63. The cat with abnormal iris appearance

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KEY SIGNS

- Abnormal iris shape.
- Abnormal iris coloration.

MECHANISM?

- Inflammatory processes, either idiopathic or associated with infectious agents, are the most common cause of changed iris appearance. Neoplasia, immune-mediated inflammation and degeneration are less frequent mechanisms for change.

WHERE?

- Iris.
- Other organ systems.

WHAT?

- Most diseases which alter iris appearance are inflammatory associated with infectious agents such as FIP, FIV, FeLV and *Toxoplasma*, or are idiopathic. Iris neoplasia from melanoma or lymphosarcoma are less common. Iris atrophy associated with age-related degeneration is common in old cats.

QUICK REFERENCE SUMMARY

Diseases causing abnormal iris appearance

DEGENERATIVE

- **Iris atrophy* (p 1299)**

Thinning of the iris with loss of normal iris color. Loss of normal pupillary constrictor function resulting in sluggish pupil light reflex in an old cat.

ANOMALY

- Iris coloboma (p 1304)

Notch-like or sectorial defect in structure of the iris. Unusual.

- Persistent pupillary membranes (p 1304)

Small strand-like structures going from one part of the iris collarette to another, to the anterior lens capsule or to the posterior corneal surface. Rare.

- Iris cyst (p 1305)

Small brown to black cyst-like structures commonly found at the pupil margin which may become more obvious with pupil dilation. May be semi-transparent.

METABOLIC

- **Pre-iridal fibrovascular membranes* (p 1303)**

New vessels growing across the anterior surface of the iris giving the iris a pink injected appearance. An intra-ocular neoplasm, a retinal detachment or signs of chronic inflammation may be evident. There may be secondary hyphema or glaucoma.

NEOPLASTIC

- **Iris neoplasia*** (p 1297)**

Diffuse iris melanoma appears as a brown to light tan discoloration, which is rapidly progressive over the iris surface over weeks to months. It usually occurs in older cats, and is usually unilateral. Lymphosarcoma appears as bilateral iris swelling, and anterior chamber hemorrhage, in a young cat with or without other signs suggesting a multicentric location. Ciliary body adenoma is rare, and appears as a slow-growing whitish to cream mass behind the pupil margin. Metastatic neoplasia from an extra-ocular primary tumor is an intra-ocular neoplasm involving the iris, and is associated with a similar neoplasm remote from the eye, e.g. mammary or uterine adenocarcinoma.

INFECTIOUS

Viral:

- **Feline leukemia virus (FeLV)** (p 1300)**

Signs of anterior uveitis such as blood, fibrin or cloudiness in the anterior chamber, miosis, or general reddening or thickening of the iris in a FeLV-positive cat. Bilateral iris swelling from lymphosarcoma may be present.

- **Feline immunodeficiency virus (FIV)** (p 1302)**

Signs of anterior uveitis such as blood, fibrin or cloudiness in the anterior chamber, miosis, or general reddening or thickening of the iris and/or swelling associated with lymphosarcoma in a FIV-positive cat.

- **Feline infectious peritonitis (FIP) virus*** (p 1295)**

Severe anterior fibrinous uveitis, usually bilateral, in a young cat. Other signs of FIP such as anorexia, weight loss, depression, pyrexia, abdominal or chest effusions and/or multifocal neurological disease.

Bacterial:

- *Bartonella henselae* (cat-scratch fever) (p 1305)

Typically, naturally infected cats only develop subclinical disease, although anterior uveitis has been reported.

Protozoal:

- ***Toxoplasma gondii**** (p 1296)**

Signs may be acute, or chronic and intermittent. Fever, lethargy and anorexia with various combinations of respiratory, hepatic, ocular and neurological signs.

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Fungal:

- **Fungal infections (*Cryptococcus neoformans*, blastomycosis, coccidioidomycosis, *Histoplasma capsulatum*)** (p 1302)**

Fever, depression, anorexia and weight loss combined with signs of other organ disease such as involvement of lung, liver, bone marrow, lymph nodes, CNS and/or eyes. Typically there is chorioretinitis progressing to anterior uveitis and endophthalmitis associated with positive serological evidence of an infectious cause, or identification of an organism in anterior chamber fluid. Fungal uveitis has a geographic distribution.

Parasitic:

- Cuterebra larval migration (ophthalmomyiasis) (p 1305)

Vision loss, poor PLR and characteristic track-like lesions in the tapetal fundus, with or without anterior uveitis.

- Ocular dirofilariasis (p 1305)

Uveitis occurs associated with presence of adult filaria in the eye. Rare.

Immune:

- **Lymphocytic-plasmacytic uveitis*** (p 1302)**

Chronic gray to slightly tan nodules in the anterior stromal surface of the iris.

Idiopathic:

- **Idiopathic uveitis*** (p 1302)**

Uveitis in a cat where extensive investigation does not reveal a possible etiology.

Trauma:

- **Penetrating injuries to the iris**** (p 1299)**

Changes may occur in the iris appearance associated with trauma, including fibrinous adhesions to adjacent structures, tears in the iris proper or iris prolapse through the outer ocular coats, i.e. the cornea and sclera. Penetrating foreign bodies may or may not be obvious.

INTRODUCTION

MECHANISM?

The most common cause of changed iris appearance is inflammation, most commonly associated with infectious agents, although inflammation secondary to neoplasia and immune-mediated disease may also occur.

Important pathophysiologic processes involved in iris inflammation (anterior uveitis) include breakdown of the blood–aqueous barrier associated with increased vessel permeability, release of chemical mediators following tissue damage, and chemotaxis of polymorphonuclear and mononuclear leukocytes.

The most important chemical mediators are probably the **arachidonic acid derivatives** released from damaged cell membranes, which then participate in the cyclo-oxygenase and the lipoxygenase pathways. Prostaglandins produced by the cyclo-oxygenase pathway are regarded as the most important chemical mediators. Oxygen free radicals may also be important.

While most types of immunologic responses are thought to occur in the eye, types II (antibody-mediated cytotoxic responses), III (immune-complex deposition and complement activation) and IV (cell-mediated cytotoxic responses) are thought to be the most important. Monocytes and macrophages are important in

phagocytosis, antigen processing and presentation to T cells.

Immune-mediated responses to retinal or lens antigens may be important in immune-mediated uveitis where no infectious cause is identified.

Some neoplastic diseases, e.g. intra-ocular lymphosarcoma can look very inflammatory, whereas others (e.g. diffuse iris melanoma) tend to cause gross pigment changes without necessarily causing an inflammatory response until the disease becomes very advