblastic infiltration into*

*orbital tissues.*

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*72.2 Test Interpretation*

*Forced duction testing will indicate that the diplopia is due to*

*restrictive rather than paretic disease process affecting the*

*EOMs. Thyroid function studies need to be assessed. Computed*

*tomography (CT) scan or magnetic resonance imaging (MRI) of*

*the orbits is useful to document EOM enlargement.*

*72.3 Diagnosis*

*Thyroid orbitopathy.*

*72.4 Medical Management*

*The treatment of thyroid eye disease begins with adequate control*

*of the underlying endocrinopathy, as many of the eye signs,*

*except for proptosis, may improve with thyroid treatment.*

*Patients should be instructed to stop smoking, as smoking has*

*been associated with the ophthalmopathy. Ocular discomfort is*

*usually due to corneal and conjunctival exposure and often*

*responds to methylcellulose artificial tears during the day and*

*ointment at night. As periorbital edema is often most prominent*

*in the morning after a period of recumbency, elevating the*

*head of the patient’s bed and sleeping partially supine are*

*advised. Wearing dark glasses with side protection will help*

*photophobia.*

*For more severe symptoms, taping the eyelids shut at night*

*or the use of goggles to provide a humidified chamber may be*

*helpful. In general, patients should be observed closely*

*throughout the period of active inflammation without more*

*aggressive therapeutic interventions, although suppression of*

*inflammation with systemic corticosteroids or radiation therapy*

*may be considered for more severe symptoms. Three*

*exceptions that require prompt and aggressive early therapy*

*are severe exposure keratopathy, severe proptosis or globe luxation,*

*and optic neuropathy.*

*Diplopia during this period is usually due to tethering of the*

*inferior and medial rectus muscles or less often the superior*

*rectus muscle. Patients are thus usually esotropic and have vertical*

*ocular misalignment. The diplopia of the early inflammatory*

*phase is treated with patching or prisms as outlined*

*concerning the symptomatic management of diplopia. Botulinum*

*toxin injection into the tight and stiff muscles may temporarily*

*help to correct a pathologic eye position and help regain*

*binocular single vision. Strabismus surgery is deferred until the*

*ocular deviation has been documented as unchanged for at least*

*a period of 6 to 12 months and the patient is in the chronic*

*phase of thyroid ophthalmopathy.*

*Systemic corticosteroids have been used successfully in the*

*treatment of congestive thyroid orbitopathy. They may improve*

*soft-tissue involvement and compressive optic neuropathy but*

*usually have little effect on strabismus and are not useful for*

*chronic fibrotic thyroid ophthalmopathy. Possible indications*

*for the use of corticosteroids include (1) acute severe signs and*

*symptoms of orbital inflammation of recent (less than 3*

*months) onset; (2) optic neuropathy, especially when used in*

*conjunction with surgical decompression of the orbit or orbital*

*radiation therapy; (3) prevention of progressive thyroid orbitopathy*

*during the treatment of thyroid disease with radioactive*

*iodine; and (4) control of signs and symptoms of thyroid orbitopathy*

*that worsen despite previous orbital radiation and/or*

*decompression. Corticosteroids may improve the orbitopathy in*

*approximately 50 to 60% of patients, but the orbitopathy often*

*worsens when the dosage of medication is reduced or discontinued.*

*Chronic corticosteroid therapy is discouraged in thyroid*

*ophthalmopathy patients because of the multiple ill effects of*

*the medication. In general, corticosteroids are a valuable temporizing*

*measure for thyroid orbitopathy but rarely provide*

*meaningful long-term benefit or resolution of the disorder.*

*Radiation therapy, like corticosteroids, is most effective within*

*the first year of onset of thyroid orbitopathy before significant*

*fibrotic changes have occurred in orbital tissues. Possible indications*

*for orbital radiation include (1) optic neuropathy, especially*

*if the patient is a poor surgical candidate; and (2) symptoms of*

*active orbital inflammation and congestion.*

*Optic neuropathy with thyroid ophthalmopathy is usually*

*caused by apical compression of the optic nerve by enlarged*

*EOMs and can cause permanent visual loss. Medical treatment*

*possibilities include high doses of oral or intravenous corticosteroids,*

*orbital irradiation, or a combination of these procedures.*

*72.5 Surgical Management*

*In general, the major clinical problems in patients with thyroid*

*ophthalmopathy include a congestive orbitopathy with eye irritation*

*and inflammation, diplopia, visual loss from corneal*

*exposure or compressive optic neuropathy, and cosmesis.*

*The clinical manifestations of the acute phase may be responsive,*

*at least partially, to systemic corticosteroid treatment,*

*other immunosuppressives, and orbital radiation therapy. Therapy*

*during the acute period is mainly directed at local measures*

*to protect the eyes from exposure and provide comfort while*

*awaiting spontaneous stabilization of the disease process. The*

*acute phase is followed by a chronic phase, characterized by*

*hypertrophy and fibrosis of the EOMs, lacrimal glands, and*

*orbital fat. The clinical manifestations of this late phase do not*

*regress spontaneously, are usually unresponsive to immunotherapy*

*or radiation, and often require surgical correction for*

*relief.*

*Fig. 72.1 External appearance showing proptosis.*

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*EOM surgery in patients with thyroid ophthalmopathy*

*should be postponed until the muscles are no longer inflamed*

*and the deviation has remained stable for at least 6 months.*

*Eyelid retraction in patients with thyroid ophthalmopathy may*

*result from excessive sympathetic activity, levator fibrosis, or*

*contracture of the inferior rectus muscle. The lid retraction may*

*be controlled by botulinum toxin injection into the levator palpebrae*

*superioris muscle. Surgical procedures are available to*

*improve eyelid retraction with options including lateral tarsorrhaphy,*

*Müller’s muscle and levator muscle lengthening, lower*

*eyelid elevation, and blepharoplasty with orbital fat excision.*

*Orbital decompression may improve lid retraction that is due to*

*distortion from the proptotic globe. Strabismus surgery may*

*relieve the compensatory component of lid retraction related to*

*restrictive EOMs but recessions of the inferior rectus muscle*

*often worsen the eyelid retraction. Therefore, the order of surgery*

*in a patient with thyroid ophthalmopathy requiring all*

*three procedures should in general be orbital decompression*

*followed by strabismus surgery followed by lid surgery. Patients*

*who fail medical treatment of optic neuropathy in thyroid disease*

*may require orbital decompression.*

*72.6 Rehabilitation and Follow-up*

*The patient must understand that the treatment of thyroid ophthalmopathy*

*usually extends over several years and that often a*

*sequence of treatments is warranted. A team approach is necessary*

*with input from endocrinology, ophthalmology, and other*

*clinical specialties. The patient must have close ophthalmologic*

*supervision to monitor for corneal epithelial breakdown that*

*would require more aggressive treatments (e.g., surgical*

*tarsorrhaphy).Visual acuity, color vision, fields, and fundus*

*must be observed closely for signs of optic neuropathy.*

~~~~~CASE 73 Anisocoria—Tonic Pupil~~~~~

*73 Anisocoria—Tonic Pupil*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 45-year-old woman was noted to have one pupil larger than*

*the other by a friend. On exam, she had anisocoria greater in*

*the light than the dark, light-near dissociation, and vermiform*

*movements of one sector of the iris to light consistent with a*

*tonic pupil.*

*Keywords: tonic pupil, Adie’s pupil, anisocoria, dilated pupil,*

*light-near dissociation, anisocoria greater in the light, vermiform*

*movements*

*73.1 History*

*A 45-year-old woman was evaluated because of anisocoria.*

*While at a cocktail party 2 weeks ago, a friend noted that one*

*pupil was larger than the other, and she feared that “it could be*

*due to a brain tumor.” She complained of occasional headaches*

*over the last several years but denied any other illnesses, significant*

*head or eye trauma, the use of any eye drops, or any visual*

*symptoms. She went to see a neurosurgeon who performed a*

*magnetic resonance imaging (MRI) of the brain that was normal*

*and stated that she may need a cerebral angiogram.*

*Examination revealed visual acuity to be 20/20 bilaterally.*

*Color vision and visual fields were normal. The right pupil*

*measured 6mm in darkness, while the left pupil measured*

*3mm. The right pupil reacted poorly and segmentally to light*

*(▶Fig. 73.1), while the left pupil reacted briskly and symmetrically*

*to light. The right pupil slowly constricted to near and*

*then slowly redilated on looking in the distance. The left pupil*

*constricted briskly to near and quickly redilated at distance.*

*Motility was normal and there was no ptosis. Slit-lamp exam*

*revealed vermiform movements of one sector of the right iris to*

*light. Fundus exam was normal.*

*Differential Diagnosis—Key Points*

*1. If a large pupil is poorly reactive to light and the visual*

*afferent system is normal, then a defect in the efferent*

*parasympathetic innervation of the pupil is likely. The*

*major entities causing an abnormal large pupil include*

*third nerve palsy, iris damage, pharmacologic dilation, or*

*tonic pupil.*

*2. In the absence of an extraocular motility deficit and ptosis,*

*an isolated dilated pupil is rarely due to a third nerve palsy.*

*3. Careful slit-lamp biomicroscopy of the iris should be*

*performed in all patients with anisocoria to exclude*

*structural iris abnormalities or damage. No such damage*

*was noted in this patient.*

*4. A careful history is usually all that is required in patients*

*with inadvertent or intentional exposure to agents that may*

*affect pupil size (e.g., scopolamine patch). The pupil size of*

*patients with pharmacologic blockade is often quite large,*

*of the order of 10 to 12mm in diameter, which is much*

*greater than the mydriasis usually noted in patients with*

*third nerve palsy or a tonic pupil. Usually, the mydriasis of*

*pharmacologic agents affects the pupil completely in 360*

*degrees, as compared to the segmental paresis of the pupil*

*in tonic pupils. A pupil dilated from a third nerve palsy or*

*tonic pupil will constrict to pilocarpine 1%, while a*

*pharmacologically blocked pupil will not constrict or will*

*constrict only partially to pilocarpine 1%.*

*5. The anisocoria is, thus, mostly likely due to a tonic pupil.*

*Tonic pupils may be due to local (ocular or orbital) lesions*

*affecting the ciliary ganglion or nerve (e.g., trauma), may be*

*due to diffuse neuropathic processes, or may be idiopathic*

*(Adie’s tonic pupil syndrome). The clinical features of a tonic*

*pupil are outlined in the list below. Pharmacologic testing*

*with low-dose pilocarpine (0.125–0.1%) may demonstrate*

*cholinergic supersensitivity in the tonic pupil.*

*73.1.1 Clinical Features of a Tonic Pupil*

*● Poor pupillary light reaction.*

*● Vermiform movements of the iris to light on slit-lamp exam.*

*● Segmental palsy of the sphincter.*

*● Tonic pupillary near response with light-near dissociation.*

*● Cholinergic supersensitivity of the denervated muscles (e.g.,*

*to dilute pilocarpine).*

*● Accommodative paresis (that tends to recover).*

*● Induced astigmatism at near.*

*● Tonicity of accommodation.*

*● Occasional ciliary cramp with near work.*

*(Adapted from Lee AG, Brazis PW. Clinical Pathways in Neuro-*

*Ophthalmology: An Evidence-Based Approach. New York, NY:*

*Thieme, 1998:362, with permission.)*

*Fig. 73.1 The right pupil measured 6mm in darkness, while the left*

*pupil measured 3 mm. The right pupil reacted poorly and segmentally*

*to light.*

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*73.2 Test Interpretation*

*Slit-lamp biomicroscopy revealed no iris injury but did show*

*vermiform, segmental movements of the iris characteristic of a*

*tonic pupil. The denervated iris sphincter is supersensitive to*

*topical parasympathomimetic solutions. Pilocarpine drops*

*(0.125%) can be used to demonstrate this, as the normal pupil*

*will constrict slightly, if at all. After 60 minutes, the pupils are*

*reexamined, and if Adie is present, the affected pupil (dilated*

*pupil) will constrict more than the normal pupil (this supersensitivity*

*is often not present for the first several weeks after*

*onset). Patients with bilateral isolated tonic pupils should have*

*serologic testing for syphilis.*

*73.3 Diagnosis*

*Isolated, idiopathic tonic pupil.*

*73.4 Medical and Surgical*

*Management*

*There are no proven roles for medical and surgical management*

*of this problem.*

*73.5 Rehabilitation and Follow-up*

*No treatment, except reassurance, is usually required. Unequal*

*bifocal reading aids or a unilateral frosted bifocal segment may*

*be used in patients with permanent accommodative paresis.*

*The initially mydriatic pupil may become smaller over time*

*(“little old Adie’s”). Although most Adie’s tonic pupils present*

*unilaterally, bilateral involvement may develop at a rate of 4%*

*per year. Holmes–Adie syndrome includes other features, notably*

*diminished deep tendon reflexes and orthostatic hypotension,*

*and should be addressed in patients with tonic pupils.*

~~~~~CASE 74 Anisocoria—Horner’s Syndrome~~~~~

*74 Anisocoria—Horner’s Syndrome*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 50-year-old man with a past medical history of hypertension*

*presented with left frontotemporal and periorbital headaches*

*for the last 3 weeks and drooping of his left upper eyelid. On*

*exam, he had anisocoria greater in the dark and 2mm of left*

*ptosis. Topical cocaine 10% into both eyes revealed marked dilation*

*of the right pupil, but poor dilation of the left pupil. Four*

*days later, hydroxyamphetamine 1% was instilled in both eyes*

*and resulted in full dilation in the right eye but poor dilation in*

*the left eye, consistent with a postganglionic Horner’s syndrome*

*due to spontaneous dissection of the internal carotid artery.*

*Keywords: Horner’s syndrome, anisocoria, carotid artery dissection,*

*miosis, anhydrosis, ptosis, anisocoria greater in the dark,*

*cocaine, hydroxyamphetamine*

*74.1 History*

*A 50-year-old man noted the onset of left frontotemporal and*

*periorbital headaches for the last 3 weeks. He denied any visual*

*complaints but noted some drooping of his left upper eyelid. He*

*denied any diplopia, trauma to his head or neck, facial numbness*

*or weakness, or other neurologic complaints. He had a history*

*of systemic hypertension.*

*Examination revealed visual acuity of 20/20 bilaterally with*

*normal color vision. Pupils measured in bright light were 4mm*

*on the right and 3mm on the left, but immediately after the*

*lights were turned off, the pupils were noted to be 5 and 3mm,*

*respectively (▶Fig. 74.1). Both pupils reacted well to light and*

*near, and there was no relative afferent pupillary defect. Visual*

*fields were normal. Motility was normal. There was 2mm of*

*left ptosis. Facial sensation and movement were normal. Slitlamp*

*examination and fundus exam were unremarkable.*

*The instillation of topical cocaine 10% into both eyes revealed*

*marked dilation of the right pupil, but poor dilation of the left*

*pupil (noted in darkness 45 minutes after two drops instilled in*

*both eyes). The patient returned 4 days later and hydroxyamphetamine*

*1% (Paredrine) was instilled in both eyes and*

*resulted in full dilation in the right eye but poor dilation in the*

*left eye.*

*Differential Diagnosis—Key Points*

*1. In a patient with anisocoria but normal pupil reaction, the*

*main differential is between a Horner’s syndrome (HS) and*

*physiologic anisocoria. The left ptosis strongly favors a left*

*HS but there are many cases reported of a “pseudo-*

*Horner’s syndrome” in which physiologic anisocoria is*

*associated with some other unrelated cause of ptosis (e.g.,*

*levator dehiscence). Simple or physiologic anisocoria has a*

*prevalence as high as 21% in the general population and is*

*associated with equal anisocoria in light and darkness.*

*2. Topical cocaine 10% will dilate both pupils equally with*

*physiologic anisocoria but will not dilate or will poorly dilate*

*the pupil in a patient with HS. Thus, cocaine testing is*

*necessary to prove the existence of an HS. Cocaine inhibits*

*the reuptake of norepinephrine at the neuromuscular*

*junction. Therefore, topical cocaine will dilate a normal pupil*

*but will not dilate a pupil with HS regardless of the location*

*of the sympathetic damage.*

*3. HS may result from a lesion anywhere along the threeneuron*

*pathway that arises as a first-order (central) neuron*

*from the posterolateral hypothalamus, then descends in the*

*brainstem and lateral columns of the spinal cord to exit at*

*the cervical (C8) and thoracic (T1–T2) levels (ciliospinal*

*center of Budge) of the spinal cord as a second-order*

*neuron. This second-order (intermediate) preganglionic*

*neuron exits the ventral root and arches over the apex of*

*the lung to ascend in the cervical sympathetic chain. The*

*second-order neurons synapse in the superior cervical*

*ganglion and exit as a third-order neuron. The third-order*

*postganglionic neuron travels with the carotid artery into*

*the cavernous sinus, on to the sixth cranial nerve for a short*

*course, and then travels with the ophthalmic division of the*

*trigeminal nerve to join the nasociliary branch of the*

*Fig. 74.1 (a) Right pupil and (b) left pupil showing anisocoria and mild left ptosis and mild upside down ptosis.*

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*trigeminal nerve, pass through the ciliary ganglion, and*

*reach the eye as long and short ciliary nerves. Damage*

*anywhere along this sympathetic pathway will result in an*

*HS.*

*4. Patients with central or first-order HS usually have*

*associated signs of hypothalamic or brainstem dysfunction.*

*Preganglionic (intermediate) HS patients may have neck or*

*arm pain, anhidrosis involving the face and neck, brachial*

*plexopathy, vocal cord paralysis, or phrenic nerve palsy. A*

*second-order HS may also occur in isolation. Important*

*etiologies of a second-order HS include neoplasms (e.g.,*

*apical lung cancer or infiltrative breast cancer), mediastinal*

*lymphadenopathy, cervicothoracic abnormalities (e.g., disc*

*disease), neck or shoulder trauma, thoracic aneurysm, or*

*local infections or inflammations. Postganglionic (thirdorder)*

*HS may occur in isolation but may also occur with*

*eye pain (e.g., cluster headache) or palsies of the third,*

*fourth, sixth, and ophthalmic division trigeminal nerves*

*(e.g., cavernous sinus thrombosis, infection, or neoplasm).*

*Etiologies of third-order HS include high cervical*

*lymphadenopathy, otitis and petrositis, trauma, and*

*vascular abnormalities of the internal carotid artery (e.g.,*

*carotid artery aneurysm or dissection). Dissection of the*

*internal carotid artery, either spontaneous or posttraumatic,*

*may result in a postganglionic HS. The HS in these cases*

*may occur in isolation but is often associated with other*

*features including ipsilateral orbital, facial, or neck pain,*

*diplopia from cavernous sinus involvement, transient*

*ischemic attacks (e.g., transient ipsilateral visual loss),*

*retinal artery occlusion or ischemic optic neuropathy, neck*

*bruit or swelling, and other cranial neuropathies.*

*5. Hydroxyamphetamine 1% (Paredrine) releases the stored*

*norepinephrine from postganglionic adrenergic nerve*

*endings at the dilator muscle of the pupil. Therefore, a*

*preganglionic HS (with intact postganglionic third-order*

*neuron) will dilate after administration of topical*

*hydroxyamphetamine 1%, while a postganglionic HS pupil*

*will not dilate (no norepinephrine stores). The Paredrine test*

*cannot be performed on the same day as the cocaine test.*

*6. Cocaine drops are most commonly used (but are now*

*difficult to obtain). Apraclonidine drops (used for glaucoma;*

*off-label application) are now replacing cocaine for the*

*diagnosis of HS because they are easy to obtain. Testing*

*with apraclonidine involves instillation of two drops of 0.5*

*or 1% apraclonidine in both eyes. After 30 to 45 minutes, a*

*normal pupil does not dilate, while a Horner pupil dilates*

*and the anisocoria reverses and the palpebral fissure*

*enlarges. Apraclonidine is a direct α-receptor agonist*

*(strong α2 and weak α1). It has no effect in eyes with intact*

*sympathetic innervation but causes mild pupillary dilation in*

*eyes with sympathetic denervation regardless of the lesion*

*location.*

*74.2 Test Interpretation*

*The response to eye drops in this patient was consistent with a*

*postganglionic (third-order) HS, and in the setting of headache,*

*neuroimaging was performed of the brain and cervical region*

*and magnetic resonance (MR) angiography of the carotid artery.*

*MR angiography revealed a dissecting aneurysm affecting the*

*high cervical carotid artery. An etiology of all cases of HS must*

*be aggressively sought depending on response to eye drops,*

*associated neurologic or medical symptoms, and the clinical situation.*

*An isolated second-order HS may, for example, be the*

*first sign of a lung neoplasm.*

*74.3 Diagnosis*

*Postganglionic HS due to spontaneous dissection of the internal*

*carotid artery.*

*74.4 Medical Management*

*HS per se requires no treatment. The etiology of the HS must be*

*treated. The patient in this case was treated for 3 months with*

*Coumadin and afterward was maintained on aspirin.*

*74.5 Surgical Management*

*No surgical treatment is indicated.*

*74.6 Rehabilitation and Follow-up*

*Cases in which no etiology is evident require close observation*

*to investigate for the development of other neurologic or medical*

*signs or symptoms.*

~~~~~CASE 75 Anisocoria—Eye Drops~~~~~

*75 Anisocoria—Eye Drops*

*Sushma Yalamanchili and Andrew G. Lee*

*Abstract*

*A 24-year-old student nurse was referred for long-standing*

*headaches, blurred vision, and anisocoria. Pupils were 8mm on*

*the right and 4mm on the left. The right pupil did not react to*

*light or near, while the left pupil reacted briskly to light and*

*near. The pupil did not constrict to dilute pilocarpine eye drops*

*because of pharmacologic mydriasis.*

*Keywords: eye drops, pharmacologic pupil, anisocoria, dilute pilocarpine,*

*headache, blurred vision, nurse, pharmacologic mydriasis*

*75.1 History*

*A 24-year-old student nurse was referred for headaches and*

*anisocoria. The headaches had been present for several years,*

*but had been worse over the last few months. They occurred*

*daily, were diffuse in nature, and were not associated with nausea*

*or vomiting. Because of the headaches, she saw a neurologist*

*who noted anisocoria, and she was thus sent for*

*ophthalmologic examination. She states that her vision was*

*always “blurry,” especially with her headaches. She denied diplopia*

*or other eye problems. She was taking medications only*

*for her headaches.*

*Examination revealed visual acuity to be 20/20 bilaterally.*

*She identified 10 of 10 Hardy–Rand–Rittler pseudoisochromatic*

*plates bilaterally. Visual fields were full. Pupils were 8mm on*

*the right (▶Fig. 75.1) and 4mm on the left. The right pupil did*

*not react to light or near, while the left pupil reacted briskly to*

*light and near. No relative afferent pupillary defect was documented.*

*Motility was normal and there was no ptosis. Facial*

*sensation and strength were normal. Slit-lamp exam revealed*

*both pupils to be smoothly round without irregularities, and*

*there was no segmental contraction of the right pupil to light.*

*Fundus exam was normal with no disc swelling noted.*

*Differential Diagnosis—Key Points*

*1. Presence of a unilateral large, nonreactive pupil raises*

*several possibilities, including a right third nerve palsy, tonic*

*pupil, iris damage, or pharmacologic mydriasis. The normal*

*motility and absence of ptosis argue strongly against a third*

*nerve palsy. The absence of pupillary irregularity and the*

*absence of visible structural iris abnormality on slit-lamp*

*examination argue against iris damage. There is no tonicity*

*of the near response or segmental sphincter palsy*

*suggestive of a tonic pupil. The most likely etiology of the*

*anisocoria is thus pharmacologic mydriasis.*

*2. Nurses, physicians, and other health care workers are*

*particularly prone to inadvertent or intentional exposure to*

*pharmacologic mydriatics. The most common agents*

*implicated in accidental exposure include sphincter blockers*

*(such as belladonna alkaloids, scopolamine patches,*

*anticholinergic inhalants, topical gentamicin, or lidocaine)*

*or dilator stimulators (e.g., ocular decongestants or*

*adrenergic inhalants used in the intensive care setting).*

*3. The pupil size of patients with pharmacologic blockade is*

*often quite large, usually greater than 8mm and often 10 to*

*12mm in diameter, which is much greater than the*

*mydriasis seen with third nerve palsy or tonic pupil*

*syndrome. The pupil is usually smoothly dilated over the*

*entire 360-degree circumference and no pupillary*

*irregularities are noted.*

*75.2 Test Interpretation*

*A pharmacologic dilated pupil will not constrict to dilute pilocarpine*

*(vs. a tonic pupil) and will constrict poorly or not at all*

*to pilocarpine 1% (vs. third nerve palsy). Over time with observation*

*alone, the pupil will return to normal size.*

*75.3 Diagnosis*

*Pharmacologic mydriasis.*

*75.4 Medical Management*

*No treatment is required except discussion concerning the findings,*

*possible etiologic agents, and reassurance.*

*75.5 Surgical Management*

*No surgical treatment is indicated.*

*75.6 Rehabilitation and Follow-Up*

*Follow-up to ensure resolution of the symptoms is reasonable.*

*Fig. 75.1 The pupil measured 8mm on the right and did not react to*

*light or near.*

*Neuro-Ophthalmology*

~~~~~CASE 76 Leukocoria~~~~~

*76 Leukocoria*

*Tatyana Beketova and Dan S. Gombos*

*Abstract*

*Retinoblastoma is an ominous cause of leukocoria in young*

*children. When a patient develops leukocoria and retinoblastoma*

*is suspected, an exam under anesthesia followed by magnetic*

*resonance imaging (MRI) should be performed. Genetic*

*testing assists in prognosis and treatment strategies. Retinoblastoma*

*management involves chemotherapy followed by*

*focal surgical techniques, such as laser and cryotherapy. Enucleation*

*may be preferred in advanced or relapsed cases. Frequent*

*follow-up examinations are necessary to monitor for*

*tumor response and recurrence. Patients with hereditary retinoblastoma*

*should have long-term follow-up due to an*

*increased risk of secondary malignancies, particularly soft-tissue*

*and bony sarcomas.*

*Keywords: leukocoria, retinoblastoma, Coats’ disease, persistent*

*fetal vasculature, RB1 gene, Chemotherapy, Cryotherapy, laser*

*therapy, enucleation*

*76.1 History*

*The family of a 9-month-old girl noted that her left eye has*

*looked “funny” for the last 3 months. The girl’s pediatrician*

*detected leukocoria and immediately referred her to an ophthalmologist*

*for evaluation and treatment. The child is an otherwise*

*healthy 9-month-old with a negative review of systems*

*with the exception of the white pupil. She was born 2 weeks*

*prematurely and had a birth weight of 6 lb., 8 oz. There is no*

*history of systemic disease or exposure to animals, and there is*

*no family history of childhood ocular disease.*

*Examination reveals a normal right eye, though only the posterior*

*pole can be seen on retinal examination. In the left eye, a*

*white, vascular lesion is obvious with a surrounding large*

*serous retinal detachment (▶Fig. 76.1 and ▶Fig. 76.2). The*

*child fixes and follows well with her right eye, but does not fix*

*or follow with her left eye. Strong objection to occlusion of the*

*right eye is noted.*

*Differential Diagnosis—Key Points*

*1. When leukocoria is noted on ophthalmologic examination,*

*an extensive differential diagnosis must be considered.*

*Almost all of the conditions that produce leukocoria in a*

*child are serious vision- or life-threatening problems.*

*Leukocoria is therefore an urgent ophthalmologic problem.*

*2. Retinoblastoma is the most ominous cause of leukocoria. It*

*is the most common intraocular malignancy of childhood,*

*occurring in approximately 1 in 18,000 to 20,000 live*

*births.1 In the United States, there are an estimated 300 to*

*350 new cases per year. Most are diagnosed prior to the age*

*of 5 years, but retinoblastoma has been reported in teenage*

*children and adults.2 The condition may be unilateral or*

*bilateral, and there is no race or gender predilection.3 The*

*most common presenting signs include leukocoria,*

*strabismus, poor vision, and family history of*

*retinoblastoma.4 Other less common presenting signs*

*include vitreous hemorrhage, pain, microphthalmus, and*

*orbital cellulitis.5 Retinoblastoma is classified based on the*

*location and extent of the tumor according to the*

*International Classification for Intraocular Retinoblastoma*

*(ABC or “Murphree” Classification).6,7*

*3. Coats’ disease is another cause of leukocoria. It is typically*

*unilateral and more common in boys. The condition is*

*characterized by an exudative retinal detachment with*

*associated telangiectatic retinal vessels and subretinal lipid*

*exudation.8 Coats’ disease can usually, but not always, be*

*differentiated from retinoblastoma on clinical examination*

*alone.*

*4. Persistent fetal vasculature (PFV) can present with*

*leukocoria, which on initial examination resembles an*

*extensive retinoblastoma. The anterior portion of the lens is*

*clear and an associated cataract, which is at the level of the*

*posterior capsule, is stark white and vascular. Eyes with PFV*

*tend to have a shorter axial length than normal, a feature*

*that is uncommon in retinoblastoma.8 The correct diagnosis*

*can usually be made with careful ophthalmologic*

*examination and ultrasound.*

*5. Numerous other conditions are included in the differential*

*diagnosis of leukocoria, including advanced retinopathy of*

*prematurity with cicatricial retinal detachment, toxocariasis,*

*large chorioretinal colobomas, uveitis, extensive medullated*

*nerve fibers, and other types of cataracts.*

*6. Genetics of retinoblastoma: Most patients with*

*retinoblastoma are karyotypically normal. However, 5 to 6%*

*of retinoblastoma patients will have a chromosome 13q14*

*deletion or translocation, resulting in 13q deletion*

*syndrome.9 Features of this syndrome include*

*developmental delay and structural facial anomalies.*

*Hereditary and nonhereditary cases of retinoblastoma exist.*

*Hereditary forms present in all cases of bilateral*

*retinoblastoma or in cases of multiple affected family*

*members, and are confirmed with genetic testing of the*

*RB1 gene. Genetic testing is crucial for assessing short-term*

*risk (additional eye tumors) and long-term prognosis*

*(nonocular secondary malignancies) while providing costeffective*

*treatment and surveillance strategies. It should*

*routinely be performed in all retinoblastoma patients.10*

*Examination of siblings and parents of an affected patient is*

*important to rule out active retinoblastoma and/or evidence*

*of regressed disease.*

*76.2 Test Interpretation*

*The major diagnostic considerations in this child are to determine*

*the extent of local disease, to rule out contralateral*

*involvement, and assess if extraocular spread has occurred.*

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*1. A magnetic resonance imaging (MRI) scan of the head and*

*orbits is performed in all newly diagnosed retinoblastoma*

*patients. The most important role of MRI is to assess for*

*extraocular extension.11 The presence of calcium in an*

*intraocular lesion noted on exam or ultrasound in a child*

*younger than 3 years is highly suggestive of retinoblastoma.*

*Computed tomography (CT) was previously used primarily*

*to confirm intraocular calcification, but ultrasound and MRI*

*have similar sensitivity and avoid radiation exposure.12,13 An*

*MRI scan is also useful in detecting extraocular orbital*

*extension, and central nervous system involvement due to*

*either metastases or the presence of a pineal tumor (socalled*

*trilateral retinoblastoma).*

*2. Ultrasound testing can offer both diagnostic and therapeutic*

*assistance. Calcium may be detected on B-scan*

*ultrasonography. A-scan ultrasonography is useful in*

*determining the height of the tumor. Both are valuable in*

*monitoring treatment response particularly if the tumor is to*

*be treated with local measures such as plaque radiation.14*

*3. Other testing: All patients affected with retinoblastoma*

*should undergo genetic counseling and a general physical*

*examination. Bone marrow and cerebrospinal fluid*

*evaluation are rarely utilized and only done in select cases*

*when extraocular extension is suspected.15 The enucleated*

*eye should be submitted for pathologic examination, and*

*genetic testing of the tumor performed.*

*4. Examination of the eyes under anesthesia was performed*

*and demonstrated a massive tumor with retinal detachment*

*in the left eye (▶Fig. 76.3). In addition, a small tumor was*

*noted in the inferior retina of the right eye.*

*76.3 Diagnosis*

*Bilateral retinoblastoma.*

*76.4 Medical Management*

*Chemotherapy is the most common form of medical management*

*for retinoblastoma, and is usually used in conjunction*

*with local surgical measures, such as laser or cryotherapy.*

*There are four routes of chemotherapy delivery—intravenous,*

*intra-arterial, periocular, and intravitreal. Intravenous chemotherapy*

*is generally used for hereditary (advanced bilateral)*

*retinoblastomas with a moderate to good prognosis and in*

*patients at high risk of metastases. Intra-arterial chemotherapy*

*allows for excellent control in nonhereditary cases, and is also*

*used for recurrent disease, subretinal seeds, and vitreous seeds.*

*Periocular chemotherapy is employed to boost local chemotherapy*

*dose in advanced retinoblastoma. Intravitreal chemotherapy*

*is used for recurrent or persistent vitreous seeds.16*

*76.5 Surgical Management*

*Examination under anesthesia is almost always required to fully*

*evaluate infants and young children with retinoblastoma or*

*suspected retinoblastoma.17 This case highlights the importance*

*of examination under anesthesia in that the tumor in the right*

*eye was not detected on clinical office examination, where only*

*the posterior pole could be readily examined.*

*While patients with retinoblastoma can be managed medically*

*in many cases, enucleation of an eye with extensive tumor*

*and no visual potential is still the treatment of choice.17 This patient*

*should undergo enucleation of the left eye using meticulous*

*technique in an attempt to obtain a long optic nerve*

*segment since the tumor tends to spread by direct extension*

*into the optic nerve. ▶Fig. 76.4 shows the gross and microscopic*

*appearance of an eye with retinoblastoma. The right eye*

*can be approached with both medical and surgical modalities.*

*The potential surgical treatments include cryotherapy, laser*

*therapy, and radioactive plaque treatment.17*

*Fig. 76.1 Clinical photograph of the patient demonstrating leukocoria*

*of the left eye.*

*Fig. 76.2 CT scan of the of brain and orbit demonstrating bilateral*

*involvement of retinoblastoma, left eye greater than right.*

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*76.6 Rehabilitation and Follow-up*

*Recurrence of the tumor can occur in the orbit even if the cut*

*margin of the optic nerve is free of disease. The physician*

*should, therefore, examine the enucleated socket each time he*

*or she examines the contralateral eye. Following local control of*

*the tumor in this child’s right eye, follow-up examinations*

*under anesthesia should be conducted every 3 to 4 months*

*until the child is 5 years of age if the genetic testing confirms an*

*RB1 germline mutation. Frequent examinations must continue*

*for several more years and an annual eye examination is prudent*

*thereafter. Long-term safety issues include protecting the*

*remaining eye with the use of polycarbonate safety glasses and*

*providing patient education on eye safety. These measures are*

*important in all monocular patients. Patients with hereditary*

*retinoblastoma have a high incidence of secondary tumors, particularly*

*soft-tissue and bony sarcomas of the extremities, and*

*should be followed long term with these risk factors in mind.18*

*Fig. 76.3 Large retinoblastoma with vitreous seeding and exudative*

*retinal detachment.*

*Fig. 76.4 (a) Gross appearance of retinoblastoma. Note long segment of optic nerve obtained at the time of enucleation. (b) Large retinoblastoma*

*with invasion of the optic nerve. (c) Histologic example of retinoblastoma demonstrating Flexner–Wintersteiner rosettes. (Photos courtesy of Ramon L.*

*Font, MD, Houston, TX.)*

~~~~~CASE 77 The Child Who Sees Poorly Out of One Eye~~~~~

*77 The Child Who Sees Poorly Out of One Eye*

*David K. Coats*

*Abstract*

*A child who fails a school screening examination or is being*

*evaluated for unexplained visual loss requires a complete history*

*and examination to determine the etiology. Many causes*

*are readily treatable but some may reflect underlying serious*

*ocular pathology. Amblyopia can occur during the critical visual*

*development period and also might be amenable to treatment*

*if detected early.*

*Keywords: amblyopia, visual loss, screening*

*77.1 History*

*A 4-year-old boy failed his preschool vision screening test. The*

*vision screening failure was confirmed by his pediatrician and*

*he has been sent for ophthalmologic evaluation and treatment*

*recommendations. The child is a robust 4-year-old with no history*

*of medical or ophthalmologic problems. The review of systems*

*is negative and, specifically there is no history of eye*

*injury, strabismus, spectacle wear, squinting, or other ophthalmologic*

*problems. The child has not previously had an ophthalmologic*

*examination and there is no family history of*

*amblyopia or childhood eye disease.*

*On examination, the technician found 20/40 vision in each*

*eye with Allen figure testing. His stereoacuity is 60 seconds of*

*ARC using the Titmus fly test. Motility evaluation reveals orthotropia*

*at distance and an exophoria of 4 prism diopters at near*

*with full ductions and versions. His cycloplegic refractive error*

*following administration of 1% cyclopentolate is + 3.00 in the*

*right eye and + 1.00 in the left eye. The ophthalmologist repeated*

*the visual acuity testing using an HOTV acuity test and found a*

*visual acuity of 20/50 in the right eye and 20/30 in the left eye.*

*Differential Diagnosis—Key Points*

*1. The majority of children who fail a school vision screening*

*test will have a normal eye examination. However, as many*

*as 25 to 30% of screening failures will have an*

*ophthalmologic problem that can benefit from treatment.*

*The differential diagnosis of poor vision in one eye includes*

*amblyopia, uncorrected refractive error, a structural eye*

*abnormality, and poor effort. Four causes of amblyopia*

*must be considered including refractive, deprivational,*

*strabismic, and idiopathic amblyopia (▶Fig. 77.1a–c).*

*Idiopathic amblyopia is probably amblyopia that occurred*

*from one of the other causes, but which is now*

*undetectable by physical examination.*

*2. Terminology: Before proceeding with the discussion on*

*amblyopia, a review of some important amblyopia*

*terminology is in order.*

*a) Occlusion amblyopia is a term used to describe iatrogenic*

*amblyopia that occurs in the sound eye as a result of*

*wearing a patch to treat amblyopia in the fellow eye. This*

*term should not be used to describe deprivational*

*amblyopia such as that caused by a cataract or corneal*

*opacities.*

*b) Foveal form vision deprivational amblyopia is a term used*

*to describe amblyopia caused by failure to produce a*

*clear image on the fovea of the involved eye. It can be*

*caused by media opacities and high refractive errors.*

*c) Abnormal binocular interaction is a term used to describe*

*a situation in which the image size or shape on the two*

*foveas is so dissimilar that the images cannot be fused.*

*One of the images is suppressed and amblyopia may*

*develop. This type of amblyopia most commonly occurs*

*due to uncorrected anisometropic refractive errors and*

*strabismus. A combination of form vision deprivation and*

*abnormal binocular interaction can coexist in some*

*patients.*

*d) Anisometropic amblyopia is amblyopia that develops on*

*the basis of an unequal refractive error. In a hyperope,*

*amblyopia usually develops in the most hyperopic eye.*

*The condition is less common in children with myopia or*

*astigmatism, but may occur when the refractive error is*

*large.*

*e) Ametropic amblyopia is bilateral amblyopia due to the*

*presence of bilateral large refractive errors. It is most*

*common with hyperopia, but may also occur with high*

*myopia and astigmatism.*

*3. Refractive amblyopia is common. It most commonly occurs*

*in one eye, but can occur in both eyes where it is called*

*ametropic amblyopia. Because the eyes are usually straight*

*when this condition is present and there are no other*

*obvious abnormalities visible to the child’s family, the*

*condition is often not diagnosed until the child fails a vision*

*screening examination either at school or in the*

*pediatrician’s office. Refractive amblyopia can occur with*

*any type of refractive error but is more common with*

*anisometropic hyperopia.*

*4. Strabismic amblyopia is also very common. It is most often*

*seen with esotropia but can occur with any type of*

*strabismus. It is least likely to occur with intermittent*

*exotropia. The size of the strabismic deviation is unrelated*

*to the presence or severity of amblyopia. Amblyopia is more*

*likely to be detected early in children with large-angle*

*strabismus because parents are readily able to detect largeangle*

*strabismus prompting a visit to the ophthalmologist*

*and subsequent diagnosis of amblyopia. Strabismic*

*amblyopia typically responds well to treatment measures.*

*5. Deprivational amblyopia is the most serious form of*

*amblyopia. It may occur in one or both eyes and is due to*

*media opacities such as cataracts, corneal opacities,*

*vitreous hemorrhage, and visual obstruction secondary to*

*ptosis. Clearing of the visual axis with institution of*

*amblyopia treatment measures such as occlusion is most*

*likely to be successful if implemented within the first few*

*months of life. Deprivational amblyopia can be recalcitrant*

*to treatment.*

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*77.2 Test Interpretation*

*Psychophysical testing, which involves the use of recognition*

*acuity tests such as HOTV testing and Snellen figure testing, is*

*the most important means of detecting the presence of amblyopia*

*and for monitoring the response to treatment. This child’s*

*examination results reveal a critically important feature of recognition*

*acuity tests. Note that his vision was equal in the two eyes*

*on Allen figure testing, but was reduced in the right eye on HOTV*

*testing. Allen figure testing tends to overestimate visual acuity in*

*children with amblyopia. Therefore, Allen figure testing should be*

*supplemented with another test such as a fixation preference test*

*or not used at all, and the child should be tested with a more*

*sophisticated test such as the E game, Landolt ring test, or Snellen*

*acuity test as soon as the child is able to cooperate. Young children*

*are often not able to cooperate well enough to read the 20/*

*20 line, but should have equal vision in the two eyes.*

*The “rule of 8’s” has been proposed as a simple tool to determine*

*if the measured screening visual acuity is typical for*

*younger children. The premise is simple and is both verbally and*

*graphically described as follows. For children 2 through 6 years*

*of age, the child’s age plus the first number of the denominator*

*of the average visual acuity should equal 8. Take, for example, a*

*3-year-old child. Using the “rule of 8,” a vision screener would*

*subtract the child’s age in years (3) from the number 8, in this*

*case yielding 5. Thus, the expected visual acuity for a 3-year-old*

*child is 20/50. If the visual acuity is worse than 20/50, there*

*should be a high degree of concern, and this child should be*

*referred for further evaluation (▶Table 77.1).*

*Fixation behavior, fixation preference, and occlusion objection*

*may be the only means of detecting amblyopia in small*

*children without resorting to preferential looking tests, which*

*are usually not necessary to diagnose amblyopia. An effort*

*should be made to assure that each eye will readily fixate on a*

*small target and that one eye is not preferred over the other. In*

*children with straight eyes, the eyes can be dissociated with a*

*vertical or horizontal prism and fixation preference tested during*

*the period of prism dissociation.*

*Common among all recognition tests is a feature known as*

*the crowding phenomenon. Patients with amblyopia are frequently*

*able to identify much smaller optotypes if the optotypes*

*are shown in isolation than if they are shown a line in a*

*full chart of letters. It is, therefore, imperative that a line of letters*

*or single letters with crowding bars be utilized to minimize*

*the chance that amblyopia will be overlooked (▶Fig. 77.2).*

*77.3 Diagnosis*

*Anisometropic amblyopia in the right eye due to uncorrected*

*hyperopia.*

*77.4 Medical Management*

*The first task in management of this child with amblyopia is to*

*correct his refractive error. The ophthalmologist may prescribe*

*the full cycloplegic refraction or may symmetrically reduce the*

*hyperopic correction in each eye so that the child must continue*

*to accommodate slightly in order to see clearly. Either of*

*these methods is reasonable provided that reduction in the*

*spherical correction is exactly the same in both eyes, so that the*

*same amount of accommodation is required to see with either*

*eye.*

*The child should be examined several weeks to months following*

*the initiation of spectacle correction. Often, the visual*

*acuity on follow-up examination will have responded to glasses*

*alone and no other treatment measures are required. If vision*

*remains reduced on retesting, other treatment measures must*

*be instituted. Frequently, children will not adapt to the use of*

*Fig. 77.1 Amblyopia can be caused by (a) strabismus; (b) refractive errors; (c) obstruction of the visual axis.*

*Table 77.1 The rule of 8: expected visual acuity performance by age*

*Age in years Expected visual*

*acuity*

*(Rule of 8)*

*2 20/60 (2 + 6)=8*

*3 20/50 (3 + 5)=8*

*4 20/40 (4 + 4)=8*

*5 20/30 (5 + 3)=8*

*6 20/20 (6 + 2)=8*

*Used with permission from Amit R. Bhatt, MD.*

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*hyperopic spectacles, particularly when the hyperopic correction*

*is moderate or high. In such cases, atropine drops may be*

*prescribed once a day for several days. This will produce a pronounced*

*and prolonged cycloplegia, thus encouraging the child*

*to wear the glasses, which are needed to produce clear vision*

*during the period of time the cycloplegia is in effect. The atropine*

*effect will gradually wear off over several days, allowing*

*the child to comfortably adjust to wearing spectacles.*

*Occlusion therapy with the use of an eye patch is a common*

*means of treating amblyopia (▶Fig. 77.3a, b). A patch is utilized to*

*cover the sound eye, thus encouraging use of the amblyopic eye.*

*Two hours of prescribed patching of the sound eye has been shown*

*to be effective for the treatment ofmild tomoderate amblyopia.*

*Optical penalization is also a useful option in treating*

*amblyopia. Atropine eye drops and/or spectacles are utilized for*

*optical penalization. If atropine is used, it is placed in the sound*

*eye. This greatly reduces the child’s ability to accommodate and*

*thus encourages utilization of the amblyopic eye. Both daily and*

*weekend atropine have both been demonstrated to be effective*

*in the treatment of moderate amblyopia. Atropine penalization*

*is sometimes supplemented by temporary reduction of the*

*spherical component of hyperopia in the sound.*

*77.5 Surgical Management*

*The role of surgery in the management of amblyopia has traditionally*

*been limited to clearing the visual axis (i.e., correct*

*ptosis or remove a media opacity such as a corneal leukoma or*

*cataract). If amblyopia is caused by strabismus, many pediatric*

*ophthalmologists believe it is best to defer strabismus surgery*

*until amblyopia has been maximally treated. Strabismus surgery*

*itself does not necessarily result in resolution of amblyopia.*

*Refractive surgery has been used successfully to improve the*

*visual outcome in children with severe anisometropia leading*

*to amblyopia or severe isoametropia. Photorefractive keratectomy,*

*laser in-situ keratomileusis (LASIK), and clear lens extraction*

*have all been studied in the treatment of amblyopia in*

*children. While gaining acceptance, most pediatric ophthalmologists*

*reserve these treatment modalities for children who are*

*not responding to or resisting attempts to treat with nonsurgical*

*modalities.*

*77.6 Rehabilitation and Follow-up*

*Ophthalmologic follow-up examinations may be needed even*

*after amblyopia has been maximally treated. Gains from excellent*

*amblyopia management can be lost if children are not*

*Fig. 77.2 Typical psychophysical tests of visual function: (line a) Snellen*

*test; (line b) E game; (line c) HOTV test; (line d) Landolt test; (line e)*

*Lea test; (line f) Allen test; (line g) single optotypes with crowding bars.*

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*observed carefully for recurrence. Refractive error will gradually*

*change as the child ages and updated prescriptions will be*

*required. Strabismic amblyopia can recur even if the eyes*

*appear aligned, due to the presence of difficult-to-detect microstrabismus.*

*Because of the potential of recurrence, maintenance*

*patching is often needed until the age of 7 to 8 years in some*

*children to prevent loss of amblyopia treatment gains.*

~~~~~CASE 78 Childhood Torticollis~~~~~

*78 Childhood Torticollis*

*David K. Coats*

*Abstract*

*Torticollis is a clinical symptom or sign that can manifest as a*

*head tilt, face turn, or chin rotation. A variety of conditions may*

*cause torticollis and the differential diagnosis in children is different*

*than for adults. This chapter describes the differential*

*diagnosis, evaluation, management, and treatment of torticollis.*

*Although nonmuscular causes of torticollis should be considered,*

*this chapter emphasizes the causes of ocular torticollis*

*including eye muscle weakness.*

*Keywords: strabismus, ocular motility, torticollis, head tilt*

*78.1 History*

*A 5-year-old boy is brought to his ophthalmologist’s office at*

*the request of his pediatrician for evaluation of an anomalous*

*head tilt. The child has undergone orthopaedic evaluation and*

*neck muscle abnormalities are absent. The child has had a relatively*

*constant left head tilt since he first gained head control*

*during the first year of life. His parents note that he strongly*

*resists any attempts to straighten his head. During the last 2*

*months, they have noticed that his eyes sometimes do not*

*appear to move together. Family history is unremarkable and*

*the review of systems is notable only for frequent eye rubbing*

*and blinking behavior.*

*On examination, the patient has a constant 10- to 15-degree*

*left head tilt (▶Fig. 78.1a, b). He fixes and follows well with*

*either eye, there is no objection to occlusion, and he alternates*

*fixation on prism dissociation testing. In the primary position,*

*an intermittent right hypertropia of 12 prism diopters is measured.*

*The deviation increases to 18 prism diopters in left gaze*

*and decreases to 4 prism diopters in right gaze. A 15 prism*

*diopter right hypertropia is present on right head tilt, while a 5*

*prism diopter right hypertropia is present on left head tilt.*

*Moderate overelevation of the right eye is noted in adduction*

*(▶Fig. 78.2a–d). Anterior segment and pupillary examination*

*are normal. Cycloplegic refraction is + 1.75 + 0.75 axis 090 in*

*both eyes. Fundus examination is normal in both eyes, though*

*mild excyclorotation of the left fundus is noted (▶Fig. 78.3a, b).*

*Differential Diagnosis—Key Points*

*1. The differential diagnosis of the child with a history of*

*infantile torticollis is extensive but ocular causes can usually*

*be easily identified on clinical examination in a cooperative*

*child. Known causes of infantile torticollis include*

*sternocleidomastoid abnormalities, superior oblique palsy,*

*Brown’s syndrome, dissociated vertical deviation,*

*nystagmus, uncorrected or improperly corrected refractive*

*errors, homonymous hemianopia, other forms of restrictive*

*or paralytic strabismus, and even unilateral hearing loss.*

*2. Superior oblique palsy is a common ocular etiology of*

*infantile torticollis seen in pediatric ophthalmology practice.*

*Superior oblique palsy may be either congenital or acquired.*

*Some believe that congenital superior oblique palsy*

*represents an anatomic laxity of the superior oblique*

*tendon, with the muscle itself functioning normally.*

*Superior oblique palsy, both acquired and congenital, can*

*be bilateral or unilateral. Unilateral superior oblique palsies*

*are much more common. It is important to make the*

*distinction between acquired and congenital superior*

*oblique palsy because acquired superior oblique palsy may*

*require neurologic evaluation including neuroimaging, while*

*congenital superior oblique palsy does not. Features that*

*suggest the presence of a congenital or early-onset superior*

*oblique palsy are the presence of a long-term anomalous*

*head tilt, facial asymmetry, and absence of subjective*

*torsion. It is theorized that a chronic head tilt results in*

*structural musculoskeletal changes in the face due to*

*gravity or other unknown factors resulting in permanent*

*structural changes in the face.*

*3. Brown’s syndrome is an interesting but uncommon cause of*

*infantile torticollis. It is typically unilateral, but may be*

*bilateral. Like superior oblique palsy, it can occur on a*

*congenital or acquired basis. Brown’s syndrome results from*

*an anomaly of the superior oblique tendon/trochlea*

*complex that prevents normal elevation of the eye. In*

*classic Brown’s syndrome, the involved eye elevates poorly*

*or not at all in adduction, demonstrates improved elevation*

*in supraduction, and shows normal or near-normal elevation*

*in abduction. A Brown syndrome can typically be*

*differentiated from a superior oblique palsy by two main*

*factors including inability to elevate the eye in adduction,*

*the opposite of what occurs in superior oblique palsy. In*

*addition, the typical child with Brown’s syndrome adopts a*

*head tilt to the opposite side, but also adopts a chin-up*

*head posture. Brown’s syndrome is rarely confused with*

*superior oblique palsy, though parents of children with*

*Brown’s syndrome often erroneously interpret the normal*

*movements of the uninvolved eye as overelevation, not*

*recognizing that the involved eye does not elevate fully.*

*4. Dissociated vertical deviation is an interesting form of*

*strabismus characterized by elevation, abduction, and*

*excyclotorsion of the involved eye when the eye is occluded*

*or the patient inattentive. For largely unknown reasons,*

*some children will adopt an anomalous head posture. The*

*anomalous head posture may be ipsilateral or contralateral*

*to the dissociated vertical deviation. In uncooperative*

*children, it can be difficult to distinguish dissociated vertical*

*deviation from superior oblique palsy. Careful evaluation*

*and repeated examinations, when necessary, will help to*

*make the distinction.*

*5. Other less common considerations in the diagnosis of*

*infantile torticollis include congenital fibrosis syndrome,*

*blowout fractures, orbital tumors, myasthenia gravis,*

*thyroid disease, unilateral hearing loss, and*

*sternocleidomastoid abnormalities.*

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*78.2 Test Interpretation*

*The child should undergo a comprehensive ocular motility evaluation*

*including a three-step test. The three-step test involves*

*measuring the hypertropia in the primary position, right and*

*left gaze, and on right and left head tilt. By analyzing the ocular*

*alignment in the various positions of gaze, the examiner is able*

*to identify the weak right superior oblique muscle.*

*If the timing of onset is unclear, consideration should be*

*given to asking the family to bring in a photo album demonstrating*

*photographs of the child in the months and years preceding*

*the examination (▶Fig. 78.1b). The presence of a*

*longstanding and consistent head tilt in photos supports the*

*diagnosis of a congenital superior oblique palsy and renders*

*neuroimaging unnecessary.*

*If the examiner is not able to demonstrate features of a congenital*

*superior oblique palsy and no other explanation is*

*obvious, the child should undergo neuroimaging of the brain*

*and orbit. Central nervous system structural abnormalities and*

*orbital abnormalities can result in superior oblique palsy or a*

*motility pattern that resembles superior oblique palsy, and*

*these conditions should be ruled out if the palsy is thought to*

*be acquired and the etiology is unclear.*

*Fig. 78.1 Photographs of the patient (a) at examination and (b) during*

*childhood, demonstrating a left head tilt.*

*Fig. 78.2 Ocular alignment in (a) the primary position and (b) left gaze and with head tilt to (c) right and (d) left. Note secondary “overaction” of the*

*right inferior oblique muscle with left gaze and hypertropia, which increases with right head tilt. Also note mild facial asymmetry with left side of face*

*smaller compared to the right side of the face.*

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*78.3 Diagnosis*

*Right superior oblique palsy with chronic left head tilt and mild*

*facial asymmetry.*

*78.4 Medical Management*

*Patients with asymptomatic or minimally symptomatic superior*

*oblique palsy do not require surgical intervention. Many*

*patients with mild superior oblique palsy are able to develop*

*sufficient vertical fusional amplitudes to maintain comfortable*

*single vision most or all of the time without treatment. Such*

*patients, however, may become symptomatic later in life as*

*control of their deviation decreases and diplopia develops.*

*Patients with small hypertropias and a mild or absent anomalous*

*head posture may benefit from treatment with an appropriate*

*vertical prism. In general, patients do not tolerate prism*

*powers greater than 4 or 5 prism diopters, though there are*

*many exceptions to this rule. Patients with a large degree of*

*ocular torsion are unlikely to be adequately managed with*

*prism therapy.*

*78.5 Surgical Management*

*Indications for strabismus surgery with acquired and congenital*

*superior oblique palsy include improvement of fusion, improvement*

*of an anomalous head posture, and improvement of diplopia.*

*Surgical treatment of superior oblique palsy typically*

*involves weakening procedures of the ipsilateral inferior oblique*

*muscle such as inferior oblique myectomy or recession.*

*Others are treated with superior oblique strengthening*

*procedures such as a superior oblique tuck, while still others*

*may undergo a combination of procedures including surgery on*

*the superior and inferior oblique muscle of the involved eye as*

*well as rectus muscle surgery.*

*78.6 Rehabilitation and Follow-up*

*Parents should be advised at the time of surgery of the potential*

*for an over- or under-correction and the potential need for*

*additional surgery in the future. Patients who have undergone*

*a superior oblique tuck often develop a mild to moderate*

*Brown’s syndrome with limitation of elevation in adduction following*

*surgery. This problem typically improves or resolves*

*with time, but may persist. In children, amblyopia may have*

*developed prior to surgery or may develop following surgery if*

*ocular misalignment persists or later develops. Therefore,*

*young children with superior oblique palsy should undergo*

*periodic ophthalmologic evaluations with particular attention*

*to fusion, stereopsis, and visual acuity testing to detect, prevent,*

*and treat amblyopia.*

~~~~~CASE 79 Aniridia~~~~~

*79 Aniridia*

*David K. Coats*

*Abstract*

*Aniridia is a cause of visual loss and congenital nystagmus. A*

*full history and clinical exam are required to make the diagnosis*

*and to differentiate isolated from hereditary cases and to*

*evaluate for potentially life threatening associations (e.g.,*

*Wilm's tumor).*

*Keywords: aniridia, Wilm's tumor, nystagmus*

*79.1 History*

*A 9-month-old boy is referred to his ophthalmologist with a*

*history of “jiggling eyes” and large pupils, both noted during*

*the first month of life. The child closes his eyes in bright sunlight*

*and does not appear to see as well as his two older siblings.*

*The boy was born at term, the mother received prenatal*

*care, and there were no perinatal complications. The child’s*

*medical history is notable for a hypospadias repair 2 months*

*earlier and for developmental delay. He has two healthy siblings*

*and two healthy parents with no significant family history of*

*ophthalmologic or medical problems.*

*On examination, the child appears to fix and follow, but the*

*fixation behavior is abnormal. A low-amplitude/high-frequency*

*horizontal pendular nystagmus is noted. Examination reveals*

*peripheral corneal opacification and vascularization. The child*

*appears to have only a very small peripheral remnant of iris*

*and an anterior pyramidal cataract is noted in both eyes*

*(▶Fig. 79.1a, b). Retinal examination is notable for the absence*

*of an obvious umbo or foveal pigmentation (▶Fig. 79.2). The*

*child’s parents and two older siblings were examined and found*

*to have normal ophthalmologic examinations.*

*Differential Diagnosis—Key Points*

*1. The syndrome of aniridia is a rare cause of infantile*

*nystagmus. It is a panocular problem that occurs with a*

*frequency of 1 in 50,000 to 100,000 live births. Multiple*

*ophthalmological defects may be present including*

*cataracts, glaucoma, corneal opacification and*

*vascularization, ectopia lentis, foveal hypoplasia, colobomas,*

*and nystagmus. It can occur as an autosomal dominant or*

*sporadic condition.*

*2. The differential diagnosis of infantile nystagmus is quite*

*extensive. Many causes of infantile-onset nystagmus can be*

*easily detected on clinical examination. For those causes*

*that are not obvious on clinical examination, special testing,*

*including eye movement recordings, is required to fully*

*evaluate and diagnose.*

*3. The genetics of aniridia are interesting. The condition can*

*occur as an autosomal dominant condition with variable*

*penetrance or as a sporadic condition. Autosomal dominant*

*forms of the condition are due to a defect in the PAX-6*

*gene.*

*4. Other cases of aniridia occur on a sporadic basis with no*

*family history. As many as 25 to 40% of infants with*

*sporadic aniridia will develop a Wilms’ tumor, typically*

*during the first few years of life. Children who are at*

*greatest risk of developing a Wilms’ tumor in association*

*with sporadic aniridia are those with concurrent congenital*

*genitourinary abnormalities and mental retardation. The*

*complex of Wilms’ tumor, aniridia, genitourinary*

*abnormalities, and retardation has been referred to as the*

*WAGR syndrome (▶Fig. 79.1).*

*Fig. 79.1 (a) Slit-lamp photograph demonstrating multiple anterior segment abnormalities, including corneal pannus, severely hypoplastic iris, and*

*anterior pyramidal cataract. (b) View with retroillumination. (Photographs courtesy of Jim Shigley, certified ophthalmic photographer.)*

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*79.2 Test Interpretation*

*Issues that must be considered in children with aniridia are the*

*potential for development of other ophthalmologic problems*

*and the potential development of serious systemic problems*

*such as Wilms’ tumor. Consultation with a geneticist and a*

*pediatrician is indicated in the management of children with*

*aniridia.*

*1. In autosomal dominant cases, multiple defects in the PAX-6*

*gene have been identified. The parents and siblings of*

*affected children should be evaluated for obvious and subtle*

*signs of aniridia. Subtle signs of aniridia in affected family*

*members include absence of the iris collarette and eccentric*

*pupils and, on angiography, a decreased retinal foveal*

*avascular zone and incomplete iris collarette. Deletion of a*

*portion of the short arm of chromosome 11 (11p13 deletion)*

*is frequently present in children with sporadic aniridia.*

*Children with such a deletion are more likely to have the*

*WAGR syndrome and are at high risk for Wilms’ tumor. This*

*patient has an 11p13 deletion (▶Fig. 79.2).*

*2. Initial screening and periodic follow-up abdominal*

*ultrasound evaluation and abdominal physical examination*

*are recommended in aniridic children at risk for Wilms’*

*tumor (▶Fig. 79.3), and such testing is typically ordered and*

*followed by the child’s pediatrician. The frequency and*

*duration of these examinations is controversial, but in*

*general, most affected children will develop Wilms’ tumor by*

*the age of 3 years (▶Fig. 79.3).*

*79.3 Diagnosis*

*Sporadic aniridia associated with developmental delay and genitourinary*

*abnormalities. This child has three components of*

*WAGR syndrome and is at high risk for developing Wilms’*

*tumor. An 11p13 deletion is present.*

*79.4 Medical Management*

*The child’s symptoms of photophobia can be improved by prescription*

*of sunglasses or shaded contact lenses. Even though*

*the child appears to have reasonable vision at this point, progressive*

*corneal opacification and vascularization, development*

*of progressive cataracts, and development of glaucoma can*

*result in future vision loss. The child should undergo a careful*

*screening ophthalmological examination including efforts to*

*rule out glaucoma. Abdominal ultrasounds should be obtained*

*at regular intervals until approximately 3 years of age. If a renal*

*abnormality is noted on abdominal ultrasound, Wilms’ tumor*

*should be suspected. Further evaluation with magnetic resonance*

*imaging (MRI) is done if an ultrasound abnormality is*

*found, and the child should be referred for biopsy if findings*

*consistent with Wilms’ tumor are noted on MRI scan. If Wilms’*

*tumor is confirmed on histopathologic examination, a pediatric*

*oncologist should be consulted.*

*79.5 Surgical Management*

*While this patient does not presently demonstrate ophthalmologic*

*abnormalities that require surgical care, the development*

*of progressive cataracts, glaucoma, and/or progressive corneal*

*opacification are strong possibilities in the future. Ophthalmologic*

*surgery on patients with aniridia is difficult, and surgery*

*should only be entertained after careful consideration of the*

*risk/benefit ratio and after exhausting nonsurgical treatment*

*modalities.*

*Fig. 79.2 Fundus of patient demonstrating foveal hypoplasia.*

*(Photograph courtesy of Jim Shigley, certified ophthalmic*

*photographer.)*

*Fig. 79.3 Abdominal ultrasound demonstrating a renal mass*

*consistent with a Wilms tumor. (Photograph courtesy of Scott R.*

*Dorfman, MD, Houston, TX.)*

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*79.6 Rehabilitation and Follow-up*

*Long-term follow-up for systemic abnormalities such as Wilms’*

*tumor has already been discussed. The child should undergo*

*periodic ophthalmological screening examinations to detect*

*the presence of progressive ocular disease as described above.*

*Early childhood educational intervention and a low-vision evaluation*

*should be done as early in the child’s life as possible. Intervention*

*in the form of preemptive education efforts and*

*low-vision aids can prove helpful in almost any patient with*

*vision abnormalities in childhood.*

~~~~~CASE 80 Retinopathy of Prematurity~~~~~

*80 Retinopathy of Prematurity*

*David K. Coats and Evelyn A. Paysse*

*Abstract*

*Modern advances in neonatal care has resulted in the survival*

*of smaller and more premature infants in the United States and*

*increased the incidence for retinopathy of prematurity (ROP).*

*Although prematurity is the major risk factor, not all premature*

*infants develop ROP and the degree of ROP is variable. This*

*chapter reviews the differential diagnosis, evaluation, management,*

*treatment, and prognosis of ROP.*

*Keywords: retinopathy of prematurity, retinal ischemia, neovascularization,*

*avascular*

*80.1 History*

*An 11-week-old, former 24-week estimated gestational age*

*premature girl presented for consultation. She is due for*

*another retinopathy of prematurity (ROP) screening examination.*

*Her last examination occurred 1 week ago and demonstrated*

*immature retina in zone 1, with no plus disease. Since*

*this last examination, she has developed sepsis and respiratory*

*compromise, requiring intravenous antibiotics and re-intubation/*

*ventilatory support. Her birth weight was 650 g. She has*

*anemia of prematurity and had an episode of necrotizing enterocolitis*

*4 weeks ago.*

*Examination reveals a frail-appearing infant girl who is intubated.*

*She is receiving 50% oxygen. She blinks briskly to the*

*light of the indirect ophthalmoscope with either eye. On fundus*

*examination, she is found to have dilation and tortuosity of the*

*posterior pole retinal vessels (▶Fig. 80.1).*

*Differential Diagnosis—Key Points*

*1. Differential diagnosis: The differential diagnosis of ROP is*

*not long. It is rarely confused with other disease entities.*

*The differential diagnosis includes familial exudative*

*vitreoretinopathy, Eales’ disease, and Norrie’s disease.*

*Though these diseases can occur in a premature infant,*

*infants with these conditions are typically term infants;*

*hence, there is little chance of confusion with ROP.*

*2. Demographics: ROP affects roughly 40,000 neonates in the*

*United States annually. Despite significant advances in the*

*treatment of ROP, severe visual impairment and blindness*

*cannot be avoided in all affected infants.*

*3. Pathogenesis: ROP is a vasoproliferative disorder of the*

*retina that affects premature infants. It can be mild and selflimiting*

*or it can progress resulting in retinal detachment*

*causing severe visual impairment or blindness. The*

*avascular peripheral retina of a premature infant may*

*produce vascular endothelial growth factors as a result of*

*ischemia that lead to the development of ROP.*

*4. Normal retinal vascularization: Normal retinal*

*vascularization begins at 16 weeks postconceptional age.*

*Blood vessels grow out from the optic disc toward the*

*periphery. The retina attains mature retinal vascularization*

*in the nasal retina at approximately 36 weeks*

*postconceptional age and in the temporal retina at*

*approximately 40 weeks postconceptional age.*

*5. ROP risk factors: The severity of ROP is inversely*

*proportional to birth weight and estimated gestational age.*

*Other possible risk factors include maternal bleeding,*

*prolonged intravenous nutrition, hypocarbia, prolonged*

*ventilation, multiple birth status, intraventricular*

*hemorrhage, hypotension, anemia, sepsis, and necrotizing*

*enterocolitis. It is difficult to isolate the impact of these*

*individual factors that tend to occur in smaller, more*

*premature infants and therefore those most at risk of ROP.*

*6. Classification of ROP:*

*a) ROP is most typically classified using the International*

*Classification for ROP (ICROP), which was published in*

*1987 and was revised in 2005. The disease is classified*

*based on the location, extent, and stage of the disease*

*with an important notation made about the status of the*

*blood vessels in the posterior pole.*

*b) Location: The location of ROP is based upon three*

*concentric rings centered on the optic nerve. Zone I is*

*the most posterior location and involves a concentric ring*

*the radius of which measures twice the distance from the*

*center of the optic disc to the center of the macula. Zone*

*II extends centrifugally from the edge of zone I to the*

*nasal ora serrata, while zone III is the remaining crescent*

*of temporal retina.*

*Fig. 80.1 The retina examination demonstrates zone I retinopathy of*

*prematurity with dilation of posterior pole vessels (plus disease).*

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*c) Extent: The extent of disease is recorded as the number*

*of clock hours (30-degree sectors) of disease*

*involvement at the leading edge of vascular development*

*in the retina.*

*d) Stage: The stage of ROP describes the severity of the*

*vascular abnormalities observed. Stage 1 signifies a*

*demarcation line between vascular and avascular retina.*

*Stage 2 looks similar to stage I but has height and width,*

*therefore extending above the plain of the retina. Stage 3*

*represents extraretinal proliferation or neovascularization*

*extending into the vitreous from the ridge. Stage 4*

*comprises a subtotal retinal detachment (stage 4A is*

*extrafoveal and stage 4B includes the fovea). Stage 5*

*represents a total retinal detachment (▶Fig. 80.2 and*

*▶Table 80.1).*

*e) Plus disease: Plus disease is a term used to characterize*

*pronounced venous dilation and arteriolar tortuosity. In*

*more severe cases, it can be associated with iris vascular*

*engorgement with poor pupillary dilation. Many ROP*

*clinical trials have used a “standard” photograph to*

*depict plus disease. Preplus disease represents an*

*abnormal state of the posterior pole vessels that is*

*insufficient to be characterize as plus disease.*

*f) Aggressive posterior ROP: This is a rapidly progressive*

*form of severe ROP (designated AP–ROP) that most*

*commonly occurs in zone I. If untreated, it can rapidly*

*progress to retinal detachment.*

*g) Threshold ROP: Threshold ROP is diagnosed when there*

*is stage 3 ROP in zone 1 or 2 for five or more contiguous*

*clock hours or eight cumulative clock hours, in the*

*presence of plus disease.*

*h) Type I ROP: Treatment is highly recommended when*

*type I ROP is present. Type I ROP is present when any one*

*of the following is seen:*

*● Zone I ROP: Any stage with plus disease.*

*● Zone I ROP: Stage 3 with no plus disease.*

*● Zone II: Stage 2 or 3 with plus disease.*

*7. Screening criteria: The current screening guidelines for ROP*

*are included in a consensus statement by the American*

*Academy of Ophthalmology, the American Association for*

*Pediatric Ophthalmology and Strabismus, and the American*

*Academy of Pediatrics. These criteria are the following:*

*a) All infants with a birth weight of 1,500 g or less and/or*

*with a gestational age of 28 weeks or less, as well as*

*those infants over 1,500 g with an unstable clinical*

*course felt to be at high risk by their attending*

*pediatrician or neonatologist.*

*b) These examinations should be carried out by an*

*ophthalmologist with experience in the examination of*

*preterm infants. It should be noted that telemedicine has*

*been successfully utilized to screen infants at risk for ROP.*

*c) The initial examination should be done typically between*

*4 and 6 weeks of chronological age, with earlier exams*

*conducted on infants with extreme prematurity. Followup*

*intervals depend upon the zone and severity of the*

*disease.*

*80.2 Test Interpretation*

*1. Retinal examination: The most important test for an infant at*

*risk for ROP is appropriately timed retinal examination with*

*scleral depression when needed to visualize the peripheral*

*retina. This patient had immature retina in zone 1 a week*

*prior to the current examination. On the present*

*examination, the infant has plus disease (dilation and*

*tortuosity of the posterior pole vessels) in zone 1. This, by*

*definition, is type I ROP.*

*2. Photographic screening: Photographic screening has been*

*reported to be a successful method for diagnosing referral*

*warranted ROP, or ROP requiring indirect ophthalmoscopic*

*examination. Photographic screening has been proposed as*

*having advantages over indirect ophthalmoscopy allowing*

*remote consultation, and facilitating comparison of findings*

*at different times, thus reducing dependence on memory*

*and diagrams to track progress of the disease.*

*3. Important historical features: Factors possibly leading to*

*higher risk in this child include the new-onset sepsis since*

*her last examination and the worsening of her respiratory*

*status requiring re-intubation and supplemental oxygen. The*

*most important risk factors for ROP in this infant are her*

*extreme prematurity and low birth weight. The overall*

*health status of a premature infant and the postconceptional*

*Fig. 80.2 Zone diagram for retinopathy of*

*prematurity, from the international classification.*

*(Reproduced with permission from Lee DA and*

*Higginbotham EJ. Clinical Guide to*

*Comprehensive Ophthalmology. New York, NY:*

*Thieme, 1999:581.)*

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*age should, however, both be considered when deciding the*

*interval for follow-up examination.*

*4. Prognosis: The Early Treatment for Retinopathy of*

*Prematurity Cooperative Group reported an unfavorable*

*structural outcome of 9.1% at 9 months for children*

*undergoing treatment with retinal ablation for type I ROP.*

*Recent studies have indicated an even better prognosis*

*following intravitreal administration of bevacizumab for*

*severe ROP.*

*80.3 Diagnosis*

*Type I, both eyes.*

*80.4 Medical Management*

*Recently, severe ROP, defined as stage 3 + ROP, has been effectively*

*treated with monotherapy consisting of intravitreal injection*

*of bevacizumab, an agent that inhibits vascular endothelial*

*growth factor. Many other subsequent studies have confirmed*

*the effectiveness of bevacizumab treatment. Monotherapy with*

*antivascular endothelial growth factor agent is widely used. The*

*long-term implications of bevacizumab treatment on the eye*

*and systemically have yet to be established.*

*80.5 Surgical Management*

*The Multicenter Trial of Cryotherapy for Retinopathy of Prematurity*

*Study in the 1980s showed an approximately 50% reduction*

*of “poor outcome,” defined as retinal detachment or*

*posterior retinal fold, in eyes treated with cryotherapy compared*

*with eyes that went untreated. Laser photoablation*

*largely replaced cryotherapy in the early 1990s. Laser photocoagulation*

*has been shown to be effective and was the most*

*common treatment modality used in the Early Treatment for*

*Retinopathy of Prematurity study. Potential complications of*

*laser photoablation include cataract and subretinal, intraretinal,*

*and vitreous hemorrhage. Severe myopia has been reported to*

*occur more commonly and children undergoing peripheral retinal*

*photocoagulation compared to those receiving monotherapy*

*with bevacizumab.*

*80.6 Rehabilitation and Follow-up*

*After treatment of type I ROP with laser photocoagulation or*

*intravitreal injection of antivascular endothelial growth factor*

*agents, the infant should be examined frequently until the disease*

*has regressed. Children treated with bevacizumab and*

*related agents should undergo continuous screening until as*

*long as 60 to 70 weeks postmenstrual age because of the potential*

*for late disease reactivation.*

*Premature infants are at risk of developing other serious ophthalmologic*

*problems, including amblyopia, strabismus, and*

*severe refractive error including myopia, astigmatism, and anisometropia.*

~~~~~CASE 81 Childhood Esotropia~~~~~

*81 Childhood Esotropia*

*Evelyn A. Paysse*

*Abstract*

*This chapter presents a case of a child with esotropia. It discusses*

*pertinent historical and examination findings of infantile*

*esotropia, the differential diagnosis, associated ocular motility*

*and visual abnormalities that can develop, the management*

*approach, and long-term expectations.*

*Keywords: esotropia, V-pattern strabismus, amblyopia, dissociated*

*vertical deviation, inferior oblique overaction*

*81.1 History*

*A 5-year-old girl with a history of crossed eyes since 2 months*

*of age presents for an examination. She has a history of strabismus*

*surgery at 8 months of age. Her mother reports that her*

*eyes were well aligned following surgery until recently when*

*her left eye has been noted to intermittently drift inward, especially*

*when she is tired. She has never been treated with occlusion*

*therapy. Her current glasses are at least 1 year old. Her*

*past medical history is otherwise unremarkable. The family history*

*is notable for a sister with esotropia that required surgical*

*intervention.*

*On examination, the child’s visual acuity, with her current*

*spectacle correction, is 20/30 OD and 20/50 OS. Her current*

*spectacle prescription is + 2.00 OD and + 2.50 OS. Motility*

*examination with spectacle correction demonstrates an intermittent*

*esotropia of 8 prism diopters at distance with a moderate*

*left dissociated vertical deviation. On version testing,*

*moderate inferior oblique muscle overaction is noted in both*

*eyes (▶Fig. 81.1a, b). A V-pattern is present with the esotropia*

*in downgaze increasing to 20 prism diopters and decreasing in*

*upgaze to 5 prism diopters. At near, an intermittent esotropia of*

*20 prism diopters is seen. Stereopsis testing reveals 3,000 seconds*

*of arc stereopsis on the Titmus stereo fly test. Cycloplegic*

*refraction is + 3.00 spheres and + 3.75 spheres in the right and left*

*eyes, respectively. Optokinetic nystagmus (OKN) testing is asymmetric,*

*demonstrating a normal response on temporal-to-nasal*

*testing, but a poor nasal-to-temporal response in both eyes. The*

*remainder of the ophthalmologic examination is normal.*

*Differential Diagnosis—Key Points*

*1. Differential diagnosis: Childhood esotropia can be due to*

*many different entities. It is helpful to divide esotropia into*

*comitant and incomitant deviations. Please see text box*

*below for differential diagnosis of childhood esotropia.*

*2. History: It is important when evaluating a child with*

*esotropia to obtain a good history. The examiner must*

*determine the onset of the esotropia, as this will aid in*

*defining the etiology. If the onset is before 6 months of age,*

*the entity could be infantile esotropia; however,*

*accommodative esotropia has also been reported as early as*

*3 months of age. A host of other esotropia syndromes may*

*also have onset in the first 6 months of life, including*

*Duane’s syndrome and Moebius’ syndrome.*

*The quality of the esotropia is also important to elicit from the*

*parents. Intermittent esotropia and esotropia that is greater at*

*near than at distance are more likely to be accommodative in*

*nature. If the deviation is larger in certain positions of gaze, all*

*comitant etiologies will be eliminated from the differential*

*diagnosis. An anomalous head posture with esotropia implies*

*an incomitant (i.e., restrictive or paralytic) strabismus with*

*fusion when using the anomalous head position, such as*

*occurs with a sixth nerve palsy, type 1 Duane’s syndrome, or*

*Moebius’ syndrome or some other advantage to using an*

*anomalous head position such as in nystagmus blockage*

*syndrome and early-onset homonymous hemianopia (see text*

*box below).*

*Finally, it is also important during history taking to*

*determine if there were any preceding events to the esotropia*

*such as a febrile illness, head trauma, or neurologic event. All*

*of these entities can be associated with a sixth nerve palsy.*

*Family history is also important to discuss because strabismus*

*is often hereditary.*

*3. Associated ocular motility abnormalities: Inferior oblique*

*muscle overaction, dissociated strabismus complex, A- and*

*V-patterns, and latent nystagmus are other motility*

*abnormalities associated with early-onset strabismus, most*

*commonly in association with infantile esotropia. Inferior*

*oblique muscle overaction is diagnosed from the version*

*examination when overelevation of the eye in adduction*

*occurs. Dissociated strabismus complex (DSC) is diagnosed*

*with cover testing. The eye under the occluder will elevate,*

*abduct, and excyclotort if it has all three components of*

*DSC. Any of these components can predominate and not all*

*components are necessary to have dissociated strabismus*

*complex. If a vertical deviation predominates, it is called*

*dissociated vertical deviation and if a horizontal deviation*

*predominates, it is called dissociated horizontal deviation.*

*Dissociated strabismus complex is often more severe in an*

*amblyopic eye. A- and V-patterns occur when the deviation*

*in upgaze and downgaze differ significantly. An A-pattern*

*esotropia is present when the esotropia is greater in upgaze*

*than downgaze by 10 or more prism diopters. A V-pattern*

*esotropia is present when the deviation in upgaze is less*

*than in downgaze by 15 or more prism diopters. Latent*

*nystagmus is a nystagmus that is present only when one eye*

*is occluded. It is most commonly associated with infantile*

*esotropia and is usually worse in the amblyopic eye.*

*4. Amblyopia: Amblyopia is commonly associated with*

*strabismus. In strabismus, amblyopia develops in children*

*secondary to the ability to suppress the image in the*

*deviating eye. This suppression develops in order to avoid*

*diplopia and confusion.*

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*Differential Diagnoses of Childhood*

*Esotropias*

*Incomitant Esotropia*

*Neurologic*

*● Sixth nerve palsy:*

*○ Congenital.*

*○ Acquired (tumor, traumatic, microvascular, inflammatory).*

*● Duane syndrome (type 1 or 3).*

*● Myasthenia gravis.*

*● Progressive external ophthalmoplegia.*

*● Moebius’ syndrome.*

*Restrictive*

*● Thyroid related ophthalmopathy.*

*● Congenital fibrosis syndrome.*

*● Duane’s syndrome (type 1 or 3).*

*● Iatrogenic (e.g., postsurgical).*

*● Posttraumatic (e.g., medial orbital wall fracture).*

*Comitant Esotropias*

*● Infantile esotropia.*

*● Ciancia’s syndrome.*

*● Nystagmus blockage syndrome.*

*● Accommodative esotropia:*

*○ Refractive.*

*○ Nonrefractive (high AC/A).*

*● Horror fusionis.*

*● Sensory esotropia.*

*81.2 Test Interpretation*

*Clinical examination of a strabismic patient is the key to diagnosis.*

*This section will concentrate on the most important parts*

*of the ophthalmologic examination for a patient with esotropia.*

*1. Stereopsis testing: Stereopsis testing should be the first part*

*of any ophthalmologic examination for a strabismic patient.*

*It will aid in determining the onset of the strabismus and in*

*prognosticating stability of the deviation over time.*

*Stereopsis is the highest form of binocular cooperation. It is*

*the ability to fuse two disparate images into a single*

*impression in depth. With good stereopsis, a patient is likely*

*to maintain a more stable alignment. Poor stereopsis implies*

*early-onset strabismus.*

*2. Ductions/versions: Ductions and versions help distinguish*

*comitant from incomitant deviations. Versions are defined as*

*binocular rotations of the eyes. The examiner has the patient*

*follow a target with his eyes into the six cardinal positions of*

*gaze to evaluate the yoke muscles and oblique muscle*

*function. Next, the examiner has the patient follow the*

*target into upgaze and downgaze to evaluate for an A- or Vpattern.*

*Ductions are defined as monocular rotations of the*

*eye. The examiner has the patient follow a target with one*

*eye covered into the same gaze positions as for versions. If*

*versions are normal, there is no need to test ductions. If,*

*however, there is an incomitant deviation on version testing,*

*ductions should be done to help differentiate a restrictive*

*from a paralytic esotropia. Restrictive etiologies will still*

*have a deficit of duction, whereas a paralytic etiology will*

*often have improved ductions in comparison to versions. Our*

*patient had full versions, inferior oblique muscle overaction,*

*and a V-pattern. All are common findings in infantile*

*esotropia patients as they get older.*

*3. Motility: Alignment at distance and near. The strabismic*

*deviation must be measured both at distance and near in the*

*diagnostic positions of gaze, with and without glasses using*

*the cover test, the cover/uncover test, and either the*

*alternate prism and cover test or the Krimsky or Hirschberg*

*test if not cooperative for alternate prism and cover testing. If*

*the esotropia is worse at near than at distance, especially if*

*intermittent, an accommodative esotropia is the most likely*

*etiology, though this does not always hold true. If the*

*deviation is worse at distance than at near, then divergence*

*insufficiency type esotropia is present. This is often a sign of*

*a sixth nerve paresis, and neuroimaging is indicated in most*

*cases to rule out hydrocephalus or an intracranial mass*

*(tumor, arteriovenous malformation, inflammatory lesion,*

*etc.) causing a sixth nerve paresis. During the motility*

*examination, one evaluates for DSC. Our patient has a*

*Fig. 81.1 (a) A 5-year-old child with esotropia. (b) Inferior oblique muscle overaction of the right eye is demonstrated.*

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*constant esotropia that is minimally worse at near than at*

*distance, with dissociated vertical deviation in the left eye.*

*These findings are consistent with infantile esotropia or*

*partially accommodative esotropia.*

*4. Cycloplegic refraction: Cycloplegic refraction should be done*

*on every strabismus patient. If it is not performed, latent*

*hyperopia may be overlooked. This is especially important in*

*esotropic patients because of the association of convergence*

*with accommodation. Cycloplegia can be accomplished using*

*topical cyclopentolate, homatropine, scopolamine, and*

*atropine. Most commonly, cyclopentolate is used because it*

*is shorter acting. Atropine is the best at achieving complete*

*cycloplegia but can last up to 2 weeks. Our child has*

*significant hyperopia that is undercorrected in her current*

*glasses. Her recurrent esotropia may be adequately treated*

*with new spectacles with the full hyperopic refractive*

*correction. Hyperopic correction can help maintain ocular*

*alignment or treat small residual deviations.*

*5. OKN: Patients with early-onset esotropia, especially infantile*

*esotropia, typically have asymmetry of optokinetic*

*nystagmus. The temporal-to-nasal direction of this reflex is*

*normal; however, a poor nasal-to-temporal direction*

*nystagmus is present. OKN can be tested with an OKN drum*

*or ribbon. The test should be performed monocularly. Our*

*patient had OKN asymmetry signifying early-onset esotropia.*

*6. Neuroimaging/orbital imaging: Neuroimaging is usually*

*indicated in patients with incomitant esotropia and*

*divergence insufficiency esotropia to rule out causes of the*

*sixth nerve palsy, such as hydrocephalus or intracranial*

*mass. Orbital imaging is also often necessary to rule out a*

*mass that could be compressing the peripheral sixth nerve.*

*Neuroimaging should also be considered in a child with lateonset,*

*large-angle esotropia or an atypical acquired largeangle*

*esotropia. Our patient did not have any of these*

*findings and, therefore, did not need an imaging study.*

*81.3 Diagnosis*

*Infantile esotropia status poststrabismus surgery, now with*

*recurrent esotropia, dissociated vertical deviation of the left*

*eye, bilateral inferior oblique muscle overaction, and amblyopia*

*of the left eye.*

*81.4 Medical Management*

*Proper management of this child first involves prescription of*

*new glasses with the full cycloplegic refraction. The examiner*

*should follow up in the next few months to recheck the ocular*

*alignment. Reduction or elimination of the deviation signifies*

*the presence of a refractive accommodative component to the*

*esotropia. Bifocal treatment can be instituted if the child on follow-*

*up is orthotropic at distance, but still esotropic at near.*

*Bifocals, however, should only be prescribed if fusion or stereopsis*

*is able to be documented. If the remaining esotropia is only*

*10 to 12 prism diopters, most ophthalmologists believe that this*

*deviation is small enough to develop stable monofixation syndrome,*

*and no surgery would be indicated. Vision should be*

*monitored at this stage for amblyopia and appropriate treatment*

*instituted.*

*81.5 Surgical Management*

*If the deviation remains greater than 10 to 12 prism diopters at*

*distance with the full cycloplegic refraction in spectacles, then*

*surgical intervention can be performed. Strabismus surgery for*

*esotropia may consist of a bilateral medial rectus recession, a*

*medial rectus recession and ipsilateral lateral rectus resection,*

*or a bilateral lateral rectus resection. The surgical decision*

*depends on the patient’s measurements, the previous strabismus*

*surgery, and the surgeon preference.*

*81.6 Rehabilitation and Follow-up*

*If the eyes are aligned and stereopsis is good with the new spectacle*

*correction, the prognosis is excellent. Regular follow-ups*

*should be performed throughout childhood as amblyopia and/*

*or esotropia can recur. The time interval between follow-up*

*evaluations will vary depending on the stability of the angle,*

*the visual acuity, and the age of the child. Strabismus surgery*

*can be repeated if the deviation recurs or a new deviation*

*develops. The better the stereopsis or fusion present, the more*

*stable the ocular alignment tends to be.*

~~~~~CASE 82 Childhood Exotropia~~~~~

*82 Childhood Exotropia*

*Evelyn A. Paysse*

*Abstract*

*This chapter presents a case of a child with intermittent exotropia.*

*It discusses pertinent historical and examination findings*

*of intermittent exotropia, the differential diagnosis, associated*

*ocular motility and visual abnormalities that can develop, the*

*management approach, and long-term expectations.*

*Keywords: exotropia, intermittent, divergence excess, pseudodivergence*

*excess, patch test, amblyopia*

*82.1 History*

*A 4-year-old boy presents with a 2-year history of intermittent*

*drifting out of the right eye. His mother states that the deviation*

*is worse when the child is tired or when he is looking at distant*

*objects. His mother initially noted this deviation approximately*

*two to three times a day; however, it recently has been getting*

*worse. She states that the eye is now deviated outward approximately*

*60% of the day. There is no history of antecedent head*

*trauma, febrile episode, or other medical problem. There is no*

*family history of strabismus or amblyopia. Review of systems is*

*notable for right eye closure in sunlight.*

*On examination, the child’s visual acuity is 20/30, OU. On*

*stereopsis testing with the Titmus stereo fly test, the child is*

*able to correctly identify nine of nine circles (40 seconds of arc).*

*The pupils are 3mm in diameter, round, with brisk response to*

*light. No afferent pupillary defect is detected. External examination*

*is normal, with no evidence of ptosis. An intermittent*

*exotropia of 50 prism diopters at distance is present, with*

*recovery of orthotropia on refixation or blinking (▶Fig. 82.1).*

*The deviation recurs immediately with occlusion of either eye.*

*A 25 prism diopter poorly controlled intermittent exotropia is*

*present at near. Ductions and versions are full. A 30-minute*

*patch test demonstrates a 50-prism diopter intermittent exotropia*

*at distance and a 45 prism diopter exotropia at near, after*

*removal of the patch. Cycloplegic refraction is + 0.50 OD (oculus*

*dexter) and + 0.75 OS. The remainder of the comprehensive*

*examination is unremarkable.*

*Differential Diagnosis—Key Points*

*This is a 4-year-old child with an intermittent exotropia worse*

*at distance than near. No amblyopia is noted, and stereopsis is*

*excellent. The differential diagnosis of exotropia is extensive,*

*but can be quickly narrowed through the use of special tests*

*during the examination.*

*1. Differential diagnosis: The exotropias can be divided into*

*comitant and incomitant deviations (see list below).*

*Comitant exotropias include congenital exotropia,*

*intermittent exotropia, and sensory exotropia. Incomitant*

*exotropias can be divided into neurologic or restrictive*

*entities. The neurologic forms of exotropia include third*

*nerve palsy, progressive external ophthalmoplegia,*

*synergistic divergence, and myasthenia gravis. The*

*restrictive entities that can cause exotropia include*

*congenital fibrosis syndrome, thyroid-related*

*ophthalmopathy (rarely), and posttraumatic or iatrogenic*

*exotropia. Duane’s syndrome (types II and III) is unique*

*because it can cause both a neurogenic and a restrictive*

*strabismus. This child has a comitant deviation, so the*

*differential diagnosis is significantly narrowed.*

*2. Classification of comitant exotropia: When evaluating a*

*child with a comitant exotropia, the examiner must first*

*classify the deviation in a number of different ways. First, he*

*or she needs to decide if the deviation is intermittent or*

*constant. Then the examiner must evaluate for a distance–*

*near disparity. This allows him or her to classify the*

*deviation either as basic exotropia, divergence excess*

*exotropia, pseudodivergence excess exotropia, or*

*convergence insufficiency exotropia.*

*3. Comitant exotropias:*

*a) Intermittent exotropia occurs as a result of a cortical*

*abnormality of fusion. The eyes are sometimes*

*orthotropic with the patient having normal stereopsis*

*and at other times, the eyes are exotropic and the*

*patient has suppression. Basic exotropia occurs when the*

*deviation is roughly the same at distance and at near.*

*Divergence excess exotropia occurs when there is a*

*larger deviation at distance than at near of at least 10 to*

*15 prism diopters. Pseudodivergence excess exotropia is*

*an exotropia that initially presents in the same way that*

*true divergence excess exotropia does, with a deviation*

*worse at distance than near. True divergence excess*

*exotropia is differentiated from pseudodivergence excess*

*exotropia with the patch test (discussed in the next*

*section, number 6). A patient with pseudodivergence*

*excess exotropia will have the near deviation increase to*

*within 10 prism diopters of the deviation at distance with*

*the patch test, while a patient with true divergence excess*

*will maintain the distance near disparity. Convergence*

*insufficiency exotropia occurs when the deviation is worse*

*at near than at distance by 10 or more prism diopters.*

*This form of exotropia is much more common in elderly*

*patients and is most Fig. 82.1 Exotropia that is often manifest with fixation at distance. often associated with diplopia.*

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*b) Congenital exotropia, as the name implies, presents at*

*birth or shortly after birth. It is rare and is often*

*associated with intracranial structural abnormalities.*

*Neuroimaging should be considered in these cases.*

*c) Sensory exotropia occurs after vision loss in one eye. An*

*eye with poor vision tends to drift. If the vision loss occurs*

*before the age of 3 years, the tendency is for an esotropia*

*to develop. Conversely, if the vision loss occurs after 3*

*years of age, the tendency is for an exotropia to develop.*

*d) Myasthenia gravis is characterized by excessive*

*fatigability of striated muscles. It is an autoimmune*

*disease that demonstrates a reduction of available*

*postsynaptic acetylcholine receptors in the end plates of*

*neuromuscular junctions of skeletal muscles. Myasthenia*

*gravis can occur in children and can cause exotropia or*

*any other ocular motility disturbance. It can be comitant*

*or incomitant. Typically, the deviation is variable and*

*worse in the afternoon or when fatigued. It is often*

*associated with ptosis and can also be associated with*

*systemic weakness, such as difficulty swallowing,*

*proximal limb weakness, and/or respiratory difficulty.*

*4. Incomitant exotropias:*

*a) Third nerve palsy can cause an exotropia of the affected*

*eye. It can also be associated with hypotropia, ptosis, and*

*mydriasis of the affected eye. A pupil-involving third*

*nerve palsy is typically due to a compressive lesion, most*

*commonly a posterior communicating artery aneurysm.*

*If a total third nerve palsy is present, complete ptosis,*

*mydriasis, exotropia, and hypotropia of the involved eye*

*will be seen. This strabismus pattern occurs because the*

*third nerve controls four of the six extraocular muscles.*

*The only remaining functional extraocular muscles then*

*are the lateral rectus and superior oblique muscles.*

*b) Duane’s syndrome, types II and III, are conditions of*

*miswiring of the sixth nerve to the lateral rectus muscle*

*and/or the medial rectus muscle. In Duane’s syndrome,*

*type II, an exotropia usually occurs associated with a*

*deficit of adduction. Duane’s syndrome, type III, causes a*

*deficit of both adduction and abduction and often leaves*

*the eye in an exotropic position.*

*c) Other exotropias:*

*1. Chronic progressive external ophthalmologia is a rare hereditary*

*condition that causes progressive deficits of*

*ocular motility, often associated with ptosis.*

*2. Congenital fibrosis syndrome is a hereditary condition in*

*which a child is born with fibrotic extraocular muscles*

*and ptosis.*

*3. Thyroid-related ophthalmopathy (Graves’ ophthalmopathy)*

*can rarely lead to an exotropia due to enlargement*

*of the lateral rectus muscles. Exotropia, however,*

*in a patient with thyroid-related ophthalmopathy, is*

*usually due to concomitant myasthenia gravis, which*

*occurs in 10% of patients with Graves’ disease.*

*4. Iatrogenic: Exotropia can also result as a consecutive*

*problem after strabismus surgery for esotropia or can*

*be iatrogenically created after surgery for retinal detachment,*

*glaucoma, blowout fracture, or other orbital*

*abnormality.*

*Types of Childhood Exotropia*

*Comitant Exotropia*

*● Essential intermittent exotropia:*

*○ Basic exotropia.*

*○ Divergence excess exotropia.*

*○ Pseudodivergence excess exotropia.*

*○ Convergence insufficiency exotropia.*

*● Congenital exotropia.*

*● Sensory exotropia.*

*● Myasthenia gravis. (Myasthenia can cause any type of*

*strabismus, incomitant or comitant.)*

*Incomitant Exotropia*

*● Third nerve palsy.*

*● Duane’s syndrome.*

*● Type II.*

*● Type III.*

*● Chronic progressive external ophthalmoplegia.*

*● Synergistic divergence.*

*● Myasthenia gravis. (Myasthenia can cause any type of*

*strabismus, incomitant or comitant.)*

*● Congenital fibrosis syndrome.*

*● Thyroid-related ophthalmopathy. (Exotropia with thyroidrelated*

*ophthalmopathy is rare. It is usually due to*

*concomitant myasthenia.)*

*● Iatrogenic:*

*○ Postsurgical.*

*○ Posttrauma.*

*82.2 Test Interpretation*

*1. Vision and stereopsis: Stereopsis should be tested first in a*

*strabismic patient as other testing, such as visual acuity or*

*motility evaluations, can be dissociative, causing the patient*

*to temporarily lose the stereopsis and/or fusion that he*

*normally has. Stereopsis testing is usually normal in a*

*patient with intermittent exotropia. Vision: Visual acuity in*

*children with intermittent exotropia is usually equal in each*

*eye with only about 10% developing amblyopia. Amblyopia*

*then, if present, should raise the examiner’s suspicion that*

*other entities could be the cause of the exotropia. Visual*

*acuity should be tested with the most sensitive method*

*possible, based on the age of a child.*

*2. External examination: Because a third nerve palsy can cause*

*exotropia and ptosis, the external examination is important.*

*Any exotropia associated with a ptosis could be a third nerve*

*palsy and special attention should be paid during the*

*ductions and versions examination for an adduction or*

*vertical duction deficit.*

*3. Pupils: A third nerve palsy can also cause mydriasis of the*

*involved eye, in addition to exotropia and ptosis. Therefore,*

*the examiner needs to carefully evaluate pupil size and, if*

*anisocoria is encountered, perform a full anisocoria workup.*

*4. Extraocular motility: Version should be performed first; if*

*full, ductions do not need to be performed. If ductions are*

*full, most of the differential diagnosis can be eliminated. A*

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*duction deficit implies a restrictive or paralytic condition.*

*Simultaneous prism and cover testing can be done next to*

*assess for the tropia present when fusion is not disrupted.*

*Alternate cover testing should be performed next, first at*

*distance, then at near, to determine the full deviation and in*

*order to classify the type of exotropia present (basic,*

*divergence excess, pseudodivergence excess, or convergence*

*insufficiency).*

*5. Anomalous head position: An anomalous head position*

*should be noted. If a head turn is present, a paralytic or*

*restrictive type of exotropia is usually present.*

*6. Patch test: When a deviation is found that is comitant and*

*worse at distance than at near by 10 to 15 prism diopters or*

*more, the examiner needs to differentiate between*

*pseudodivergence excess exotropia and true divergence*

*excess exotropia by performing a patch test. The patch test*

*works by disrupting fusional convergence. With the patient*

*wearing the correct cycloplegic refraction, an occlusion patch*

*is placed over one eye for approximately 20 to 45 minutes.*

*Next, the examiner carefully removes the patch, paying*

*careful attention to continue to occlude the previously*

*patched eye with his hand or an occlusion paddle to avoid*

*any binocular visual stimulation. Next, the child’s ocular*

*alignment is remeasured with alternate cover testing at*

*distance and near. Throughout the entire testing period, the*

*child is not allowed to have binocular stimulation. If the*

*deviation at near continues to be 10 to 15 prism diopters less*

*than at distance, then true divergence excess exotropia is*

*diagnosed. If the near deviation increases to within 10 prism*

*diopters of the distance deviation, then pseudodivergence*

*excess exotropia is diagnosed. Our patient had an increase of*

*the near deviation to within 10 prism diopters of the*

*distance deviation and, therefore, has pseudodivergence*

*excess exotropia.*

*7. Cycloplegic refraction: It is always important to perform a*

*cycloplegic refraction on every child with strabismus.*

*Correction of high hyperopia (+ 4.00 diopters or more) will*

*improve the control of an exodeviation in some children.*

*This is counterintuitive to general understanding because*

*accommodation (which is required with high hyperopia to*

*see clearly) typically stimulates convergence. In the case of*

*high hyperopia, however, some children hypoaccommodate*

*as their brain was never exposed to a clear image and it does*

*not realize what the world really looks like. With*

*hypoaccommodation, the eyes then become exotropic based*

*on a sensory etiology. By giving these children a clear visual*

*world with the hyperopic glasses, their sensory status can*

*improve and subsequently their motor alignment.*

*82.3 Diagnosis*

*Pseudodivergence excess type intermittent exotropia.*

*82.4 Medical Management*

*Medical management is aimed at decreasing the time that the*

*patient is exotropic (i.e., increasing fusional control). The actual*

*deviation will usually not change. This sort of management can*

*be divided into either passive management or active management.*

*1. Passive management is utilized most in younger children*

*(i.e., usually younger than 4 to 5 years), because they usually*

*cannot cooperate or understand the exercises of active*

*management. Overminused spectacles and alternate or*

*dominant eye part-time occlusion are included in passive*

*management options. In overminusing, a child is given*

*glasses with a more myopic correction than he or she needs.*

*Overminusing a spectacle correction causes an increase in*

*accommodative demand and subsequently accommodative*

*convergence. Overminusing is helpful in some children in*

*order to delay surgical management or while waiting for*

*children to mature enough for active management. It rarely*

*cures the exotropia. Alternate eye occlusion is performed by*

*patching alternate eyes on alternate days. Dominant eye*

*occlusion is performed by patching the nondeviating eye*

*daily. A daily patching period of approximately 1 to 2 hours*

*is usually prescribed. Occlusion therapy, also known as*

*patching therapy, is based on the theory that it weakens the*

*suppression scotoma that has been set up in a child with*

*intermittent exotropia and may lead to better control.*

*2. Active management consists of a various exercises to*

*stimulate convergence and fusion and to increase diplopia*

*awareness. Convergence exercises can only be accurately*

*achieved in children who can understand how to perform*

*them. These exercises cause asthenopia or eye fatigue, and*

*children younger than 5 years of age are usually not able to*

*consistently comply. An easy convergence exercise to*

*perform at home is the “pencil pushup.” This exercise is*

*performed by having the child fixate on a small fixation*

*target affixed to a tongue blade, popsicle stick, or pencil. Next*

*the parent brings the object progressively closer to the*

*child’s nose while the child’s eyes converge on the target*

*until fusion breaks and one eye becomes exotropic. The*

*fixation target is then moved back out again and the exercise*

*is repeated. Typically, 10 repetitions are done two to three*

*times a day. A number of other convergence exercises can be*

*performed with a red glass or synoptophore. Computer*

*orthoptic exercises are also available to improve convergence*

*amplitudes. Progressively increasing base-out prism can also*

*be used to stimulate convergence. Convergence exercises are*

*helpful for the conditions of convergence insufficiency*

*exotropia and basic exotropia, but are not typically helpful in*

*patients with divergence excess exotropia.*

*82.5 Surgical Management*

*Surgery is recommended in patients when the control of the*

*exotropic deviation becomes poor. The decision of “poor control”*

*is based on a number of different assessments, including*

*parental impression and clinical examination. Typically, an ophthalmologist*

*will decide to perform strabismus surgery on a*

*child when the deviation is present more than 40 to 50% of the*

*time. Most pediatric ophthalmologists prefer to delay surgery*

*in exotropic patients until the child is 4 years or older, if the*

*control is adequate. The type of surgical procedure performed*

*will depend on the classification of the exotropia and surgeon*

*preference. Bilateral lateral rectus recessions can be performed*

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*for divergence excess exotropia, pseudodivergence excess exotropia,*

*and basic exotropia. A lateral rectus recession with an*

*ipsilateral medial rectus resection can be performed for basic*

*exotropia, pseudodivergence excess exotropia, and convergence*

*insufficiency exotropia. Bilateral medial rectus resections can*

*be performed for convergence insufficiency exotropia.*

*82.6 Rehabilitation and Follow-up*

*Intermittent exotropia is a lifelong condition. Because the cause*

*of intermittent exotropia lies with a cortical defect of fusion,*

*the entity is never “cured.” The follow-up interval depends on*

*the level of control and age of the patient. Typically, if medical*

*management is being used, follow-up ranges between 2 and 6*

*months for reevaluation. If surgery has been performed, healing*

*occurs over approximately 6 weeks. Surgical patients must still*

*be followed long term, because the deviation can recur. Recurrence*

*of exotropia has been cited in the literature at a rate of 20*

*to 40%. Surgery can be repeated for symptomatic or cosmetically*

*noticeable deviations. Children with exotropia should be*

*followed for decreasing stereopsis and the onset of amblyopia,*

*both signs of worsening control.*

~~~~~CASE 83 Childhood Ptosis~~~~~

*83 Childhood Ptosis*

*Evelyn A. Paysse*

*Abstract*

*This chapter presents a case of a child with congenital ptosis. It*

*discusses pertinent historical and examination findings of congenital*

*ptosis, the differential diagnosis that must be ruled out*

*including third nerve palsy and Horner’s syndrome, associated*

*ocular motility and visual abnormalities that can develop, the*

*management approach, and long-term expectations.*

*Keywords: ptosis, amblyopia, Marcus Gunn jaw wink, Horner’s*

*syndrome, third nerve palsy, congenital, anisometropia*

*83.1 History*

*A 17-month-old boy presents with a droopy right upper lid. His*

*parents state that this right upper lid has been “lazy” since*

*birth. They also state that he holds his chin up when he is walking*

*or watching TV. No ocular motility disturbance has been*

*noted. His parents also volunteer that occasionally the child lets*

*the lid block his pupil. There is no family history of ptosis, strabismus,*

*or hereditary muscular disorders. The child is otherwise*

*healthy and developing normally with a negative review*

*of systems.*

*The child has good fixation and following visual behavior in*

*both eyes (without correction) without a fixation preference for*

*either eye. The child notably has a preferred chin-up head posture*

*of 15 degrees. External examination demonstrates a moderate*

*to severe right upper lid ptosis (▶Fig. 83.1). The*

*interpalpebral fissure on the right is 6.5mm and on the left is*

*10mm. The eyelid margin-to-reflex distance with the child’s*

*head in the primary position is 0.5 and 3.5mm in the right and*

*left eyes, respectively. With a chin-up head posture, the eyelid*

*margin to reflex distance is 2mm in the right eye and 3mm in*

*the left eye. Levator function is 6mm in the right eye and*

*12mm in the left eye. No appreciable lid crease is noted in the*

*right upper lid. The pupils are both 3mm in diameter, round,*

*and briskly reactive to light. There is no afferent pupillary*

*defect. The eyes are orthotropic and versions are full. Cycloplegic*

*refraction is –0.25 + 1.50 Å~ 90 degrees in the right eye*

*and + 0.50 sphere in the left eye. The rest of the comprehensive*

*examination is unremarkable.*

*Differential Diagnosis—Key Points*

*1. This is a 17-month-old child who has had ptosis of the right*

*upper lid since birth. The history is significant for the lack of*

*variability, lack of previous trauma, lack of strabismus, and*

*lack of anisocoria. Childhood ptosis has an extensive*

*differential diagnosis (see list below).*

*2. The differential diagnosis of a child with ptosis includes the*

*following:*

*a) Congenital ptosis occurs from a developmental*

*abnormality of the levator muscle. The levator muscle is*

*hypoplastic with fibrous or fatty infiltration. The degree*

*of the ptosis actually decreases in downgaze relative to*

*the other eye secondary to the fibrotic nature of the*

*levator muscle in this condition. This is helpful to the*

*child who often assumes a chin-up posture as the ptotic*

*lid is less ptotic when this head position is utilized and*

*the visual axis is better exposed.*

*b) Horner’s syndrome is suspected when its classic triad of*

*miosis, anhydrosis, and mild ptosis of the involved eye*

*are present. Horner’s syndrome occurs secondary to*

*dysfunction of the sympathetic chain on the ipsilateral*

*side. Acquired Horner’s syndrome requires an evaluation*

*for serious diseases such as neuroblastoma. Congenital*

*Horner’s syndrome is typically associated with*

*heterochromia, with the lighter pigmented iris on the*

*involved side.*

*c) Third nerve palsy causes a moderate to severe ptosis. It*

*may be associated with vertical strabismus, exotropia,*

*and/or mydriasis. The severity and etiology of the third*

*nerve palsy will determine which of these signs is*

*present. A third nerve palsy can be congenital or it can*

*be acquired due to tumor, trauma, vascular abnormality,*

*or inflammatory lesions of the brainstem or orbit (see*

*chapters 66 and 67).*

*d) Marcus Gunn jaw-wink ptosis occurs from a synkinesis of*

*the trigeminal (V) nerve to the oculomotor (III) nerve*

*(trigemino-oculomotor synkinesis). Stimulation of the*

*pterygoid branch of the trigeminal nerve, responsible for*

*the muscles of mastication, will also stimulate the levator*

*muscle because of the miswiring and will elevate the*

*upper lid. Pterygoid nerve stimulation occurs most*

*Fig. 83.1 Facial photograph of the patient*

*demonstrating ptosis of the right upper lid. Note*

*the absence of a lid crease on the affected lid.*

*(Adapted from Lee DA and Higginbotham EJ.*

*Clinical Guide to Comprehensive Ophthalmology.*

*New York, NY: Thieme,1999:153.)*

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*commonly with sucking, swallowing, chewing, or on*

*lateral movement of the jaw. This entity is most*

*commonly diagnosed in the neonatal period when a child*

*is bottle- or breastfeeding but can occasionally be*

*overlooked until later in life.*

*e) Other causes of ptosis:*

*1. Myasthenia gravis causes ptosis that is variable in severity*

*and timing. It is commonly associated with other*

*extraocular motility abnormalities that do not*

*necessarily follow the rules of neurologic innervation.*

*Myasthenia gravis can be purely ocular or can be ocular*

*and systemic. Systemic findings of myasthenia*

*gravis include respiratory compromise, weakness of*

*proximal extremities, and dysphagia (see chapter 71).*

*2. Ptosis associated with double elevator palsy is typically a*

*moderate to severe congenital ptosis, associated with*

*the inability to elevate the eye either in adduction or*

*abduction.*

*3. Ptosis associated with chronic progressive external ophthalmoplegia*

*is an acquired ptosis associated with progressive*

*extraocular motility deficits. It can also be*

*associated with other ophthalmologic and systemic*

*abnormalities, such as retinal pigmentary abnormalities*

*and heart block, seen in Kearn–Sayres syndrome.*

*4. Mechanical ptosis results from a mass lesion that restricts*

*elevation of the lid such as a large hemangioma,*

*lymphangioma, neurofibroma, or dermoid.*

*5. Levator dehiscence occurs secondary to trauma or stretching*

*of the levator muscle, usually over years as could be*

*caused by insertion of contact lens. It is a slowly progressive,*

*acquired ptosis. The distance between the lid crease*

*and lid margin is increased in this entity.*

*6. Pseudoptosis occurs secondary to a primary hypotropia*

*on the involved side with the resultant corresponding*

*upper lid depression. This is not a true ptosis; that is,*

*when the hypotropic eye fixates, the apparent ptosis*

*resolves.*

*3. Childhood ptosis is associated with several other important*

*ophthalmologic abnormalities. Amblyopia is the most*

*important potential problem associated with ptosis. It can*

*occur secondary to one of several mechanisms. The most*

*devastating amblyopia is caused by occlusion of the*

*involved eye due to obstruction of the visual axis. This will*

*produce severe form of vision deprivation amblyopia, such*

*as in a child with a congenital cataract. Amblyopia due to*

*ptosis can also occur secondary to anisometropia. The*

*anisometropia seen in children with congenital ptosis*

*usually occurs secondary to astigmatism, created by the*

*upper lid compressing the flexible infant cornea. Strabismus*

*can occasionally be associated with ptosis and pseudoptosis.*

*This is frequently the case in children with double elevator*

*palsy who have a hypotropia of the involved side and a*

*pseudoptosis.*

*83.1.1 Causes of Childhood Ptosis*

*● Congenital ptosis.*

*● Horner’s syndrome.*

*● Third nerve palsy.*

*● Marcus Gunn jaw-winking ptosis.*

*● Myasthenia gravis.*

*● Double elevator palsy.*

*● Chronic progressive external ophthalmoplegia.*

*● Mechanical ptosis:*

*○ Lid hemangioma.*

*○ Lid neurofibroma.*

*● Levator dehiscence.*

*● Pseudoptosis.*

*83.2 Test Interpretation*

*The major diagnostic considerations in a child with ptosis are*

*related to careful ophthalmologic examination. The following*

*discussion will concentrate on the most relevant parts of an*

*examination.*

*1. Vision: It is imperative to obtain the best visual acuity or*

*visual behavior (e.g., fix and follow; central, steady,*

*maintained) possible in the child. The examiner should*

*perform the most rigorous vision test the child is capable of.*

*Fixation preference should be assessed in addition to visual*

*behavior in a nonverbal or preverbal child. If the child has*

*strabismus, it is easy to assess for fixation preference. The*

*examiner simply covers one eye to gain fixation in the other,*

*then removes the occluder and watches for any refixation*

*movement to the previously covered eye. This would signify*

*a fixation preference for the previously covered eye. Fixation*

*preference is more difficult to ascertain when a child does*

*not have strabismus. The vertical prism test can be useful.*

*Several variations of this test exist. One method involves*

*holding a 10 to 14 prism diopter hand-held prism base down*

*in one of the examiner’s hands. Next, the examiner gains the*

*child’s fixation on a small target. The examiner then places*

*the vertical prism in front of one of the child’s eyes while*

*watching for a refixation movement. If the child refixates,*

*the examiner will note an upward movement of both eyes as*

*the child switches fixation to the eye looking through the*

*prism. This test should be done several times on one eye and*

*then repeated on the other eye. Typically, if amblyopia is not*

*present, no refixation movement will be noted when the*

*prism is placed in front of either eye. If there is consistent*

*refixation movement when the prism is held before one eye*

*but not the other, amblyopia should be suspected. Our child*

*has normal and equal visual acuity in each eye.*

*2. Pupils: Anisocoria in the presence of ptosis can be due to*

*Horner’s syndrome or a third nerve palsy. If anisocoria is*

*noted, the examiner must note whether the anisocoria is*

*worse in lighted or dimly lit conditions, in order to discern*

*whether the iris dilator muscle (i.e., sympathetic nervous*

*system) or the iris sphincter (i.e., parasympathetic nervous*

*system) is the problematic muscle. If the anisocoria is worse*

*in dimly lit conditions, the dilator muscle is problematic and*

*a Horner syndrome should be suspected. If the anisocoria is*

*worse in lighted conditions, then the iris sphincter is the*

*problem, and a third nerve palsy may be present. Further*

*workup for each of these entities should be performed.*

*3. External examination: Several different measurements*

*should be performed when evaluating a ptosis patient. The*

*Childhood Ptosis*

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*palpebral fissure height, the margin reflex distance, and*

*levator function are needed to evaluate ptosis to help*

*determine etiology and to decide on the best management*

*approach. In children, attention for an anomalous head*

*posture is also important. A chin-up head posture is adaptive*

*and usually signifies less risk for amblyopia than severe*

*ptosis without a chin-up head posture. The distance between*

*the lid crease and the lid margin is also helpful in*

*differentiating the different types of ptosis. If this distance is*

*higher than average, the ptosis is more likely due to a levator*

*dehiscence. If a lid crease is completely absent or*

*rudimentary, the ptosis is more likely congenital. One must*

*also assess the child for a Bell phenomenon prior to surgical*

*treatment. Ptosis caused by double-elevator palsy, congenital*

*fibrosis syndrome, or progressive external ophthalmoplegia*

*is often associated with a decreased or absent Bell’s*

*phenomenon. Patients with an abnormal Bell phenomenon*

*are at increased risk of exposure keratopathy and other*

*related problems following surgery. Finally, infants should be*

*evaluated while sucking on a bottle and older children*

*should be asked to move their jaw laterally from side to side*

*to rule out trigemino-oculomotor synkinesis. Each of these*

*maneuvers will stimulate the pterygoid branch of the*

*trigeminal nerve and, if jaw winking is present, will*

*stimulate the superior branch of the oculomotor nerve and*

*elevation of the involved lid will occur. Our child has severe*

*ptosis with moderate levator function, absent lid crease, and*

*an increase in palpebral fissure height in down-gaze, all*

*signs consistent with congenital ptosis.*

*4. Motility: Motility abnormalities can be associated with*

*ptosis if a third nerve palsy, double-elevator palsy, congenital*

*fibrous syndrome, or dense amblyopia (sensory strabismus)*

*is present. A careful motility examination should be done*

*and any abnormalities noted should be addressed.*

*5. Slit-lamp examination/anterior segment evaluation: If*

*evaluating a mild ptosis for a Horner syndrome, it is helpful*

*to look for heterochromia. Heterochromia is seen in patients*

*who have a congenital or very early onset Horner’s*

*syndrome. The lighter pigmented iris is on the involved side.*

*6. Cycloplegic refraction: Significant anisometropia and*

*astigmatism are common sequelae of long-standing ptosis. If*

*significant anisometropia exists, spectacle correction should*

*be prescribed. If amblyopia is detected, appropriate*

*amblyopia treatment should also be instituted (see chapter*

*77.) Our child has minimal anisometropia with good vision*

*in both eyes.*

*83.3 Diagnosis*

*Congenital ptosis of the right upper lid with anomalous chin-up*

*head posture and absence of amblyopia.*

*83.4 Medical Management*

*Medical management is only helpful for the associations of congenital*

*ptosis, namely, amblyopia and anisometropia. Amblyopia*

*is typically treated either with occlusion therapy or with*

*pharmacologic or optical penalization (see chapter 77). The*

*type of amblyopia therapy will depend on patient compliance,*

*cooperation, and physician preference. Anisometropia and*

*astigmatism should be corrected if deemed significant. Vigilant*

*follow-up throughout the childhood years must be done to*

*insure that amblyopia, once treated, does not recur.*

*83.5 Surgical Management*

*Ptosis, if significant, is a surgical disease. Surgery also offers, in*

*addition to an increased visual field and cosmetic benefits,*

*improvement of an anomalous head posture, which could allow*

*for improvement in development and coordination. Surgical*

*treatment goals are to elevate the ptotic lid for better vision and*

*increased visual field, and to reform the lid crease if it is absent*

*or rudimentary for cosmesis. It is important to decrease the*

*surgical dose if the Bell phenomenon is absent or decreased*

*because of the risk of exposure keratopathy.*

*Several different surgical treatment approaches are possible.*

*The choice of procedure depends on the severity of the ptosis*

*and levator function. The Fasanella–Servat procedure is used*

*for small ptosis of 2mm or less. A small wedge of conjunctiva,*

*superior tarsus, levator palpebrae, and Müller’s muscle are*

*resected in this procedure. This is an excellent procedure for a*

*Horner syndrome–associated ptosis. The levator resection is the*

*most versatile procedure and gives an excellent cosmetic result.*

*It can be performed for mild, moderate, and severe ptosis if*

*enough levator function is present. The frontalis suspension*

*procedure is typically reserved only for severe ptosis without*

*adequate levator function (typically 4mm or less). As its name*

*implies, it is a suspension procedure in which material is*

*threaded through the upper lid and attached to the frontalis*

*muscle. The material acts as a sling to hold the lid up. Different*

*materials, including a variety of sutures (Supramid, nylon, Prolene,*

*Gore-Tex), silicone rods, and organic materials, such as*

*banked or autogenous fascia lata or palmaris longus tendon,*

*have been utilized as the suspension material. The best longterm*

*results are found with the use of an autogenous fascia lata.*

*Results with banked fascia lata are almost as long lasting. All*

*synthetic materials have been shown to have a shorter life span*

*and increased risk for late complications such as granuloma formation*

*and other inflammatory reactions. The potential complications*

*of ptosis surgery, though infrequent, include early*

*and late infection, suture granuloma, exposure keratopathy, retrobulbar*

*hemorrhage, and overcorrections.*

*83.6 Rehabilitation and Follow-up*

*A child with congenital ptosis needs to be followed throughout*

*childhood for the associated problems of amblyopia and anisometropia.*

*Once treated, amblyopia can recur until a child is age*

*7 to 10 years old. Therefore, surveillance must continue. Following*

*surgical repair of ptosis, healing will occur over approximately*

*1 month. It is common after surgery for the child to*

*have some lagophthalmos when sleeping. Ocular lubrication at*

*night helps for the first month, and can usually be abandoned*

*thereafter, as children adapt very well to the small amount of*

*lagophthalmos that occurs from these procedures. When the*

*Bell reflex is absent, lubrication is usually needed permanently*

*after surgery. Lid height should be followed over time, as ptosis*

*can recur.*

~~~~~CASE 84 The Apparently Blind Infant~~~~~

*84 The Apparently Blind Infant*

*David K. Coats and Evelyn A. Paysse*

*Abstract*

*The apparently blind infant may truly be blind or may simply*

*appear to be blind. The condition may be due to prenatal, perinatal,*

*or postnatal etiologies. Some common congenital etiologies*

*for a blind infant include anophthalmos, microphthalmos,*

*coloboma, congenital cataract, and infantile glaucoma. Ophthalmia*

*neonatorum, retinopathy of prematurity, and cortical visual*

*impairment may occur in the perinatal period. Leukocoria or*

*white pupillary reflex (e.g., congenital cataract, persistent*

*hyperplastic primary vitreous, or retinoblastoma) is also discussed.*

*This chapter describes the evaluation (including possible*

*exam under anesthesia, funduscopy, refraction, corneal*

*diameter measurement, and measurement of intraocular pressure),*

*management, treatment, and prognosis of specific causes*

*of the apparently blind infant.*

*Keywords: blind infant, prenatal, postnatal, intrauterine, cortical*

*visual impairment*

*84.1 History*

*A 3-month-old girl is brought to her ophthalmologist by her*

*parents because of concerns that she may be blind. They report*

*that she has poor eye contact, that she does not respond to*

*parental facial expressions, and that she does not appear to*

*respond to bright lights. The child’s prenatal and birth histories*

*are unremarkable. Her past ophthalmologic and medical histories*

*are unremarkable. The child has two siblings, aged 2 years*

*and 5 years, who visually responded much more at 3 months of*

*age than the patient does and who are developmentally and*

*visually normal at this time. The review of systems is otherwise*

*negative. The child appears to be normal from a developmental*

*standpoint, though the child has not been seen by her pediatrician*

*in several weeks.*

*On examination, a healthy-appearing 3-month-old girl is sitting*

*on her mother’s lap. The ocular adnexal and other facial*

*features appear normal. The child does not fixate on or follow*

*any target and does not respond to facial gestures. She does*

*blink when a bright light is directed into her eyes. Optokinetic*

*nystagmus (OKN) testing demonstrates an occasional beat of*

*nystagmus, but attention is poor and the test results are equivocal.*

*The eyes are orthotropic with full versions to oculocephalic*

*testing. Spontaneous nystagmus is not seen. The pupillary*

*examination reveals pupils that are 5mm in size and moderately*

*reactive to light with no afferent pupillary defect, and no*

*paradoxical pupillary reaction is present. Anterior segment and*

*fundus examinations are normal.*

*Differential Diagnosis—Key Points*

*1. Poor vision in a child requires consideration of an extensive*

*differential diagnosis. In general, poor vision in an infant*

*should be divided into poor vision without nystagmus and*

*poor vision with nystagmus. If nystagmus is present, the*

*differential diagnosis includes bilateral structural*

*abnormalities of the cornea lens, retina, or optic nerve*

*leading to a bilateral severe, afferent dysfunction. Idiopathic*

*infantile nystagmus is also a consideration if nystagmus is*

*present. The absence of nystagmus strongly supports a*

*cortical-based abnormality.*

*2. Delayed visual maturation (DVM) is an interesting and*

*troubling problem that is not infrequently encountered in*

*young infants. In general, the absence of fixation behavior*

*in a child 4 to 6 weeks of age is rarely alarming to*

*pediatricians or parents. If obvious visual fixation behavior is*

*not present after this time, however, parents and*

*pediatricians alike become very concerned. DVM can be*

*classified into three major groups: (1) isolated DVM, (2)*

*DVM with associated central nervous system (CNS) disease,*

*and (3) DVM with associated structural eye abnormalities. In*

*isolated DVM, the absence of obvious visual behavior is the*

*only abnormality noted. The child is developmentally and*

*neurologically normal and typically has normal*

*electrophysiologic testing results. DVM can also coexist with*

*systemic disease and/or intellectual disability or with ocular*

*disease such as optic nerve hypoplasia and albinism. The*

*etiology of the DVM is unknown, but some have suggested*

*that delayed myelination of the optic nerves and/or tracts*

*or delayed synaptogenesis in the visual pathways may be*

*the etiology. Visual behavior in this condition eventually*

*normalizes by 6 to 8 months of age in most cases.*

*3. Cortical visual impairment (CVI) is another important*

*condition that must be considered. A child with CVI will*

*appear clinically similar to the child with DVM. Typically the*

*child with CVI, however, has a history of perinatal hypoxia or*

*another serious neurological event suggesting the*

*possibility of hypoxic brain injury and typically also has*

*concurrent neurologic and/or systemic abnormalities.*

*4. Structural abnormalities of the eye must be carefully ruled*

*out. In general, bilateral structural abnormalities that are*

*severe enough to produce blindness typically will present*

*with concurrent nystagmus. Affected patients may initially*

*appear similar to the child with DVM because nystagmus*

*may not develop until the child is several months of age.*

*Careful ophthalmologic examination will usually eliminate*

*the confusion.*

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*84.2 Test Interpretation*

*The ophthalmologist should work in conjunction with the*

*child’s pediatrician or neurologist. The child suspected of having*

*DVM should undergo a careful developmental assessment.*

*If the developmental milestones are normal, isolated DVM is*

*the likely diagnosis. Time will allow this diagnosis to be confirmed*

*as the child begins to develop normal visual behavior*

*with age. This child is developmentally normal.*

*A neurological assessment is important in this situation and*

*can be conducted by the child’s pediatrician or a neurologist.*

*The presence of neurologic abnormalities can coexist with*

*DVM. The prognosis, however, for DVM with neurologic abnormalities*

*is not as good, and vision is often slower to improve*

*compared with isolated DVM. Our patient had a normal screening*

*neurological examination.*

*In general, unless neurologic and/or systemic abnormalities*

*are found, the child with isolated DVM does not need to*

*undergo electrophysiologic testing. If tested, however, the*

*child’s electroencephalogram (EEG) must be normal. If the EEG*

*is abnormal, the child does not have isolated DVM. The visual*

*evoked potential (VEP) test in a child with isolated DVM may be*

*mildly delayed and attenuated or may be normal. The test is*

*useful in predicting eventual development of good vision. The*

*electroretinogram is also normal in children with isolated DVM.*

*This child’s parents requested a VEP test.*

*It is of paramount importance for the ophthalmologist to*

*interact appropriately with parents, pediatricians, and neurologists.*

*It is extremely important to explain carefully to the*

*parents what DVM is and its prognosis. It is improper to declare*

*an infant visually impaired in the first 4 to 6 months of life, as*

*many will prove to have normal vision as the visual system*

*matures. Alleviating parental and referring physician fear is a*

*major role of the ophthalmologist in treating infants with this*

*condition. An extensive workup, however, is not initially*

*needed if the infant is developmentally and neurologically normal.*

*84.3 Diagnosis*

*Isolated DVM.*

*84.4 Medical Management*

*The child should undergo a careful initial developmental and*

*neurologic assessment. Periodic assessments of development*

*and neurologic function should also be undertaken by the*

*child’s pediatrician. Continued normal development is strongly*

*suggestive of isolated DVM and the likelihood of eventual*

*improvement of vision.*

*84.5 Surgical Management*

*No surgical treatment is indicated.*

*84.6 Rehabilitation and Follow-up*

*For the typical infant with isolated DVM, vision typically will*

*become normal by the time the infant is 6 to 8 months old. At*

*this point, no further evaluation or intervention is required,*

*and such a child can be expected to do well. On the other hand,*

*if the vision fails to improve by 6 to 8 months of age, further*

*evaluation including electrophysiologic testing and neuroimaging*

*is indicated. In a child with DVM associated with neurologic*

*abnormalities, developmental delay, and/or ocular abnormalities,*

*visual response may be delayed until as late as 1 to 2 years*

*of age.*

~~~~~CASE 85 Optic Nerve Hypoplasia~~~~~

*85 Optic Nerve Hypoplasia*

*David K. Coats and Evelyn Paysse*

*Abstract*

*Optic nerve hypoplasia (ONH) produces variable visual loss and*

*a small optic nerve in one or both eyes. It can be associated with*

*other intracranial defects (e.g., septo-optic dysplasia [SOD] or*

*DeMorsier’s syndrome, brain and pituitary malformations, and*

*hypoplasia of the corpus callosum). Some children with ONH*

*have nystagmus and vision can range from no light perception*

*to 20/20. Hormone deficiencies should be tested and treated.*

*Neuroimaging may be required. This chapter reviews the evaluation,*

*management, treatment, and prognosis of ONH.*

*Keywords: optic nerve hypoplasia, hypothalamic pituitary axis*

*85.1 History*

*A 3-year-old boy is referred by another ophthalmologist. The*

*child was diagnosed with esotropia and amblyopia in the right*

*eye at age 2 years. The referring ophthalmologist prescribed*

*full-time patching of the left eye, which was done sporadically*

*for approximately 6 months. No improvement in the child’s*

*vision was noted, prompting referral for a second opinion and*

*treatment recommendations.*

*The child’s medical history is notable for a weight and height*

*in the 15th percentile, but is otherwise unremarkable. The*

*review of systems is completely negative with the exception of*

*the ophthalmologic complaints and there is no family history of*

*strabismus or amblyopia.*

*The patient is shown in ▶Fig. 85.1. Best-corrected visual*

*acuity is 20/200 in the right eye and 20/30 in the left eye. Motility*

*evaluation reveals an esotropia of 25 prism diopters at distance*

*and at near with full ductions and versions. Pupillary*

*testing reveals a 1 + relative afferent pupillary defect (RAPD) in*

*the right eye. Cycloplegic refraction is + 1.25 diopters in both*

*eyes and initial evaluation of the posterior pole reveals a normal*

*disc, macula, and vessels. The ophthalmologist is concerned*

*by the presence of the RAPD and performs a more careful evaluation*

*of the posterior pole. The disc of the right eye appears*

*slightly pale. The vessels on the nerve are crowded. The disc*

*diameter is small, and a double-ring sign is noted (▶Fig. 85.2a,*

*b). The left disc is also slightly smaller than normal.*

*85.2 Test Interpretation*

*1. When an RAPD was noted in this child, careful scrutiny of*

*the optic discs became paramount. Several methods can be*

*utilized to obtain a better view of the posterior pole in an*

*uncooperative or marginally cooperative child. These*

*measures include the use of direct ophthalmoscopy, or*

*indirect ophthalmoscopy using a 14-diopter lens. Both of*

*these techniques offer greater magnification compared to*

*indirect ophthalmoscopy with a 20-diopter lens but have the*

*disadvantage of being either difficult to perform on an*

*uncooperative child (direct ophthalmoscopy) or not readily*

*Differential Diagnosis—Key Points*

*1. An RAPD should always be a tip-off that amblyopia is not the*

*problem and a careful evaluation to determine the etiology*

*of the afferent abnormality should be carried out. While it is*

*true that trace RAPDs may occasionally be seen in children*

*with amblyopia, the presence of an easily identifiable RAPD*

*is not consistent with a diagnosis of amblyopia. The*

*examiner must explain its presence and is advised to refer*

*the child for a second opinion if a plausible explanation*

*cannot be found.*

*2. Optic nerve hypoplasia is a relatively common congenital*

*anomaly of the optic nerves. It may occur in one or both*

*eyes and may be isolated or may be associated with central*

*nervous system (CNS) and endocrine abnormalities. The*

*condition is difficult to diagnose in an uncooperative child.*

*Nevertheless, a detailed and magnified view of the disc*

*must be obtained. The so-called double-ring sign may or*

*may not be present, and when present, may be mistaken for*

*a normal-sized optic nerve. This is especially true if indirect*

*ophthalmoscopy, which offers only minimal magnification,*

*is the only technique used to examine the discs. Often, an*

*anomalous configuration of retinal vessels on the disc is the*

*first tip-off that there is a problem with the optic nerve,*

*prompting a more detailed look.*

*3. Vision can vary from 20/20 to no light perception. Many*

*children with severe optic nerve hypoplasia appear*

*completely blind at birth but demonstrate useful vision later*

*in life. When severe and bilateral optic nerve hypoplasia is*

*present, the child will also have nystagmus and presents a*

*less formidable diagnostic challenge.*

*4. Optic nerve hypoplasia is commonly associated with midline*

*CNS defects such as absence of the septum pellucidum and/*

*or corpus callosum and posterior pituitary ectopia.*

*Hemispheric migrational anomalies may also be present.*

*When optic nerve hypoplasia coexists with these midline*

*CNS defects, the terms septo-optic dysplasia or De Morsier*

*syndrome have been utilized.*

*5. Patients with septo-optic dysplasia may suffer a variety of*

*pituitary hormone abnormalities, including abnormalities of*

*growth hormone and of the adrenocorticosteroid axis. It is*

*important to recognize this condition because*

*corticotrophin deficiency has been associated with sudden*

*death in children with septo-optic dysplasia following an*

*otherwise uneventful febrile illness, and growth hormone*

*deficiency can result in severe growth retardation.*

*Endocrine abnormalities are most likely to occur in children*

*with posterior pituitary ectopia and hemispheric migrational*

*abnormalities.*

*6. Optic neuritis and optic atrophy are included in the*

*differential diagnosis of this child with poor vision in one eye*

*and an RAPD. These conditions can be ruled out on clinical*

*examination.*

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*available (14-diopter lens) in most ophthalmology practices.*

*Modified (monocular) indirect ophthalmoscopy offers a*

*useful imaging option. With this technique, a standard 20-*

*diopter lens is held 5 to 6cm in front of the child’s eye. The*

*direct ophthalmoscope is then held approximately 18 cm*

*away. The aerial image produced by the 20-diopter lens is*

*then focused with the direct ophthalmoscope. This*

*technique allows adequate magnification to accurately assess*

*the optic nerves without requiring the close proximity to the*

*child that is required for direct ophthalmoscopy.*

*Examination of the eyes under anesthesia is sometimes*

*required in particularly uncooperative children. The*

*potential for serious problems due to corticotrophin*

*deficiency should be considered and steroids administered*

*before anesthesia if this problem is suspected. For this*

*reason, consultation with an endocrinologist should be*

*completed before undergoing any surgical intervention or*

*anesthetic.*

*2. Magnetic resonance imaging of the brain is the preferred*

*neuroimaging study to rule out midline CNS defects and*

*hemispheric migrational abnormalities. Specifically, the*

*examiner should review the scan for absence of the corpus*

*callosum or septum pellucidum and for pituitary*

*abnormalities. Ectopia of the posterior pituitary bright spot*

*is highly suggestive of current or future endocrine*

*abnormalities. This child’s MRI scan is shown in ▶Fig. 85.3.*

*Endocrine testing should be conducted by an endocrinologist or*

*the child’s pediatrician. This is imperative and urgent. This patient*

*had a markedly reduced growth hormone level. The most*

*common endocrine abnormalities that present in septo-optic*

*dysplasia are growth hormone and corticotrophin deficiency.*

*These conditions should be detected early in the disease course*

*to prevent a potential medical disaster. The child’s pediatrician*

*should be advised of the child’s condition and the need to follow*

*growth and endocrine parameters carefully and frequently.*

*85.3 Diagnosis*

*Septo-optic dysplasia, with bilateral, asymmetric optic nerve*

*hypoplasia. The child is also suffering from a growth hormone*

*deficiency with resulting short stature and low weight.*

*Fig. 85.1 Esotropia noted in a patient on initial examination. (This*

*image is provided courtesy of Andrew G. Lee, MD, Iowa City, IA.)*

*Fig. 85.2 (a) Small right optic nerve with “double ring” sign. (b) Normal left optic nerve of another patient for comparison. (These images are provided*

*courtesy of Andrew G. Lee, MD, Iowa City, IA.)*

*Fig. 85.3 Magnetic resonance scan demonstrating absence of the*

*septum pellucidum. (This image is provided courtesy of Andrew G. Lee,*

*MD, Iowa City, IA.)*

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*85.4 Medical Treatment*

*The child should be under the care of an endocrinologist and*

*should undergo pituitary hormone replacement as needed with*

*close follow-up of his growth parameters. Despite the fact that*

*the child has optic nerve hypoplasia, there is still the potential*

*to improve the vision in his right eye if a component of functional*

*amblyopia coexists with the anatomical defect. Such*

*patients should receive a trial of amblyopia therapy before concluding*

*that the visual impairment is irreversible.*

*85.5 Surgical Treatment*

*Strabismus surgery or botulinum toxin injection can be offered*

*to repair the child’s esotropia. The child’s parents should be*

*advised, however, that the strabismus has a higher likelihood to*

*recur following surgery due to the poor vision. Surgery should*

*be deferred until amblyopia treatment has been maximized.*

*Typically, strabismus surgery is postponed until school age to*

*minimize the total number of strabismus surgeries the patient*

*will have to undergo in his lifetime.*

*85.6 Rehabilitation and Follow-up*

*As with all functionally monocular patients, polycarbonate*

*safety spectacles should be prescribed to protect the child’s better-*

*seeing eye. In children with optic nerve hypoplasia, ongoing*

*evaluation of growth and endocrine parameters should continue*

*throughout early childhood, even if the child appears to*

*be growing normally at initial diagnosis. Endocrine abnormalities*

*have been detected and problems have been noted with*

*delayed onset as late as 3 to 4 years of age. Stress doses of corticosteroids*

*should be administered in patients with corticotrophin*

*abnormalities in situations such as acute illness, surgery,*

*or serious injury.*

*85.6.1 Note*

*The child described in this case is a composite of several children*

*used to demonstrate common findings of optic nerve*

*hypoplasia.*

~~~~~CASE 86 Ptosis~~~~~

*86 Ptosis*

*Amina I. Malik*

*Abstract*

*Ptosis involves droopiness of the upper eyelid and is most commonly*

*due to levator aponeurosis dehiscence from age. Other etiologies*

*include congenital, myogenic (myasthenia gravis or other*

*myopathy), mechanical (mass on eyelid), or Horner’s syndrome.*

*If the ptosis is mild, it can be observed, but if it is interfering*

*with superior peripheral vision, surgical repair can be performed.*

*Keywords: ptosis, eyelid droop*

*86.1 History*

*A 72-year-old woman was referred for drooping of her upper*

*eyelids. The patient stated that the drooping had slowly progressed*

*over the last 3 to 4 years. The drooping was now severe*

*enough to interfere with her vision, and she often found herself*

*manually lifting her lids to improve her visual field. There was*

*no previous history of periocular trauma or surgery. She had*

*undergone bilateral cataract extraction with placement of*

*intraocular lenses 4 years previously. There was no history of*

*muscle weakness or fatigue, and she had no known neurologic*

*disease. She did not complain of diplopia or significant fluctuation*

*of the lid position during the day. Inspection of old photographs*

*did not show the presence of ptosis.*

*Examination showed corrected visual acuity of 20/20 OU. The*

*patient was orthophoric with full ductions and versions on*

*motility examination. Ptosis of both upper eyelids was present,*

*with the right upper lid being lower than the left upper lid in*

*both primary position and downgaze. The palpebral fissures*

*measured 5mm on the right and 6mm on the left (▶Fig. 86.1).*

*The marginal reflex distances were 0 on the right and 1 on the*

*left. The levator function measured 14mm on both sides.*

*Inspection of the tarsal conjunctiva on both sides showed no*

*significant abnormalities and no orbital masses were palpated.*

*The upper eyelid creases were effaced on both sides, and the*

*superior sulci were deepened.*

*Differential Diagnosis—Key Points*

*1. In this patient, there is bilateral ptosis, which has been slowly*

*progressive. There is good preservation of levator function, and*

*the absent upper eyelid crease and the deep superior sulci are*

*consistent with an aponeurotic ptosis. The more ptotic eyelid is*

*lower in downgaze, which contrasts with congenital ptosis.*

*Furthermore, the opportunity to inspect previous photographs*

*confirms the acquired nature of the lid malposition.*

*Aponeurotic ptosis results from a disinsertion of the levator*

*aponeurosis from its normal attachment on the anterior*

*tarsus. While levator disinsertion may occur following trauma*

*or severe edema, it is most commonly an age-related change.*

*The presence of good lid excursion (> 12mm) indicates*

*preservation of levator function and is important in*

*distinguishing aponeurotic ptosis from other types of ptosis.*

*2. Neurogenic ptosis results from interruption of the*

*innervation to the eyelid elevators, including levator*

*aponeurosis (cranial nerve III) and Muller’s muscle*

*(sympathetic innervation). It may be congenital or acquired.*

*Horner’s syndrome, myasthenia gravis, or other neurologic*

*conditions may cause neurogenic ptosis. Careful pupil*

*examination and testing with topical cocaine and Paredrine*

*will confirm the presence of Horner’s syndrome. Ice testing,*

*edrophonium (Tensilon) testing, or acetylcholine receptor*

*antibodies should be performed if there is history of ptosis*

*worsening with fatigue and myasthenia gravis is suspected.*

*3. Myogenic ptosis may also be congenital or acquired.*

*Myogenic congenital ptosis results from abnormal*

*development and fibrosis of the levator muscle and may be*

*unilateral or bilateral. In contrast to aponeurotic ptosis, the*

*ptotic lid will be higher in downgaze and the levator function*

*is severely reduced, usually measuring less than 7mm.*

*Acquired myogenic ptosis occurs in muscular diseases such as*

*muscular dystrophy, chronic progressive external*

*ophthalmoplegia (Kearns–Sayre syndrome), or*

*oculopharyngeal dystrophy. The levator function is markedly*

*diminished, and ocular motility is often severely impaired.*

*4. Mechanical ptosis results from the presence of a mass*

*within the eyelid. The mass may be congenital or acquired*

*and may be inflammatory or neoplastic. The ptotic lid*

*should be everted to allow examination of the tarsal*

*conjunctiva and fornix. Palpation of the orbit may reveal a*

*mass superiorly. More commonly, severe blepharochalasis*

*may produce mechanical ptosis.*

*5. Conditions that may mimic the presence of eyelid ptosis*

*should be included in the differential diagnosis. The eyelid*

*may appear ptotic if the globe is small (phthisis bulbi) or*

*displaced posteriorly (enophthalmos). Eyelid retraction on*

*one side may simulate ptosis of the contralateral lid.*

*Fig. 86.1 Clinical photograph depicting bilateral ptosis of the eyelids*

*that is more marked on the right side. Note the absent lid crease and*

*the deep superior sulcus on both sides.*

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*86.2 Test Interpretation*

*If neurogenic or myogenic ptosis is suspected, appropriate testing*

*as discussed earlier should be performed. It is critical to*

*establish the correct diagnosis, not only to allow the correct*

*management of the lid malposition, but also to ensure that any*

*systemic disease is identified and treated appropriately.*

*86.3 Diagnosis*

*Ptosis of both upper eyelids due to levator aponeurosis disinsertion.*

*86.4 Medical Management*

*If ptosis is mild and the patient is asymptomatic, no treatment*

*is indicated. If ptosis is severe enough to cause symptomatic*

*visual field impairment, taping of the lid or the use of eyelid*

*crutches attached to the patient’s spectacles may be tried. In*

*most patients, these measures are only temporizing, and surgical*

*correction of the lid malposition is required to effect a longterm*

*solution.*

*86.5 Surgical Management*

*Most cases of severe aponeurotic ptosis will require surgical*

*treatment to achieve long-term satisfactory results. The anterior*

*approach to ptosis repair allows reattachment or advancement*

*of the dehisced levator aponeurosis to the anterior tarsus.*

*This is accomplished through an external incision that also*

*allows for re-establishment of the eyelid crease. Alternatively, a*

*posterior approach can be used where Muller’s muscle is*

*resected. Complications of surgery include undercorrection or*

*overcorrection, asymmetric or unsatisfactory lid contour, or*

*lagophthalmos with exposure symptoms.*

*86.6 Rehabilitation and Follow-up*

*The patient underwent external levator advancement on both*

*upper eyelids. The procedure was performed using local infiltrative*

*anesthesia allowing for intraoperative adjustment of lid*

*height and contour. Postoperatively, the patient noted an*

*improvement in her visual field, and she suffered no complications*

*from the surgical procedure.*

~~~~~CASE 87 Thyroid Eye Disease~~~~~

*87 Thyroid Eye Disease*

*Amina I. Malik*

*Abstract*

*Thyroid eye disease is the most common etiology of proptosis,*

*which is unilateral or bilateral. Signs include proptosis, eyelid*

*retraction, limited extraocular motility, increased intraocular*

*pressure in upgaze, and, in extreme cases, optic neuropathy.*

*Diagnosis is established by exam, thyroid blood work, and imaging*

*confirming the presence of enlarged extraocular muscle bellies.*

*Treatment can include observation for mild cases, but*

*surgical decompression may be indicated to reduce proptosis*

*and for optic neuropathy. This can be followed by eye muscle*

*surgery for diplopia and by eyelid retraction repair if present.*

*Keywords: thyroid eye disease, proptosis, eyelid retraction, decompression*

*87.1 History*

*A 44-year-old woman was referred for evaluation of pain*

*around both eyes. The pain was described as dull ache, and*

*worsened with eye movement. She had noted increasing prominence*

*of both eyes over the past 18 months and complained*

*that both eyes felt “gritty.” She had no complaints of diplopia or*

*blurred vision, and there was no previous ocular history of surgery*

*or trauma. Her past medical history was unremarkable,*

*and there was no history of thyroid dysfunction. Her review of*

*symptoms was significant for heat and cold intolerance, but she*

*reported no recent change in weight, body hair growth or loss,*

*or change in the quality of her voice. There was no known cardiovascular*

*or neurologic disease.*

*Examination showed corrected visual acuity of 20/20 in each*

*eye. Normal color vision defect was detected with Hardy–*

*Rand–Rittler color plates. Both pupils reacted normally, without*

*relative afferent pupillary defect. The motility exam showed*

*orthophoria with mild (–1) restriction of upgaze on both sides.*

*Upper and lower eyelid retraction was present with palpebral*

*fissures measuring 16 and 15mm on the right and left sides,*

*respectively (▶Fig. 87.1). Temporal flaring of the upper lids was*

*noted, and 2mm of lagophthalmos was present bilaterally.*

*There was increased resistance to retropulsion of both globes;*

*no orbital masses were palpated. Exophthalmometry measurements*

*were 22mm on the right side and 21mm on the left*

*(▶Fig. 87.2). Intraocular pressures were 21mm Hg on the*

*right side and 20mm Hg on the left. Slit-lamp examination*

*showed scattered punctate epithelial erosions of both corneas*

*inferiorly. Mild bulbar conjunctival injection was present bilaterally,*

*most pronounced at the insertion of horizontal rectus*

*muscles. The anterior segments were otherwise unremarkable.*

*Dilated fundus exam showed both optic discs to be flat without*

*pallor. The retina appeared normal, and there were no choroidal*

*striae.*

*Differential Diagnosis—Key Points*

*1. One of the most common causes of proptosis in middleaged*

*adults is thyroid eye disease (Graves’ disease), and this*

*patient demonstrates many of the salient features of this*

*condition.*

*For purposes of evaluation and management, the ophthalmic*

*findings of thyroid eye disease can be divided into three*

*categories: optic nerve dysfunction, motility disturbance, and*

*eyelid retraction. Vision loss in Graves’ disease can be due to*

*corneal exposure, compressive optic neuropathy from*

*enlarged extraocular muscles and increased orbital fat, or*

*stretch optic neuropathy from severe proptosis. Restrictive*

*motility disturbances in Graves’ disease result from*

*inflammation and swelling of the extraocular muscles,*

*followed by fibrosis. The inferior rectus muscle is most*

*frequently involved, followed by the medial, superior, and*

*lateral rectus muscles. Fibrosis of the levator and Müller’s*

*muscle in the upper eyelid and the lid retractors in the lower*

*eyelid causes upper and lower eyelid retraction. Eyelid*

*retraction can also be worsened by proptosis. Scleral show and*

*lagophthalmos leading to severe corneal exposure may result*

*from eyelid retraction.*

*The diagnosis of thyroid-related ophthalmopathy is made on*

*clinical grounds, and confirmed radiographically. In addition to*

*demonstrating the enlarged extraocular muscles, computed*

*tomography (CT) or magnetic resonance imaging (MRI) of the*

*orbit allows assessment of the degree of proptosis and of the*

*optic nerve near the orbital apex. Consultation with an*

*internist or endocrinologist should be sought to evaluate the*

*patient’s thyroid status. The ophthalmic disease and thyroid*

*dysfunction, if present, often run independent courses, and*

*the patients should be thoroughly educated in this regard.*

*2. Idiopathic orbital inflammation may also occur as a bilateral*

*disease, though it is more common unilaterally, and may*

*produce a localized myositis. In idiopathic orbital*

*inflammation, the CT scan will show enlargement of the*

*entire muscle, including the tendon. This contrasts with the*

*tendon sparing typically seen in Graves’ disease.*

*3. Other causes of bilateral proptosis include bilateral orbital*

*metastasis from a distant primary malignancy and diffuse*

*orbital infiltrative processes such as amyloidosis or*

*sarcoidosis. A detailed clinical history and lab work*

*radiographic evaluation of the orbits will help distinguish*

*these entities from Graves’ disease.*

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*87.2 Test Interpretation*

*Automated perimetry (Humphrey visual field) testing was performed*

*and showed no significant abnormalities. A CT scan of*

*the orbits demonstrated mild to moderate extraocular muscle*

*enlargement of both inferior rectus muscles and the left medial*

*rectus muscle. Tendon sparing, typical of Graves’ disease, was*

*present. Posteriorly, the optic nerves did not appear compressed.*

*87.3 Diagnosis*

*Thyroid eye disease (i.e., Graves’ orbitopathy) with eyelid*

*retraction and bilateral proptosis.*

*87.4 Medical Management*

*Corneal exposure changes may be treated with frequent instillation*

*of artificial tears and lubricating ointment at bedtime.*

*Punctal occlusion, either temporary or permanent, may be considered.*

*Wearing of a moisture shield at bedtime may help*

*ameliorate nocturnal drying due to lagophthalmos and*

*decreased Bell’s phenomenon. Elevated intraocular pressure*

*due to orbital congestion and/or associated glaucoma may be*

*treated with topical intraocular pressure–lowering drops.*

*Active orbital inflammation or the presence of optic neuropathy*

*warrants treatment. High doses of oral corticosteroids (prednisone*

*80–100mg daily) or pulsed high-dose intravenous*

*steroids can be administered. Patients who cannot take steroids*

*could be considered for radiation therapy to the orbits or surgical*

*decompression.*

*Most patients with symptomatic restrictive strabismus will*

*eventually require strabismus surgery. During the active*

*inflammatory phase, wearing a patch over one eye may relieve*

*the patient’s symptoms. Prisms are usually not effective*

*because of the noncomitant nature of the motility disturbance.*

*Motility measurements should be stable for at least 3 to 4*

*months before strabismus surgery is performed.*

*87.5 Surgical Management*

*Patients with compressive optic neuropathy that is unresponsive*

*to steroid therapy or radiation treatment or in whom the*

*steroids cannot be successfully tapered may be considered for*

*orbital decompression. In addition, patients with severe proptosis*

*leading to corneal exposure may be considered for orbital*

*decompression, even in the absence of optic neuropathy. Orbital*

*decompression can be achieved with one-, two-, or three-wall*

*decompression or with orbital fat removal. Surgical approach is*

*tailored to each patient depending on degree of disease*

*severity. Orbital decompression may cause exacerbation of*

*existing diplopia or creation of diplopia in a patient without*

*previous symptoms. The patient must be fully apprised of this*

*risk and must understand that subsequent strabismus surgery*

*may be required.*

*Strabismus surgery may be indicated in thyroid eye disease if*

*symptomatic diplopia is present. Motility measurements*

*should be stable for at least 3 to 4 months before surgery to*

*ensure that the patient is not in an active inflammatory phase.*

*Additionally, strabismus surgery should follow orbit decompression*

*surgery because the motility pattern may be altered*

*after orbit surgery.*

*Severe eyelid retraction is addressed only after any needed*

*orbit or muscle surgery. Eyelid retraction can cause severe functional*

*as well as cosmetic problems, and again, treatment must*

*be individualized. Recession of the levator aponeurosis in the*

*upper eyelid and of the lower lid retractors allows for improved*

*coverage of the bulbar surface and improved cosmesis.*

*87.6 Rehabilitation and Follow-up*

*The patient maintained good visual acuity and did not develop*

*significant diplopia. She was treated initially with frequent artificial*

*tears and punctal occlusion to improve the corneal surface.*

*After 4 months of stable symptoms, she underwent*

*recession of all four eyelids. There were no intraoperative or*

*Fig. 87.1 Clinical photograph depicting marked eyelid retraction with*

*widened palpebral fissures and scleral show.*

*Fig. 87.2 Lateral view demonstrates proptosis of the globe.*

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*postoperative complications, and the patient was satisfied with*

*the cosmetic result as well as the relief of her exposure symptoms.*

*Endocrinology evaluation revealed hypothyroidism, and*

*the patient has been maintained on thyroid hormone replacement*

*therapy.*

~~~~~CASE 88 Ectropion~~~~~

*88 Ectropion*

*Amina I. Malik*

*Abstract*

*Ectropion of the lower eyelid is usually involutional, due to*

*increased laxity of the tarsoligamentous sling that normally*

*supports the eyelid. This can lead to problems with tearing due*

*to poor punctal apposition to the globe, dryness from poor tear*

*distribution, and irritation from conjunctival hypertrophy as*

*well as keratinization of the exposed tarsal conjunctival surface.*

*Cicatricial ectropion can also be seen, due to chronic UV damage*

*or other trauma to the eyelid causing anterior lamellar*

*shortening. A mechanical ectropion is usually easily identified*

*by the presence of a mass on the lid causing the lid margin to*

*be displaced downward. Paralytic ectropion occurs following*

*temporary or permanent seventh nerve palsy. The presence of*

*other accompanying signs of seventh nerve impairment, including*

*facial weakness and brow ptosis on the ipsilateral side,*

*makes the diagnosis apparent. Nonsurgical treatment involves*

*lubrication for dry eye. Surgical treatment is tailored toward*

*the underlying etiology.*

*Keywords: ectropion, lid sagging, dry eye*

*88.1 History*

*A 70-year-old man presented with left eye irritation that had*

*been present for the last year. He had bilateral cataract surgery*

*3 years previously, and there was no other history of ocular disease*

*or trauma.*

*Examination showed a corrected vision of 20/20 OD and 20/*

*25 OS. The external examination showed a marked “out-turning”*

*of the left lower eyelid with associated tarsal conjunctival*

*injection diffusely (▶Fig. 88.1a, b). His left corneal exam*

*showed 1 + superficial punctate keratitis inferiorly. No masses*

*were palpated. There was mild dermatochalasis of both upper*

*lids. Both lower lids exhibited moderate horizontal laxity with*

*delayed snapback test. The remainder of the eye examination*

*was within normal limits.*

*Differential Diagnosis—Key Points*

*1. The patient has an ectropion of the left lower eyelid. In this*

*age group, the most common cause of ectropion is related to*

*involutional (age-related) changes within the eyelid. The most*

*prominent change relates to increased laxity of the*

*tarsoligamentous sling that normally supports the eyelid. As*

*the laxity of the lid progresses, the eyelid will commonly*

*develop a medial ectropion first. At this stage, the patient*

*may complain of epiphora due to eversion of the lower lid*

*punctum. If untreated, the eyelid will eventually develop a*

*generalized ectropion involving the entire lid. Prolonged eyelid*

*eversion may then result in conjunctival hypertrophy as well*

*as keratinization of the exposed tarsal conjunctival surface.*

*2. Cicatricial ectropion must be included in the differential*

*diagnosis of an out-turning eyelid. This condition results*

*from a vertical shortening of the anterior lamella of the lid,*

*which may occur after surgical or accidental trauma to the*

*lower lid or cheek area. Excision of malignant skin cancers or*

*overaggressive skin removal during a lower lid*

*blepharoplasty may produce a cicatricial ectropion. To*

*determine if the anterior lamella is vertically shortened, a*

*manual attempt to lift the lid into its normal position should*

*be made. Inability to easily lift the lid to its normal position*

*indicates the presence of a cicatricial component. This*

*shortening of the anterior lamella must be addressed in any*

*surgical correction of the lid malposition.*

*3. A mechanical ectropion is usually easily identified by the*

*presence of a tumor or other mass on the lid causing the lid*

*margin to be displaced downward. Less common causes of*

*mechanical ectropion include edema of the lid or herniation*

*of orbital fat.*

*4. Paralytic ectropion occurs following temporary or*

*permanent seventh nerve palsy. The presence of other*

*accompanying signs of seventh nerve impairment, including*

*facial weakness and brow ptosis on the ipsilateral side, make*

*the diagnosis apparent.*

*Fig. 88.1 (a) Clinical appearance of lower lid ectropion. (b) Injection of the exposed tarsal conjunctiva is best seen on lateral view.*

*Ectropion*

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*88.2 Test Interpretation*

*Inability to lift the eyelid manually might suggest cicatricial or*

*restrictive etiology.*

*88.3 Diagnosis*

*Involutional ectropion of the left lower eyelid with resultant*

*ocular irritation.*

*88.4 Medical Management*

*Mild involutional ectropion may be treated with artificial tears*

*or lubricating ointment. If the condition is progressive or if*

*symptoms are not alleviated with lubrication, then surgical management*

*is the definitive treatment.*

*88.5 Surgical Management*

*The correct type of ectropion must be diagnosed so that the*

*appropriate surgical procedure can be chosen. If a cicatricial*

*component exists, the anterior lamella of the lid must be vertically*

*elongated through the use of a free, full-thickness skin*

*graft. Paralytic ectropion is most commonly addressed using a*

*lateral tarsorrhaphy or medial or lateral canthoplasties.*

*The surgical treatment for involutional ectropion most commonly*

*employs one of several horizontal shortening procedures,*

*such as the lateral tarsal strip procedure or a fullthickness*

*wedge resection of the eyelid. If the ectropion is*

*primarily medial, the “lazy-T” procedure may be efficacious. This*

*procedure includes a full-thickness pentagonal wedge resection*

*immediately lateral to the lower lid punctum combined with an*

*elliptical excision of tarsal conjunctiva and retractors posterior to*

*the punctum (medial spindle procedure). If medial canthal laxity*

*comprises a significant contribution to the lid malposition, a*

*medial canthal plication may be performed.*

*88.6 Rehabilitation and Follow-up*

*The patient underwent a lateral tarsal strip procedure in*

*conjunction with a medial spindle procedure. The corrected*

*eyelid position ameliorated the patient’s symptoms of ocular*

*irritation.*

~~~~~CASE 89 Entropion~~~~~

*89 Entropion*

*Amina I. Malik*

*Abstract*

*Entropion is most commonly involutional due to (1) horizontal*

*laxity of the eyelid; (2) disinsertion or dehiscence of the lower*

*eyelid retractors; (3) overriding of the preseptal orbicularis;*

*and (4) relative enophthalmos of the globe due to atrophic*

*changes of the orbital soft tissues. Temporizing everting sutures*

*(Quickert-Rathbun sutures) may be used to effect immediate*

*relief of the patient’s discomfort. Surgical treatment involves*

*reinsertion of the lower eyelid retractors with lateral horizontal*

*eyelid-tightening surgery. Other causes of entropion include*

*spastic (from ocular irritation or lid edema), cicatricial (due to*

*vertical shortening of the posterior lamella of the eyelid) due to*

*Stevens–Johnson syndrome, cicatricial pemphigoid, or posttrauma*

*scarring after chemical or thermal burns. Treatment of*

*cicatricial entropion includes tarsal fracture with placement of*

*everting sutures for mild cases. More severe cases in which the*

*tarsus is severely scarred and distorted may require tarsal and*

*mucus membrane grafting. Available materials for grafting*

*include hard-palate mucosa, preserved scleral grafts, and autogenous*

*ear cartilage*

*Keywords: entropion, eyelid rotation*

*89.1 History*

*A 75-year-old woman presented with complaints of severe*

*right eye pain that has been progressively worsening for 2*

*years. The patient has discovered that she can alleviate her pain*

*if she manually retracts her right lower eyelid.*

*Examination shows “in-turning” of the right lower eyelid*

*causing the lashes to rub against the epibulbar surface*

*(▶Fig. 89.1). Moderate horizontal laxity of the lower lid is*

*present. With gentle downward traction on the right lower*

*eyelid, the lid margin can be restored to its normal position;*

*however, the in-turning recurs when the patient blinks.*

*Differential Diagnosis—Key Points*

*1. The patient has an entropion of the right lower eyelid.*

*Involutional entropion is the most common type of*

*entropion in this clinical setting. Age-related changes that*

*contribute to the development of the condition include the*

*following: (1) horizontal laxity of the eyelid; (2) disinsertion*

*or dehiscence of the lower eyelid retractors; (3) overriding*

*of the preseptal orbicularis; and (4) relative enophthalmos*

*of the globe due to atrophic changes of the orbital soft*

*tissues.*

*2. Other causes of entropion should be considered and ruled*

*out before proceeding with treatment. Ocular irritation or*

*lid edema may cause a temporary spastic entropion. This*

*condition occurs after intraocular surgery or other trauma*

*to the lid that produces edema of the periocular soft*

*tissues. The combination of lid edema, orbicularis spasm,*

*and underlying involutional changes can result in a spastic*

*entropion. The condition may improve once the underlying*

*cause of the edema is corrected; however, it may be*

*necessary to correct the involutional changes surgically via*

*Quickert-Rathbun sutures to evert the lid to its normal*

*anatomic position.*

*3. Cicatricial entropion occurs when there is vertical*

*shortening of the posterior lamella of the eyelid. This*

*condition may result from a variety of conditions including*

*Stevens–Johnson syndrome, cicatricial pemphigoid, or*

*posttrauma scarring after chemical or thermal burns. The*

*digital eversion test, or the ability to easily rotate the lid*

*margin to its normal position using downward traction on*

*the lid, allows the examiner to determine if a cicatricial*

*condition is present. The posterior tarsus should be*

*inspected for evidence of scarring or loss of the inferior*

*fornix. Treatment of cicatricial entropion includes tarsal*

*fracture with placement of everting sutures for mild cases.*

*More severe cases in which the tarsus is severely scarred*

*and distorted may require tarsal and mucus membrane*

*grafting. Available materials for grafting include hard-palate*

*mucosa, preserved scleral grafts, and autogenous ear*

*cartilage.*

*89.2 Test Interpretation*

*The lid was not restricted, suggesting involutional entropion.*

*89.3 Diagnosis*

*Involutional entropion of the right lower eyelid.*

*Fig. 89.1 Clinical appearance of lower lid entropion. Overriding of the*

*preseptal orbicularis can be seen.*

*Entropion*

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*89.4 Medical Management*

*Taping the lid may provide acute relief of the patient’s symptoms;*

*however, this is rarely satisfactory over the long term.*

*Lubricating drops and ointment should also be given to*

*improve the ocular irritation.*

*89.5 Surgical Management*

*Temporizing everting sutures (Quickert-Rathbun sutures) may*

*be used to effect immediate relief of the patient’s discomfort. To*

*achieve a more permanent correction, surgical management*

*directed toward the primary cause(s) of the entropion is indicated.*

*Horizontal tightening of the lid using a lateral tarsal strip*

*procedure will often satisfactorily correct the entropion. The*

*Wies procedure, in which a full-thickness horizontal incision is*

*used to create an adhesion between the anterior and posterior*

*lamellae of the lid, is another option. Lastly, direct repair of the*

*lower lid retractors can be performed through a skin–orbicularis*

*incision. This procedure may be combined with a horizontal*

*shortening procedure.*

*89.6 Rehabilitation and Follow-up*

*The patient underwent a Wies procedure of the lower eyelid*

*with satisfactory correction of the lid entropion. She experienced*

*no postoperative complications.*

~~~~~CASE 90 Trichiasis~~~~~

*90 Trichiasis*

*Amina I. Malik*

*Abstract*

*Trichiasis involves rubbing of eyelashes against the cornea. Most*

*commonly, this is due to lower eyelid entropion or aberrant*

*lashes present posterior to the gray line (distichiasis). In the*

*face of chronic prolonged inflammation, the meibomian glands*

*may undergo metaplastic transformation into hair follicles. This*

*transformation results in the presence of fine lashes emanating*

*from the previous meibomian gland orifices. This occurs commonly*

*when posterior lamellar scarring is present and may be*

*diffuse or segmental. Treatment includes epilation with forceps,*

*cryotherapy, electrolysis, or laser. Surgical options include eyelid*

*wedge excision, lash follicle excision, or entropion repair.*

*Keywords: trichiasis, entropion, distichiasis*

*90.1 History*

*A 64-year-old woman presented with complaints of chronic*

*irritation of the left eye that had been worsening over the last 2*

*years. There was no previous ocular history.*

*Ophthalmic examination was remarkable for an entropion of*

*the left lower eyelid (▶Fig. 90.1). The lid was easily returned to*

*its normal position using gentle manual downward pressure.*

*The tarsal conjunctiva showed mild erythema without evidence*

*of cicatricial changes, and the inferior fornix was deep without*

*symblepharon. When the lid was everted, a row of fine nonpigmented*

*lashes was noted posterior to the gray line. These*

*lashes were in contact with the epibulbar surface. Mild punctate*

*corneal changes were present inferiorly. The inferior bulbar*

*conjunctiva showed rose bengal staining in the areas associated*

*with the abnormal lashes. Diffuse thickening of the lid margin*

*was noted as well as the presence of fine telangiectatic vessels.*

*Scattered debris, including collarettes, were present on the*

*lashes of all four eyelids.*

*Differential Diagnosis—Key Points*

*1. This patient has ocular irritation due to two components.*

*The first is the eyelid malposition, or entropion of the lid.*

*The second component is the abnormal row of lashes*

*present posterior to the gray line. In the face of chronic*

*prolonged inflammation, the meibomian glands may*

*undergo metaplastic transformation to hair follicles. This*

*transformation results in the presence of fine lashes*

*emanating from the previous meibomian gland orifices, a*

*condition referred to as distichiasis. These abnormal lashes*

*may, in turn, rub the globe and cause trichiasis with ocular*

*irritation.*

*This occurs commonly when posterior lamellar scarring is*

*present and may be diffuse or segmental.*

*2. Ocular irritation may be produced by ocular surface*

*disorders such as Sjögren’s syndrome, blepharitis, or*

*meibomian gland dysfunction. Careful evaluation of the*

*ocular tear film should be performed including assessment*

*of the tear breakup time. Instituting a lid hygiene program,*

*frequent use of artificial tears, and consideration of punctal*

*occlusion may help these disorders.*

*90.2 Test Interpretation*

*Schirmer’s testing may provide some quantitative measurement*

*of tear production. The use of fluorescein and rose bengal*

*dye aids in the identification of abnormal dry areas of the epibulbar*

*surface.*

*90.3 Diagnosis*

*1. Trichiasis of the lower eyelid due to aberrant lashes*

*(distichiasis) and lower lid entropion.*

*2. Blepharitis and meibomian gland dysfunction of all four*

*eyelids.*

*90.4 Medical Management*

*Treatment of misdirected lashes may be challenging, and recurrence*

*is frequent regardless of the modality used. Until surgery*

*can be performed, lubricating drops and ointment should be*

*prescribed. If only a few abnormal lashes are present, simple*

*epilation may be performed. While this will effect immediate*

*relief of the patient’s symptoms, the lashes will almost always*

*recur within 3 months, and consideration of other treatments*

*is usually required:*

*● Electrolysis may be used for focal areas of trichiasis. The*

*recurrence rate is high, and extensive use of electrolysis may*

*result in scarring of the eyelid margin.*

*Fig. 90.1 Clinical photograph showing entropion of the left lower*

*eyelid with trichiasis.*

*Trichiasis*

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*● Cryotherapy is one of the more effective treatments for*

*trichiasis. It may be performed using a local infiltrative*

*anesthetic. A nitrous oxide probe is applied to the area of*

*aberrant lashes using a double freeze-thaw technique. The*

*concomitant use of a thermocoupler allows for monitoring of*

*the eyelid temperature and helps avoid overtreatment.*

*Bringing the eyelid tissues to –20 °C will effect ablation of the*

*hair follicle without damage to the surrounding tissues.*

*Complications include loss of skin pigmentation and eyelid*

*notching. If some of the aberrant lashes recur, the procedure*

*can be repeated.*

*● Argon laser ablation has been used to treat focal areas of*

*aberrant lashes. The laser is less effective than cryotherapy*

*but does not result in the posttreatment edema produced*

*after cryotherapy. This may be particularly important in*

*patients with existing inflammatory lid conditions such as*

*ocular cicatricial pemphigoid.*

*90.5 Surgical Management*

*The lower lid entropion may be surgically corrected as discussed*

*elsewhere.*

*Surgical management of trichiasis may be considered if the*

*lashes are grouped in one area of the eyelid and there is sufficient*

*horizontal laxity of the lid. Under these circumstances, a*

*full-thickness pentagonal wedge containing the area of aberrant*

*lashes may be excised. The lid defect is repaired in the standard*

*fashion, and a cantholysis can be performed to allow closure of*

*the defect without undue tension.*

*A lid-splitting procedure can also be used in which the lid is*

*split between the anterior and posterior lamella. The bulbs of*

*the hair follicles can then be identified within the tarsus and*

*removed, or the cryoprobe can be applied directly to the tarsal*

*plate.*

*90.6 Rehabilitation and Follow-up*

*The patient underwent a Wies procedure to correct the lower*

*eyelid entropion. At the same time, cryotherapy was applied to*

*the aberrant lashes. Postoperatively, the patient did well, with*

*only focal recurrence of the distichitic lashes. These were retreated*

*with additional cryotherapy in the office. A lid hygiene*

*program to address the patient’s blepharitis and meibomian*

*gland dysfunction was also instituted.*

~~~~~CASE 91 Dacryocystitis~~~~~

*91 Dacryocystitis*

*Amina I. Malik*

*Abstract*

*Dacryocystitis is an infection of the lacrimal sac due to blockage*

*in the nasolacrimal duct. Symptoms include tearing, pain, redness,*

*and swelling in medial canthal area. Diagnosis is clinical.*

*Treatment includes antibiotics and surgical drainage of lacrimal*

*sac abscess, followed by dacryocystorhinostomy surgery.*

*Keywords: dacryocystitis, epiphora, nasolacrimal duct obstruction,*

*lacrimal sac mass*

*91.1 History*

*A 44-year-old woman was referred for evaluation of tearing*

*and pain of the right lower eyelid medially. Her past medical*

*history was significant for lethal midline granuloma (midfacial*

*necrotizing lesion) for which she had undergone multiple procedures,*

*including removal of the nasal septum and frontoethmoidectomies.*

*She reported constant epiphora of the right eye*

*since the time of her surgeries and had more recently noted*

*intermittent redness of the right lower eyelid, associated with*

*tenderness and mucous discharge from the eye. She had been*

*previously treated with an unknown ophthalmic antibiotic drop.*

*Examination showed erythema of the right lower lid medially*

*with associated tenderness to palpation (▶Fig. 91.1). No definite*

*masses were palpated in the lacrimal sac region. There was*

*a whitish mucoid discharge expressed from the punctum upon*

*palpation of the lacrimal sac, and the conjunctiva was mildly*

*injected. The puncta of the right upper and lower eyelid were*

*present and appeared patent. There was a well-healed surgical*

*incision over the nose with residual distortion of the nasal*

*architecture. The remainder of the ophthalmic examination*

*was completely normal. Nasolacrimal irrigation was performed*

*and demonstrated complete obstruction of the distal nasal lacrimal*

*system. The upper system was patent as demonstrated by*

*the reflux of irrigating solution through the upper and lower*

*puncta. Inspection of the inner nose showed a large nasal defect*

*with an absent septum.*

*Differential Diagnosis—Key Points*

*Dacryocystitis, or inflammation of the lacrimal sac, may be*

*caused by a wide variety of disorders. The common*

*denominator is obstruction of the nasal lacrimal duct (NLD)*

*causing impaired drainage of tears from the lacrimal sac. The*

*affected patient will complain of epiphora, and repeated*

*episodes of dacryocystis may ensue due to the chronic stasis of*

*tears in the lacrimal sac and resultant infection.*

*1. Congenital NLD obstruction occurs in approximately 5% of*

*full-term newborns and may lead to acute dacryocystitis.*

*The cause is usually a thin residual mucosal membrane at*

*the lower end of the lacrimal duct causing impaired*

*drainage of tears.*

*2. In adults, acquired NLD obstruction more commonly occurs*

*at the junction of the lacrimal sac and the duct. Chronic*

*inflammation from adjacent sinus disease, viral infections,*

*autoimmune disorders, stones, and use of some*

*medications such as 5-fluorouracil or Phospholine Iodide*

*may contribute to the development of NLD obstruction. A*

*careful history to rule out previous facial or canalicular*

*trauma or surgery should be obtained. Rarely, tumors of the*

*lacrimal sac may produce epiphora and dacryocystitis. A*

*palpable mass within the lacrimal sac, particularly with*

*extension above the level of the medial canthal tendon,*

*should raise the suspicion of a neoplasm.*

*3. Preseptal cellulitis and orbital cellulitis may initially present*

*as a dacryocystitis. The infection may extend to involve the*

*periocular tissues both anterior and posterior to the orbital*

*septum. Preseptal and orbital cellulitis are discussed*

*elsewhere in the text.*

*91.2 Test Interpretation*

*Many authors recommend delaying NLD irrigation until the*

*acute infection has resolved, although gentle irrigation may be*

*safely performed if the infection does not appear too severe.*

*The presence of the obstruction should be demonstrated, and*

*the level of the obstruction (NLD, canalicular) must be determined.*

*Passage of the Bowman probe into the canaliculus and*

*sac will help distinguish the level of obstruction. Observation of*

*reflux through the upper and lower puncta signifies patency of*

*the upper lacrimal system. Failure of the irrigant to reach the*

*nose confirms the presence of an NLD obstruction.*

*Other tests that may be of use in evaluating the lacrimal system*

*include dacryocystography and scintigraphy. In dacryocystography,*

*radiopaque dye is injected into the canaliculi, and an*

*X-ray is subsequently obtained. If an obstruction is present, the*

*dye will be visualized remaining within the lacrimal sac. To*

*Fig. 91.1 Clinical appearance of patient with erythema and mild*

*edema of the right lower eyelid over the region of the lacrimal sac. The*

*previous surgical incision over the nose is visible.*

*Dacryocystitis*

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*perform dacryoscintigraphy, a drop containing a radioactive*

*marker is placed on the conjunctival surface, and sequential*

*scans are obtained. The passage of the marker into the canaliculi,*

*lacrimal sac, and duct can thus be documented. The*

*advantage of this latter test is that it more closely mimics physiologic*

*conditions and may demonstrate functional obstruction*

*of the lacrimal system when other testing methods have demonstrated*

*anatomic patency.*

*91.3 Diagnosis*

*Dacryocystitis, right side, secondary to disrupted NLD as a*

*result of the patient’s previous nasal surgery.*

*91.4 Medical Management*

*The acute infection should be treated with oral or intravenous*

*antibiotics, depending on the severity of the infection. If a pyocele*

*or abscess is present, aspiration may yield material for*

*smears and cultures to guide antibiotic therapy. The patient*

*should be instructed to apply warm compresses frequently to*

*the inflamed site. Addition of antibiotic ophthalmic drops is of*

*limited value and is usually not needed.*

*91.5 Surgical Management*

*Most patients with dacryocystitis will eventually require*

*dacryocystorhinostomy (DCR) to prevent further episodes of*

*infection. Surgery is best deferred until resolution of the infectious*

*process. In a few patients, however, medical management*

*will not totally resolve the infection, and a DCR will need to be*

*performed while active inflammation is still present.*

*91.6 Rehabilitation and Follow-up*

*The patient was treated with oral antibiotics resulting in rapid*

*resolution of the inflammation. She subsequently underwent a*

*DCR with placement of silicone tubing, with good resolution of*

*her epiphora. She continues under the care of her ear, nose, and*

*throat physician and oncologist for treatment of the lethal midline*

*disease.*

~~~~~CASE 92 Idiopathic Orbital Inflammation~~~~~

*92 Idiopathic Orbital Inflammation*

*Amina I. Malik*

*Abstract*

*Idiopathic orbital inflammation typically presents with acute*

*onset of pain and orbital signs. Differential diagnosis includes*

*infection, autoimmune diseases (sarcoidosis, rheumatoid*

*arthritis,Wegener’s granulomatosis) or thyroid-related orbitopathy.*

*Treatment is with high-dose corticosteroids with slow*

*taper, typically with a rapid response to the treatment.*

*Keywords: idiopathic orbital inflammation, orbital pseudotumor,*

*proptosis, chemosis, eye pain*

*92.1 History*

*A 63-year-old man presented with a 2-day history of left eye*

*pain and decreased vision. There was no previous history of*

*ophthalmic disease, surgery, or injury. His past medical history*

*was significant for poorly controlled hypertension. His review*

*of systems revealed no history of rheumatoid disease or collagen*

*vascular disease. There was no history of diabetes mellitus.*

*Examination showed best corrected vision of 20/20 OD and*

*20/400 OS. There was a 2 + relative afferent pupillary defect of*

*the left pupil. Marked periorbital edema and erythema with*

*3mm of left globe proptosis was noted. There was increased*

*resistance to retropulsion of the left globe. There was significant*

*motility deficit in all directions of gaze with associated pain.*

*The slit-lamp examination was notable for 3 + left conjunctival*

*injection with diffuse chemosis (▶Fig. 92.1). Dilated fundus*

*exam was notable for left diffuse choroidal thickening.*

*Differential Diagnosis—Key Points*

*1. This patient presents with signs and symptoms of diffuse*

*orbital inflammation of acute onset. Inflammatory*

*processes, either infectious or noninfectious, should be*

*strongly considered. The absence of known risk factors such*

*as history of sinus disease, diabetes mellitus, malignancy,*

*immunosuppressive therapy, or recent trauma lowers the*

*suspicion for an infectious process.*

*Idiopathic orbital inflammation may present in several forms:*

*acute anterior orbital inflammation in which the inflammatory*

*process primarily affects the globe, including the sclera,*

*Tenon’s capsule, and the immediate adjacent orbital*

*structures. The differential diagnosis includes a ruptured*

*dermoid cyst, acute hemorrhage into an orbital*

*lymphangioma, orbital cellulitis, leukemic infiltrate, and*

*collagen vascular disease. Idiopathic orbital inflammation may*

*also present as diffuse idiopathic orbital inflammation in which*

*the majority of the orbital structures are involved in the*

*inflammatory process. On occasion, the inflammation may be*

*confined primarily to one orbital structure; for example, an*

*orbital myositis may occur when an extraocular muscle is*

*preferentially affected, and dacryoadenitis may occur if the*

*orbital inflammation is centered in the lacrimal gland. These*

*latter patients present with eyelid edema, and a diffusely*

*enlarged, painful, lacrimal gland. The enlarged lacrimal gland*

*can be readily visualized by manually lifting the lid and*

*inspecting the superotemporal forniceal region. Other causes*

*of lacrimal gland enlargement include bacterial infections,*

*sarcoidosis, and lymphomatous infiltration of the gland.*

*2. Thyroid-related orbital inflammation must be considered in*

*any case of orbital inflammation with proptosis. A careful*

*medical history and review of symptoms will reveal a*

*concurrent history of thyroid disease or symptoms suggestive*

*of thyroid dysfunction such as heat/cold intolerance,*

*unexplained changes in body weight, or changes in body hair*

*or voice quality. The neck should be carefully palpated for*

*evidence of an enlarged thyroid gland. Orbital imaging will*

*show extraocular muscle enlargement with sparing of the*

*tendon insertions of the muscles. While thyroid-related*

*orbital inflammation is often asymmetric, there will usually be*

*radiographic evidence of bilateral disease.*

*3. Orbital inflammation may be a manifestation of systemic*

*collagen-vascular disease, such as polyarteritis nodosa or*

*Wegener’s granulomatosis. A review of systems will often*

*reveal a history of renal or pulmonary disease. Systemic*

*evaluation should include assessment of serum*

*antineutrophil cytoplasmic antibody including both the*

*cytoplasmic pattern and the perinuclear pattern (c-ANCA*

*and p-ANCA), rheumatoid factor, and ANA testing.*

*4. Unsuspected orbital infections may result in pronounced*

*signs of orbit inflammation. Most bacterial infections are*

*the result of penetrating trauma to the orbit. Fungal*

*infections may occur both in the setting of ocular trauma*

*and in immunosuppressed individuals such as patients with*

*diabetes mellitus or patients receiving chemotherapy.*

*Immunosuppressed patients may be susceptible to orbital*

*infections caused by Mucor or Aspergillus. Lastly, the possibility*

*of a retained orbital foreign body, with or without associated*

*infection, must be excluded. The clinical history is paramount*

*in guiding the subsequent evaluation and workup.*

*92.2 Test Interpretation*

*A magnetic resonance imaging (MRI) of the orbit, before and*

*after administration of gadolinium contrast material, was*

*obtained (▶Fig. 92.2). There was diffuse anterior orbital inflammation*

*with diffuse scleral thickening, especially posteriorly.*

*Inflammation of the adjacent tissues was noted. The choroidal*

*thickening seen on the funduscopic exam was well demonstrated.*

*There was no evidence of a discrete neoplastic process.*

*92.3 Diagnosis*

*Idiopathic orbital inflammation with associated scleritis and*

*secondary choroidal effusion.*

*Idiopathic Orbital Inflammation*

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*92.4 Medical Management*

*The patient was afebrile and the white blood cell count was*

*normal. Systemic evaluation revealed no evidence of collagenvascular*

*disease. Intravenous steroid treatment (methylprednisolone,*

*250mg every 6 hours) was instituted. Within 24 hours,*

*there was marked improvement in the orbital inflammation,*

*and the patient reported resolution of his pain. By 48 hours, the*

*vision in the left eye was 20/40, and the relative afferent pupil*

*defect had resolved. The patient was converted to oral prednisone*

*and discharged from the hospital. At subsequent followup*

*examination, his vision had returned to normal, and all of*

*the orbital inflammatory signs had resolved. A follow-up MRI*

*was obtained to rule out the possibility of inflammation masking*

*an underlying neoplastic process. The MRI was normal.*

*92.5 Surgical Management*

*In the current case, the patient’s orbital disease responded*

*promptly and dramatically to the institution of steroid therapy,*

*which is a hallmark of idiopathic orbital inflammation. If clinical*

*improvement had not been seen after 48 hours of steroid*

*treatment, orbital biopsy to obtain tissue for histopathologic*

*and microbiologic studies would have been indicated.*

*92.6 Rehabilitation and Follow-up*

*The patient was referred for systemic evaluation for collagenvascular*

*disease or lymphoma. All studies were negative, and*

*the patient did well as the oral steroid therapy was slowly*

*tapered. He has not experienced further episodes of orbital*

*inflammation.*

~~~~~CASE 93 Orbital Cellulitis~~~~~

*93 Orbital Cellulitis*

*Amina I. Malik*

*Abstract*

*Orbital cellulitis presents with eye pain, redness, chemosis,*

*proptosis, and limited extraocular motility. The most common*

*etiologies are ethmoid sinusitis or trauma to the eyelid. The differential*

*diagnosis includes idiopathic orbital inflammation,*

*preseptal cellulitis, or vascular malformation. Diagnosis is made*

*by examination and computed tomography (CT) scanning confirming*

*involvement beyond the orbital septum. Treatment*

*includes intravenous antibiotics. If orbital abscess is present,*

*surgical drainage may be indicated if vision is threatened.*

*Keywords: orbital cellulitis, proptosis, eye pain, chemosis*

*93.1 History*

*A 7-year-old boy was referred for evaluation and treatment of*

*right-sided eyelid swelling, pain, and fever. His symptoms*

*began 4 days prior to presentation. No definite complaint of*

*decreased vision was elicited. The presumptive diagnosis of*

*preseptal cellulitis had been made, and the patient had been*

*placed on oral antibiotics. Two days later, the child was reevaluated*

*and found to have progression of the right upper lid*

*edema, now causing a complete ptosis. Because of the disease*

*progression despite oral antibiotics, the patient was referred to*

*a tertiary care center.*

*Upon his arrival, it was noted that the child was somewhat*

*lethargic and continued to complain of pain around the right*

*eye. The patient’s temperature was 100 °F. There was marked*

*periorbital edema and erythema with complete ptosis of the*

*eyelid (▶Fig. 93.1). Enlarged preauricular and submandibular*

*lymph nodes were palpated. The eyelid was gently lifted to*

*allow for testing of the visual acuity, which was found to be 20/*

*25 OD and 20/20 OS. The conjunctiva appeared diffusely*

*injected, and there was decreased motility of the right globe in*

*all directions of gaze. No conjunctival discharge was noted. Mild*

*proptosis of the globe appeared to be present; however, the diffuse*

*lid edema and tenderness precluded formal exophthalmometry*

*measurements. The pupils reacted normally with no*

*relative afferent defect. The anterior segments were quiet, and*

*the dilated fundus exam showed no significant abnormalities.*

*Differential Diagnosis—Key Points*

*1. Preseptal cellulitis produces inflammation and infection of*

*the eyelids and periorbital tissues anterior to the orbital*

*septum. The condition most commonly results from*

*periocular trauma or a skin infection. Clinical findings*

*include marked erythema and edema of the eyelids and*

*periocular soft tissues. Conjunctival discharge and regional*

*lymphadenopathy may be present. The globe is not*

*involved, and pupillary function, visual acuity, and ocular*

*motility remain undisturbed. Conjunctival cultures should*

*be obtained, and treatment with oral antibiotics instituted.*

*If an abscess is present or develops during the course of the*

*disease, it may be surgically drained. Care must be taken to*

*avoid violating the orbital septum as this may allow seeding*

*of the deeper orbital structures by the infection. The most*

*common organism causing preseptal cellulitis is*

*Staphylococcus aureus, and use of a penicillinase-resistant*

*penicillin, such as oxacillin, results in prompt resolution of*

*the infection.*

*2. Orbital cellulitis results from inflammation and infection of*

*the orbital tissues posterior to the orbital septum. Orbital*

*cellulitis is most commonly caused by secondary extension*

*of acute or chronic bacterial sinusitis. Less commonly,*

*preseptal cellulitis, dacryocystitis, or dental infection may*

*progress to an orbital cellulitis. Clinical findings include the*

*changes associated with preseptal cellulitis including eyelid*

*edema and erythema. In addition, there is conjunctival*

*chemosis, ocular motility restriction, and pain with eye*

*movement. Decreased vision and pupillary abnormalities*

*may be present in severe cases. The patient may be febrile*

*and lethargic. Urgent radiographic imaging, preferably*

*computed tomography (CT) scan, is indicated to evaluate*

*the paranasal sinuses and the extent of the orbital disease.*

*The presence of a subperiosteal abscess may be an*

*indication for surgical drainage. Recent reports of successful*

*medical management of children with subperiosteal*

*abscesses have prompted reevaluation of the best*

*treatment protocol for these patients. It may be appropriate*

*to institute antibiotic therapy and observe the patient*

*carefully. Worsening of the visual acuity or ocular motility,*

*or failure to show clinical improvement after 48 hours of*

*treatment, is an indication to proceed with surgical drainage*

*of the subperiosteal abscess. This should be performed in*

*conjunction with an ear, nose, and throat (ENT) surgeon if*

*significant sinusitis is present. In children, orbital cellulitis is*

*commonly caused by a single microorganism (Streptococcus*

*sp or Haemophilus influenzae), whereas, in adults, multiple*

*organisms, including anaerobes, are often isolated. With the*

*advent of the H. influenzae type-B vaccine (HiB), there has*

*been a decreasing incidence of H. influenzae–associated*

*cases of orbital cellulitis in children.*

*Complications of orbital cellulitis can ensue if appropriate*

*evaluation and management are delayed. These include orbital*

*apex syndrome, blindness, brain abscess, cavernous sinus*

*thrombosis, and even death.*

*3. Infiltration of the orbit by leukemic cells or extraocular*

*extension of retinoblastoma may mimic an orbital cellulitis.*

*Appropriate radiographic imaging and a complete*

*ophthalmic examination, including dilated fundus exam,*

*must be performed in all patients with presumed orbital*

*cellulitis.*

*4. Idiopathic orbital inflammation can also present with pain,*

*swelling, and redness similar to orbital cellulitis. However*

*this is not associated with fever or any of the predisposing*

*factors seen with cellulitis.*

*Orbital Cellulitis*

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*93.2 Test Interpretation*

*A CT scan of the orbits and paranasal sinuses was obtained*

*emergently. The scan showed a large subperiosteal abscess in*

*the superomedial aspect of the right orbit. There was extensive*

*thickening of the ethmoid sinus mucosa consistent with sinusitis.*

*No bony abnormalities were present.*

*93.3 Diagnosis*

*Orbital cellulitis with associated sinusitis.*

*93.4 Medical Management*

*Systemic intravenous antibiotic treatment is indicated and*

*infectious disease consult may be helpful.*

*93.5 Surgical Management*

*Because the patient had failed to improve on previous therapy,*

*he was taken to the operating room where the large subperiosteal*

*orbital abscess was drained, and an ethmoidectomy was performed*

*by an ENT surgeon. Preoperative blood cultures obtained*

*and intraoperative cultures of the purulent material within the*

*abscess failed to reveal a causative organism. The patient was*

*treated with intravenous ceftriaxone and clindamycin on the recommendation*

*of the pediatric infectious disease consultation.*

*93.6 Rehabilitation and Follow-up*

*The patient showed marked improvement of his clinical findings,*

*and he remained afebrile. After 48 hours of intravenous antibiotics,*

*treatment was converted to oral antibiotics, and he was discharged.*

*Subsequent follow-up examination showed complete*

*resolution of the periorbital swelling and motility restriction.*

~~~~~CASE 94 Dacryoadenitis~~~~~

*94 Dacryoadenitis*

*Amina I. Malik*

*Abstract*

*Dacryoadenitis involves inflammation of the lacrimal gland that*

*typically presents with eye pain and fullness to the upper outer*

*aspect of the eyelid in area of the lacrimal gland. Etiology can*

*be infectious, idiopathic, or cancerous. Diagnosis involves clinical*

*exam and computed tomography (CT) showing lacrimal*

*gland enlargement. Treatment is with antibiotics if infectious*

*or steroids if inflammatory.*

*Keywords: dacryoadenitis, lacrimal gland mass, tearing*

*94.1 History*

*A 12-year-old boy presented with a 1-week history of swelling*

*of the left upper eyelid. The boy was otherwise healthy without*

*known chronic medical disease. On examination, there was*

*redness and fullness of the temporal aspect of the left upper lid*

*that created an “S-shaped” deformity of the eyelid (▶Fig. 94.1).*

*Manual elevation of the left upper eyelid revealed marked injection*

*and chemosis of the bulbar conjunctiva laterally with*

*enlargement and erythema of the palpebral lobe of the lacrimal*

*gland (▶Fig. 94.2). There was moderate tenderness over the*

*enlarged lacrimal gland. Mild enlargement of the regional*

*lymph nodes was also noted. The remainder of the ocular*

*examination, including motility, was normal. There was no evidence*

*of intraocular inflammation.*

*94.2 Test Interpretation*

*Computed tomography (CT) or magnetic resonance (MR) scan*

*of the orbit might show enlargement of the lacrimal gland or a*

*mass without any surrounding bony erosion or soft-tissue*

*invasion.*

*94.3 Diagnosis*

*Acute dacryoadenitis, presumably secondary to EBV infection.*

*Fig. 94.1 Clinical appearance showing “S-shaped” deformity of the left*

*upper eyelid. (Figure courtesy of Robert R. Waller, MD.)*

*Differential Diagnosis—Key Points*

*1. The clinical course and physical findings of inflammation*

*centered within the lacrimal gland strongly suggest acute*

*dacryoadenitis. Patients with acute dacryoadenitis typically*

*present with rapid enlargement and inflammation of the*

*lacrimal gland. The clinical examination reveals erythema*

*and edema of the temporal aspect of the upper eyelid as*

*well as the temporal aspect of the tarsal and bulbar*

*conjunctiva. Palpation of the superotemporal orbit shows*

*the lacrimal gland to be diffusely enlarged and tender.*

*Regional lymphadenopathy is often present.*

*Before the advent of widespread childhood immunization,*

*mumps represented the leading cause of acute dacryoadenitis.*

*More recent studies have demonstrated an association*

*between recent Epstein–Barr virus (EBV) infection and*

*episodes of dacryoadenitis. Up to one-third of patients with*

*clinical acute dacryoadenitis will have serologic evidence of*

*EBV infection. Antibodies to viral capsid antigen are detectable*

*with the onset of clinical symptoms about 6 weeks after*

*exposure. Viral capsid antigen IgM falls to low levels after*

*several weeks, while viral capsid antigen IgG will persist*

*indefinitely. Antibodies to EBV nuclear antigen increase a few*

*weeks after the onset of clinical infection and remain*

*detectable for years. Thus, the presence of antiviral*

*capsid antigen antibodies with absent or rising anti-EBV*

*nuclear antigen antibodies is diagnostic for recent EBV*

*infection.*

*2. Other infectious causes of acute dacryoadenitis have been*

*identified. These include staphylococcus, streptococcus,*

*and gonococcus. The presence of purulent discharge should*

*prompt cultures. Empiric antibiotic therapy, both topical*

*and systemic, may be instituted until culture results are*

*available to guide further therapy.*

*3. Idiopathic orbital inflammation may involve the lacrimal*

*gland preferentially, producing a clinical picture of acute*

*dacryoadenitis. While eyelid erythema and edema may*

*occur, additional orbital signs such as orbital pain,*

*restricted eye movement, and proptosis may also be*

*present.*

*4. Primary and secondary lacrimal gland tumors may also*

*cause enlargement of the lacrimal gland. Primary lacrimal*

*gland tumors include both epithelial and nonepithelial*

*lesions. The lacrimal gland may also be secondarily involved*

*by direct extension of a tumor from an adjacent orbital site,*

*or by hematogenous spread of a metastatic lesion. Lacrimal*

*gland tumors are discussed in detail elsewhere.*

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*94.4 Medical Management*

*In the present case, the clinical picture is highly characteristic*

*of acute dacryoadenitis, and the patient had no accompanying*

*orbital signs or symptoms. Serologic evaluation was positive for*

*anti-EBV capsid antigen antibodies and negative for antiviral*

*nuclear antigen antibodies, thereby establishing the diagnosis of*

*acute dacryoadenitis secondary to EBV infection. Management*

*may include anti-inflammatory therapy with topical or oral corticosteroid*

*medication, though the disease is self-limited.*

*94.5 Surgical Management*

*There is no proven role for surgical management of this*

*problem.*

*94.6 Rehabilitation and Follow-up*

*Follow-up for resolution of symptoms is reasonable.*

~~~~~CASE 95 Orbital Tumors of Childhood~~~~~

*95 Orbital Tumors of Childhood*

*Amina I. Malik*

*Abstract*

*The most common primary benign orbital tumors in children*

*are dermoids, epidermoids, and cystic lesions. Vascular tumors*

*such as capillary hemangiomas are also common tumors in*

*children. Neural tumors including optic nerve gliomas and neurofibromas*

*can also be seen in pediatric population. The most*

*common primary orbital malignant tumor is rhabdomyosarcoma.*

*Secondary tumors with orbital invasion can be seen with*

*neuroblastoma and metastasis can see with Ewing’s sarcoma or*

*osteosarcoma. Treatment is based on type of tumor.*

*Keywords: orbital tumors, pediatric tumors, eyelid swelling*

*95.1 History*

*An 8-month-old healthy boy presented for evaluation of a mass*

*over the right eye. The mass had been present since shortly*

*after birth, and the parents reported a slow continual enlargement*

*of the mass. The child was born at full-term after an*

*uncomplicated pregnancy. He was otherwise healthy with no*

*known medical problems. There was no associated change in*

*color or size of the mass with crying or Valsalva’s maneuvers.*

*Examination showed central fixation with following in each*

*eye. The rest of his ophthalmic exam was only notable for a*

*moderately firm mass over the superotemporal right eyelid*

*(▶Fig. 95.1). The mass measured approximately 20mm Å~*

*10mm Å~ 5mm and was fixed to the underlying tissues. The*

*overlying skin was intact without discoloration or ulceration.*

*Careful palpation of the superior orbital rim revealed no*

*discernable defect. There was no measureable proptosis, and*

*both orbits were normal to retropulsion. No other masses were*

*palpated.*

*Differential Diagnosis—Key Points*

*1. Orbital tumors in children, as in adults, may be subdivided*

*into primary tumors and secondary tumors. The most*

*common primary orbital tumors in children are dermoids,*

*epidermoids, and cystic lesions. These tumors are*

*considered to be choristomas, and are congenital with*

*variable age of presentation related to their slow growth.*

*Histologically, dermoids are cystic structures lined by*

*keratinized epithelium with adnexal structures, such as hair*

*follicles or sweat glands, contained within the cyst wall.*

*Epidermoid cysts have a similar histologic appearance except*

*that adnexal structures are not present. Dermoids most*

*commonly occur at the superotemporal orbital rim at the*

*zygomaticofrontal suture. Less commonly, they may be*

*present at the superonasal aspect of the orbit. While these*

*lesions are benign, they tend to slowly enlarge. They may also*

*rupture as the result of minor trauma to the area, inciting a*

*severe granulomatous inflammation of the surrounding*

*tissues. Therefore, it is recommended that these lesions be*

*excised surgically, making certain that the entire cyst wall and*

*its contents are removed.*

*2. Vascular lesions of the orbit also occur commonly in children.*

*The most common of these is the capillary hemangioma,*

*which may involve the eyelids or orbit. There is an associated*

*reddish discoloration of the overlying skin, and the size of the*

*lesion may enlarge with crying or Valsalva’s maneuvers.*

*Hemangiomas may be of sufficient size as to induce visually*

*significant astigmatism or obstruct the visual axis, with the*

*risk of developing amblyopia. Thus, although these tumors*

*are benign, the child should be followed carefully to check*

*for amblyopia. The natural history of these lesions is often*

*slow and spontaneous involution. If, however, the risk of*

*amblyopia is imminent, treatment may be required, including*

*surgery, systemic or intralesional steroids, and topical or*

*systemic beta-blocker therapy. Other modalities that have*

*been employed include radiotherapy, cryotherapy, and laser*

*(CO2, Nd:YAG, argon) ablation.*

*Lymphangioma is another vascular tumor that may involve the*

*orbit in children. These lesions may wax and wane in size and*

*may undergo rapid enlargement in association with upper*

*respiratory infections. They are also prone to spontaneous*

*hemorrhage, which can cause dramatic enlargement. If the*

*lesion involves the anterior orbit, a dark-colored cystic lesion*

*may be evident beneath the conjunctiva. Hemorrhage within a*

*deep orbital lymphangioma may produce sudden proptosis of*

*the affected globe. Lymphangiomas are typically poorly*

*circumscribed tumors that interdigitate with the surrounding*

*orbital structures, thereby precluding complete surgical*

*extirpation. They can, however, be surgically reduced by excising*

*a portion of the cyst wall and evacuating the hemorrhagic*

*material. This material has a characteristic dark-brown color,*

*giving rise to the clinical appearance of a “chocolate cyst.”*

*Fig. 95.1 Clinical photograph showing well-circumscribed mass in the*

*superotemporal right orbit. The overlying skin is intact.*

*Orbital Tumors of Childhood*

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*3. Neural tumors include optic nerve glioma and*

*neurofibroma. Both of these tumors occur with increasing*

*frequency in children with neurofibromatosis. Optic nerve*

*glioma may cause slowly progressive axial proptosis with*

*variable effects on the visual acuity and visual field.*

*Radiographically, these tumors create a characteristic*

*fusiform enlargement of the optic nerve. The appropriate*

*management of these tumors remains controversial. Careful*

*monitoring of vision and the degree of proptosis is*

*indicated. Periodic radiographic evaluation should also be*

*performed to evaluate for extension of the glioma into the*

*intracanalicular portion of the optic nerve. Surgical removal*

*of an optic nerve glioma involving the intracanalicular optic*

*nerve or threatening the optic chiasm may be indicated.*

*Plexiform neurofibromas of the eyelid and orbit are considered*

*pathognomonic for neurofibromatosis type 1. These tumors*

*may cause a mechanical ptosis of the eyelid as well as cosmetic*

*deformity, classically described as “S-shaped.” The lesion often*

*interdigitates with other eyelid structures, including the levator*

*aponeurosis, thereby making complete surgical extirpation*

*unfeasible. The surgical approach involves debulking the tumor*

*while maintaining as much function of the eyelid and eye as*

*possible.*

*4. Rhabdomyosarcoma should be included in the differential*

*diagnosis of a childhood orbital tumor. This tumor*

*represents the most common primary orbital malignancy of*

*childhood. Typically, these lesions will present with rapidly*

*progressive proptosis, and prompt radiographic evaluation*

*and surgical biopsy are indicated. Adequate tissue should be*

*obtained to allow for special testing, including*

*immunohistochemical studies and transmission electron*

*microscopy to demonstrate the presence of diagnostic cross*

*striations. Treatment must be coordinated with oncologists*

*and radiotherapists and usually includes radiotherapy and*

*chemotherapy.*

*5. Secondary tumors of the orbit include retinoblastoma with*

*extraocular extension into the orbit. Therefore, a complete*

*ophthalmic examination is mandatory in the evaluation of a*

*child with a suspected orbital tumor. Malignancies may also*

*metastasize to secondarily involve the orbit. In children,*

*neuroblastoma is the most common metastatic orbital*

*tumor, producing sudden proptosis, often associated with*

*ecchymosis, which may be bilateral. A thorough physical*

*examination may reveal a palpable abdominal mass.*

*Treatment may include a combination of surgery*

*chemotherapy and radiation. Despite treatment, the*

*prognosis for metastatic neuroblastoma is poor. Other*

*malignancies that may metastasize to the orbit in children*

*include Ewing’s sarcoma and osteosarcoma.*

*95.2 Test Interpretation*

*Computed tomography or magnetic resonance scan of the orbit*

*will better delineate the lesion.*

*95.3 Diagnosis*

*Dermoid cyst of the right orbit.*

*95.4 Medical Management*

*There is no medical treatment for this condition.*

*95.5 Surgical Management*

*As discussed previously, surgical removal of a dermoid cyst is*

*recommended due to the risk of traumatic rupture and resultant*

*inflammatory response. Some authors recommend delaying*

*surgery until the infant is at least 6 months old to decrease*

*the risk of anesthesia. In the current case, the tumor was*

*approached through a lid crease incision to allow for a cosmetically*

*acceptable inconspicuous scar. The lesion was dissected from*

*the surrounding tissues and completely excised (▶Fig. 95.2). The*

*patient has done well without further sequelae.*

~~~~~CASE 96 Orbital Tumors in Adults~~~~~

*96 Orbital Tumors in Adults*

*Amina I. Malik*

*Abstract*

*The most common orbital tumor is a cavernous hemangioma.*

*Orbital tumors typically present with painless progressive*

*proptosis. Other orbital signs such as chemosis, limited extraocular*

*motility, and resistance to retropulsion can be seen. Other*

*orbital neoplasms include lymphoid tumors, neural tumors,*

*vascular tumors, metastatic tumors, or lacrimal gland neoplasm.*

*Imaging is indicated to determine extent of tumor*

*involvement. Treatment depends on type of tumor and the clinical*

*presentation ranging from observation to surgical excision*

*with chemotherapy and/or radiation.*

*Keywords: orbital tumors, cancer, neoplasm, proptosis*

*96.1 History*

*A 44-year-old man was referred for evaluation of proptosis of*

*the left eye. The patient had no previous medical history. He*

*reported increasing painless prominence of the left eye without*

*associated diplopia. His glasses prescription had been changed*

*twice in the past year.*

*Examination showed visual acuity of 20/20 OU with a manifest*

*refraction of –2.25 D OD and + 1.00 D OS. Motility and pupil*

*examination were within normal limits. The palpebral fissure*

*was widened on the left side, and Hertel exophthalmometry*

*disclosed 4mm relative proptosis OS (▶Fig. 96.1). There was*

*increased resistance of the left globe to retropulsion OS. No*

*bony defects or definite masses were palpated. There was no*

*regional lymphadenopathy and no bruits were auscultated over*

*the orbits. The anterior segment was quiet by slit-lamp examination;*

*the bulbar conjunctiva was unremarkable without evidence*

*of abnormal vascularity. Dilated examination of the left*

*fundus revealed choroidal striae of the posterior pole. The optic*

*nerve was normal, and no hemorrhage or exudate was present.*

*The right fundus was normal.*

*Differential Diagnosis—Key Points*

*1. This patient presents with evidence of a mass lesion of the*

*left orbit, namely progressive proptosis and a decrease in his*

*myopic refractive error. Tumors may arise within the orbit*

*primarily, or they may involve the orbit secondarily.*

*Secondary orbital tumors may extend directly into the orbit*

*from adjacent structures such as paranasal sinuses, or*

*malignancies may metastasize to the orbit hematogenously*

*from a distant site.*

*The most common primary orbital tumor in adults is the*

*cavernous hemangioma. Patients are typically middle-aged*

*and present with painless proptosis. Radiographically,*

*cavernous hemangiomas are well-circumscribed, retrobulbar*

*lesions that may show irregular enhancement after injection of*

*contrast material. Ultrasound examination reveals medium to*

*high internal reflectivity. Because of the typical clinical and*

*radiographic appearance, biopsy is usually not required to*

*establish a diagnosis, and treatment is not required if the*

*proptosis is minimal and the patient is asymptomatic. If*

*treatment is indicated, the tumor can be removed in toto via a*

*medial or lateral orbital approach. Because the cavernous*

*hemangioma has limited communication with the systemic*

*circulation, preoperative arteriography is not indicated.*

*Histopathologically, these tumors are encapsulated and*

*contain numerous endothelial-lined vascular channels*

*containing red blood cells.*

*2. Hemangiopericytoma is another vascular orbital tumor that*

*arises in middle-aged adults. The tumor arises from*

*pericytes, and although it may radiographically and grossly*

*appear well circumscribed, hemangiopericytoma is an*

*infiltrative lesion that may produce proptosis, motility*

*abnormalities, or conjunctival prolapse. The treatment is*

*complete surgical extirpation. Local tumor recurrence may*

*occur and is not predictable based on the histopathologic*

*features of the lesion. Treatment of recurrent*

*hemangiopericytoma is problematic, and there is a risk of*

*malignant transformation. Surgical debulking procedures in*

*combination with radiation treatment have been employed*

*to treat tumor recurrences with mixed results.*

*3. Lymphoproliferative lesions of the orbit range from reactive*

*lymphoid hyperplasia to orbital lymphoma. These lesions*

*have a variety of clinical appearances, depending on the*

*exact orbital structures that are involved. Diagnosis usually*

*requires tissue biopsy with special studies (e.g.,*

*immunohistochemistry flow cytometry, gene*

*rearrangement studies) to determine the presence of a*

*clonal population of lymphocytes. Lymphoma may be*

*limited to the orbit or may involve the orbit as part of a*

*systemic process, so systemic workup in conjunction with*

*oncology is indicated. Treatment involves surgical debulking*

*with radiation.*

*4. Neural tumors that may involve the orbit in adults include*

*meningioma and schwannoma. Meningiomas may arise*

*from the optic nerve sheath and involve the orbit primarily.*

*More commonly, the meningioma arises intracranially and*

*extends to involve the orbit secondarily. Meningiomas*

*typically present in middle-aged women, with the clinical*

*findings determined by the tumor location. Primary*

*meningiomas of the optic nerve cause early visual*

*symptoms with axial proptosis. Computed tomography (CT)*

*imaging shows a diffusely thickened optic nerve that may*

*contain calcifications. Injection of contrast material may*

*give rise to the characteristic “railroad track” appearance of*

*the enlarged optic nerve sheath. In contrast, secondary*

*orbital meningiomas may have little effect on the vision until*

*the tumor has achieved significant size. If the tumor is arising*

*from the lateral portion of the sphenoid, the patient may*

*present with a temporal fossa mass in addition to proptosis.*

*Schwannomas, which are composed of proliferations of*

*Schwann cells, often arise from the sensory nerves of cranial*

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*nerve V, but may arise from any peripheral nerve sheath.*

*Orbital schwannomas are typically intraconal, wellcircumscribed*

*tumors, and multiple tumors may be present.*

*Symptoms and signs are determined by the tumor location.*

*Because of their encapsulation, schwannomas are amenable to*

*complete surgical removal.*

*5. Fibrous histiocytoma is the most common primary*

*mesenchymal orbital tumor in adults. These tumors*

*infiltrate the surrounding orbital structures, making them*

*difficult to remove completely. Fibrous histiocytomas may*

*be locally aggressive leading to frequent recurrences. There*

*are benign and malignant forms of fibrous histiocytoma,*

*and histopathologic study of the tumor is necessary for*

*accurate diagnosis. Cases of malignant transformation of a*

*previous benign tumor have also been reported.*

*6. Lacrimal gland tumors generally fall into two categories:*

*epithelial and nonepithelial. Within these two categories,*

*both benign and malignant variants exist. Of the*

*nonepithelial lesions, the vast majority are inflammatory*

*and may be infectious or noninfectious. Noninfectious*

*inflammatory entities include sarcoid, Wegener’s*

*granulomatosis, and orbital pseudotumor.*

*The most common epithelial neoplasm of the lacrimal gland is*

*the pleomorphic adenoma. Other epithelial tumors of the*

*lacrimal gland include adenoid cystic carcinoma, squamous*

*carcinoma, and mucoepidermoid carcinoma. Epithelial lacrimal*

*gland tumors present as a mass in the lacrimal fossa and*

*produce downward displacement and proptosis of the globe.*

*Bony erosion of the lacrimal fossa is often seen on CT scan. If*

*an epithelial lacrimal gland tumor is suspected preoperatively,*

*a lateral orbitotomy should be performed and the entire tumor*

*removed en bloc. Failure to preserve the surrounding capsule*

*results in an increased risk of recurrence and malignant*

*transformation. Malignant epithelial lacrimal gland tumors*

*have the capacity to metastasize widely and cause death.*

*7. A wide variety of visceral carcinomas as well as cutaneous*

*melanomas may involve the orbit secondarily by metastatic*

*spread. However, breast and lung carcinomas account for*

*the majority of orbital metastatic tumors. A previous history*

*of malignancy exists in 75% of patients presenting with*

*metastatic orbit disease. Thus, in 25% of patients, the orbital*

*tumor is the first manifestation of the patient’s malignancy.*

*In a patient with a previously established cancer diagnosis, a*

*fine-needle aspiration biopsy may be performed to confirm*

*the orbit diagnosis before the patient proceeds with*

*therapy. Some orbital lesions may not be amenable to fineneedle*

*biopsy; this is particularly true for fibrotic tumors,*

*such as scirrhous breast carcinoma or tumors that are*

*posteriorly located in the orbit adjacent to the optic nerve.*

*96.2 Test Interpretation*

*An orbital CT scan demonstrated a well-circumscribed retrobulbar*

*tumor pressing on the posterior aspect of the globe*

*(▶Fig. 96.2). There were no associated bony changes, and*

*the tumor showed only marginal enhancement with contrast*

*material.*

*96.3 Diagnosis*

*Probable cavernous hemangioma of the left orbit.*

*96.4 Medical Management*

*There is no medical treatment for this condition.*

*96.5 Surgical Management*

*Because of the patient’s progressive proptosis and changing*

*refractive error, surgical excision was recommended. A lateral*

*orbitotomy was performed and a dark-red encapsulated tumor*

*was removed in toto (▶Fig. 96.3). Histopathologic evaluation*

*confirmed the diagnosis of cavernous hemangioma.*

*Fig. 96.1 Clinical photograph showing proptosis of the left eye.*

*Fig. 96.2 CT scan demonstrating the well-circumscribed retrobulbar*

*tumor in the left orbit. The mass is pressing on the posterior aspect of*

*the left eye.*

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*96.6 Rehabilitation and Follow-up*

*The patient did well postoperatively. The refractive error in his*

*left eye stabilized at –2.00 D, and the choroidal striae in the left*

*eye slowly resolved.*

~~~~~CASE 97 Benign Tumors of the Eyelid~~~~~

*97 Benign Tumors of the Eyelid*

*Amina I. Malik*

*Abstract*

*Benign eyelid tumors are characterized by very slow growth*

*over many years and a lack of skin ulceration, scaling, madarosis,*

*or telangiectasia. These tumors include nevi, seborrheic keratosis,*

*actinic keratosis, and squamous papillomas. Adnexal*

*structures of eyelid can also give rise to benign eyelid tumors*

*including syringoma, hidrocystoma, and pilomatrixoma. The lesion*

*may be observed, or it may be surgically excised. In most*

*cases, the procedure can be performed as an office procedure*

*using a local anesthetic. The resulting small defect can be*

*repaired primarily or allowed to heal by secondary intention.*

*Keywords: eyelid tumor, swelling of eyelid, eyelid neoplasm*

*97.1 History*

*A 32-year-old man presented for evaluation of a left upper eyelid*

*lesion that had been present for several years and that had*

*been slowly enlarging for last several months. He reported no*

*associated redness or bleeding from the lesion and there was*

*no history of previous skin disease or skin cancer. He was in*

*good health and took no medications. His ophthalmic examination*

*was within normal limits with the exception of the external*

*exam. There was a 10mm Å~ 8mm Å~ 5mm smooth domeshaped*

*skin lesion involving the preseptal eyelid skin of the left*

*upper lid (▶Fig. 97.1). The tumor was amelanotic, and the overlying*

*skin was intact without ulceration or telangiectasia. There*

*was no regional lymphadenopathy and no other skin lesions*

*were present on the head and neck region.*

*Differential Diagnosis—Key Points*

*1. The very slow growth over many years and the lack of skin*

*ulceration, scaling, madarosis, or telangiectasia support the*

*benign nature of this tumor. Nevi are melanocytic lesions*

*that may appear pigmented or amelanotic, and they are*

*among the most common benign eyelid tumors.*

*Histopathologically nevi are divided into three categories,*

*depending on the depth of the nevus cells. In junctional*

*nevi, the nevus cells are grouped at the epidermal–dermal*

*junction. As some of the nevus cells drop into the deeper*

*dermis, the lesion is categorized as a compound nevus.*

*Lastly, when all of the nevus cells are present in the dermis,*

*the term intradermal nevus is employed. Nevi are most likely*

*present at birth and may acquire melanin pigment over*

*time, particularly in association with puberty. They may also*

*display slow growth over time. Nevi frequently occur at or*

*near the eyelid margin, but do not cause loss of cilia or*

*significant distortion of the eyelid architecture. Changes in*

*pigmentation of the lesion may raise the concern of*

*possible melanoma, or nevi may cause cosmetic concerns*

*due to their location on the eyelid or eyelid margin. Nevi are*

*amenable to an excisional biopsy or shave biopsy, and the*

*specimen should be submitted for histopathologic*

*evaluation to confirm the clinical diagnosis.*

*2. Benign epithelial lesions occur often on the eyelid and*

*should be considered in the differential diagnosis. Squamous*

*papilloma appears as a well-circumscribed nonpigmented*

*lesion on the eyelid or eyelid margin. In contrast to the*

*smooth surface of an intradermal nevus, the papilloma has*

*an irregular frondlike surface. Examination of the lesion*

*under magnification at the slit lamp will usually reveal small*

*pinpoint vessels at the tip of each frond.*

*Histopathologically, papillomas are composed of thickened,*

*or acanthotic, epidermis, overlying numerous fibrovascular*

*cores. The normal maturation pattern of the epidermis is*

*not disturbed.*

*Seborrheic keratosis is another common benign tumor that*

*affects sun-exposed skin including the eyelids. These lesions*

*may be appear variably pigmented and have an oily crusty*

*appearance. The lesions are sessile and appear to “sit” on the*

*epidermal surface. Histopathologically, acanthosis,*

*hyperkeratosis, and papillomatosis are present. Additionally,*

*pseudohorn cysts, representing infoldings of the epidermis,*

*are frequently observed.*

*Inverted follicular keratosis is considered by most pathologists*

*to represent an inflamed variant of seborrheic keratosis. These*

*lesions may display exuberant hyperkeratosis creating a*

*cutaneous horn. At the base of the lesion, the acanthotic*

*epithelium contains numerous whorls of keratin, referred to as*

*squamoid eddies.*

*Actinic keratosis appears as reddish flat, slightly scaly lesions*

*on sun-exposed skin of the face, including the eyelids.*

*Histopathologically, they display hyperkeratosis and*

*parakeratosis, or abnormal retention of squamous cell nuclei in*

*the surface keratin. Additionally, there is disruption of the*

*normal orderly maturation pattern of the epidermis, and*

*increased mitotic activity is present. Actinic keratoses are*

*considered premalignant lesions, meaning that if left*

*untreated, they may transform to a squamous cell carcinoma.*

*Complete surgical excision is therefore indicated.*

*Keratoacanthomas may display relatively rapid growth and*

*display a keratin-filled central crater surrounded by an elevated*

*thickened epidermal margin. These lesions are often selflimited*

*with spontaneous involution after 4 to 6 weeks.*

*Keratoacanthomas arise from pilosebaceous glands and closely*

*resembles squamous cell carcinoma.5 Some arguments*

*support classifying keratoacanthoma as a variant of invasive*

*squamous cell carcinoma. Surgical excision is indicated for*

*histologic confirmation or for cosmetic concerns.*

*Epithelium may proliferate beneath the skin surface where it*

*may form epidermal inclusion cysts. These cysts grow slowly*

*and form a firm subcutaneous nodule, appearing whitishyellow*

*clinically. Epidermal inclusion cysts may arise from the*

*infundibulum of the hair follicle or from entrapped epithelial*

*rests that become implanted during minor trauma.*

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*Histologically, the cysts are lined by stratified squamous*

*epithelium and are filled with keratin debris.*

*3. The adnexal structures of the skin may give rise to a number*

*of benign eyelid tumors. Of these lesions, syringomas,*

*arising from the sweat glands, are the most common.*

*Clinically, these tumors appear as multiple yellowish*

*papules. Histologically, numerous proliferating ductal*

*structures, lined by a double row of cuboidal epithelium, are*

*present. Some of the ductal structures have a characteristic*

*“comma” shape, and there may be extensive fibrosis of the*

*surrounding stroma.*

*Hidrocystomas may arise from either eccrine or apocrine sweat*

*glands and appear as translucent cysts beneath the skin*

*surface. Eccrine hidrocystomas frequently appear as multiple*

*small cysts, whereas the apocrine hidrocystoma is most often a*

*solitary nodule. Hidrocystomas occur most commonly at the*

*lateral canthus or are associated with the eyelid margin.*

*Pilomatrixoma is a tumor that occurs more frequently in*

*children or young adults. The lesion has a reddish-blue color,*

*and there may be a history of minor trauma to the area.*

*Microscopically, the tumor is composed of islands of basophilic*

*cells with interposed “shadow” cells. Areas of dystrophic*

*calcification are scattered throughout the lesion, and*

*associated granulomatous inflammation is often present.*

*97.2 Test Interpretation*

*The morphologic appearance of the lesion is usually characteristic,*

*but tissue diagnosis by pathologic examination is recommended*

*in suspicious cases.*

*97.3 Diagnosis*

*Benign eyelid tumor, most likely intradermal nevus.*

*97.4 Medical Management*

*There is no medical treatment for this condition.*

*97.5 Surgical Management*

*Because of the apparent benign nature of the tumor, no further*

*ancillary testing is indicated. The lesion may be observed, or it*

*may be surgically excised. In most cases, the procedure can be*

*performed as an office procedure using a local anesthetic. The*

*resulting small defect can be repaired primarily or allowed to*

*heal by secondary intention. Care must be taken not to create*

*distortion of the eyelid margin or significant shortening of the*

*anterior lamella of the eyelid. Any excised specimen should be*

*sent for histopathologic confirmation.*

*97.6 Rehabilitation and Follow-up*

*The patient underwent excisional biopsy of the upper eyelid lesion,*

*and histopathologic examination of the specimen confirmed*

*the diagnosis of intradermal nevus (▶Fig. 97.2). The*

*patient has done well without evidence of recurrence.*

~~~~~CASE 98 Malignant Tumors of the Eyelid~~~~~

*98 Malignant Tumors of the Eyelid*

*Amina I. Malik*

*Abstract*

*Malignant eyelid tumors can present with skin ulceration,*

*telangiectasias, madarosis, and asymmetry in growth. The most*

*common eyelid malignancy is basal cell cancer, typically on the*

*lower eyelid. Other eyelid malignancies include squamous cell*

*cancer, sebaceous cell cancer, and melanoma. Wide surgical*

*excision of the tumor is indicated once the diagnosis is established.*

*Because sebaceous gland carcinoma can metastasize*

*widely, a complete metastatic evaluation should also be*

*obtained. Incomplete excision will leave the patient at risk for*

*local recurrence as well as metastatic dissemination. Radiation*

*treatment has been employed for palliative therapy but is not*

*effective as a primary treatment modality.*

*Keywords: malignant eyelid tumors, eyelid swelling, eyelid cancer,*

*skin cancer*

*98.1 History*

*A 55-year-old man presented for evaluation of an enlarging skin*

*nodule of his right upper eyelid. The lesion had been present*

*for approximately 8 months and had grown fairly rapidly. The*

*patient recalled one episode of bleeding from the area after he*

*had picked at the lesion.While there was no previous history of*

*skin cancer, the patient reported an extensive sun-exposure*

*history. His ophthalmic examination was within normal limits*

*except for the external examination. There was a large elevated*

*nonpigmented nodule involving the skin of the right upper eyelid*

*near the medial canthal region (▶Fig. 98.1). The nodule*

*measured 15mm Å~ 12mm Å~ 7mm and showed numerous*

*small telangiectatic vessels on its surface. The edges of the*

*tumor had a thickened pearly appearance. There was no ulceration*

*present. The skin underlying the lesion was freely moveable,*

*and the tumor did not appear fixed to the underlying deep*

*structures. There was no regional lymphadenopathy. The skin*

*of the patient’s face showed diffuse sun-exposure changes consisting*

*of fine wrinkles and telangiectatic vessels and scattered*

*areas of crusting.*

*Differential Diagnosis—Key Points*

*1. The relative rapid growth of this lesion, the history of*

*previous bleeding, and the clinical features suggest a*

*malignant tumor. Basal cell carcinoma is the most common*

*malignancy of the eyelid and most commonly involves the*

*lower eyelid and the medial canthal region. Risk factors for*

*basal cell carcinoma include fair skin, northern European*

*ancestry, history of extensive sun exposure, or history of*

*previous basal cell carcinoma. Patients with a family history*

*of skin cancer may be at an increased risk for developing*

*basal cell carcinoma.*

*Clinically, basal cell carcinomas are categorized as nodular,*

*nodular-ulcerative, or morpheaform. Microscopically, basal cell*

*carcinomas are composed of nests and cords of proliferating*

*epidermal basilar cells. Palisading nests of the nuclei at the*

*periphery is a characteristic feature. In the morpheaform*

*variant, the tumor nests invade the deep dermis and are*

*associated with a marked stromal fibrosis.*

*The treatment for basal cell carcinoma is complete surgical*

*extirpation of the tumor. The lesion should be excised with a*

*margin of uninvolved adjacent tissue, and the free margins*

*should be confirmed pathologically. Reconstruction should*

*ensue only after complete removal of the malignancy is*

*verified. On occasion, the basal cell carcinoma may be very*

*extensive and involve deep vital structures such that complete*

*removal is not possible. In such cases, radiation therapy and*

*chemotherapy have been employed after surgical debulking of*

*the tumor.*

*2. The second most common malignancy of the eyelid is*

*squamous cell carcinoma. The ratio of basal cell carcinoma*

*to squamous cell carcinoma frequency is approximately 40*

*to 1. In contrast to basal cell carcinoma, squamous cell*

*carcinoma more frequently involves the upper eyelid and*

*behaves more aggressively. The tumor may have an*

*ulcerative appearance and may show crusting or*

*hyperkeratosis. Squamous cell carcinoma may invade*

*adjacent structures such as the orbit or lacrimal drainage*

*system and may metastasize to regional lymph nodes or*

*spread hematogenously to distant sites. Squamous cell*

*carcinoma can also undergo perineural spread, leading to*

*cranial nerve palsies.*

*As with basal cell carcinoma, the treatment for squamous cell*

*carcinoma is complete surgical removal. A wide margin of*

*uninvolved tissues should be obtained. There is a higher*

*recurrence rate for squamous cell carcinoma as compared to*

*basal cell carcinoma. If there is orbital invasion, exenteration*

*may be required to achieve complete removal of the tumor.*

*Fig. 98.1 Clinical photograph showing nonpigmented elevated lesion*

*over the medial canthal region. There is irregular crusting over the*

*surface of the lesion.*

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*3. Sebaceous carcinoma accounts for less than 0.8% of eyelid*

*tumors; however, its protean clinical appearance causes this*

*entity to be frequently confused with inflammatory lesions*

*or other eyelid disorders, thereby delaying correct diagnosis*

*and appropriate treatment. Sebaceous carcinoma arises*

*from the meibomian glands or, less frequently, from the*

*glands of Zeiss. It may also arise from sebaceous units*

*within the caruncle or eyebrow. Patients are usually over 50*

*years old, and the tumor may masquerade as a chalazion,*

*chronic blepharitis, ocular cicatricial pemphigoid, basal cell*

*carcinoma, or squamous carcinoma. Therefore, the clinician*

*should maintain a high level of suspicion for possible*

*sebaceous carcinoma in an older patient with a recurrent*

*chalazion or chronic unilateral blepharitis that is refractory*

*to treatment.*

*Biopsies of suspicious lesions should be sent to the pathology*

*laboratory with a request for special lipid stains. These include*

*oil red O and Sudan black stains and must be performed on*

*frozen tissue, because routine processing of the tissue will*

*dissolve any lipid that is present. Good communication*

*between the clinician and the pathologist is therefore of*

*paramount importance. Because many general pathologists*

*lack familiarity with this entity, the clinician should not hesitate*

*to seek outside consultation if there is a high clinical suspicion*

*of sebaceous gland carcinoma.*

*Wide surgical excision of the tumor is indicated once the*

*diagnosis is established. Because sebaceous gland carcinoma*

*can metastasize widely, a complete metastatic evaluation*

*should also be obtained. Incomplete excision will leave the*

*patient at risk for local recurrence as well as metastatic*

*dissemination. Radiation treatment has been employed for*

*palliative therapy but is not effective as a primary treatment*

*modality.*

*4. Malignant melanoma may arise in the eyelid, just as it may*

*occur in the skin or mucus membranes throughout the*

*body. Cutaneous melanomas may be subclassified as lentigo*

*maligna, superficial spreading melanoma, and nodular*

*melanoma. The nodular melanoma is the most common*

*type affecting the eyelid and has a more aggressive clinical*

*course. The eyelid can be secondarily involved from primary*

*melanoma arising in the conjunctiva or by metastasis of*

*melanoma from other sites.*

*The treatment for cutaneous melanoma is wide surgical*

*excision with microscopic verification of clear margins. The*

*finding of lymphatic or vascular invasion on microscopic*

*evaluation should prompt referral for possible regional lymph*

*node dissection. As with cutaneous melanomas arising*

*elsewhere, an invasion depth of greater than 1.5mm portends*

*a higher risk for recurrence and the development of metastatic*

*disease.*

*98.2 Test Interpretation*

*Morphologic appearance is suspicious, but tissue diagnosis is*

*required for confirmation of malignancy.*

*98.3 Diagnosis*

*Lesion of the right upper eyelid (medial canthal region); probable*

*basal cell carcinoma.*

*98.4 Medical Management*

*Imiquimod and 5-fluorouracil are FDA-approved topical creams*

*used for superficial basal cell carcinomas. These are applied to*

*the lesions for up to 6 weeks or longer and have shown cure*

*rates up to 80%. Vismodegib can be taken orally for rare cases of*

*metastatic basal cell carcinoma or locally advanced basal cell*

*carcinoma. This medicine works by blocking the “hedgehog”*

*signaling pathway, which is a key step in the development of*

*basal cell carcinoma. Vismodegib is approved only for very limited*

*circumstances where the nature of the cancer precludes*

*other treatment options (such as surgery or radiation). Sonidegib,*

*a second oral hedgehog inhibitor drug, was approved by*

*the FDA in 2015 for patients with locally advanced basal cell*

*carcinomas, specifically patients whose tumors have recurred*

*following surgery or radiation therapy, or who are not candidates*

*for surgery or radiation therapy.*

*98.5 Surgical Management*

*Ancillary testing is not indicated prior to establishing the diagnosis*

*by incisional or excisional biopsy. Once the diagnosis is*

*known, patients with sebaceous carcinoma or cutaneous melanoma*

*should undergo a complete metastatic evaluation. This is*

*usually conducted under the supervision of an oncologist. If*

*complete removal of the tumor will require extensive reconstructive*

*procedures, an incisional biopsy can be performed*

*first to correctly establish the diagnosis. Small lesions, however,*

*may be removed in toto at the time of initial biopsy. Many surgeons*

*advocate the use of cryotherapy to the margins of the*

*resulting defect to decrease the risk of tumor recurrence.*

*Reconstruction procedures are dictated by the size and location*

*of the defect once clear surgical margins have been verified.*

*The current patient underwent excisional biopsy of the lesion*

*due to the high clinical suspicion of basal cell carcinoma. Intraoperative*

*frozen section analysis confirmed the diagnosis of*

*basal cell carcinoma with free surgical margins (▶Fig. 98.2).*

*Fig. 98.2 Histopathology of the tumor showing a nodular basal cell*

*carcinoma. The nuclear palisading around the periphery of the nests is*

*apparent (H&E; original magnification Å~ 13.2).*

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*Because of the location of the defect, a full-thickness skin graft*

*was used to repair the defect to avoid creating lagophthalmos*

*or webbing of the medial canthal region.*

*98.6 Rehabilitation and Follow-up*

*The patient did well postoperatively with a satisfactory functional*

*and cosmetic result. He has been educated about his*

*increased risk for the development of new skin malignancies and*

*is under the care of a dermatologist for continued surveillance.*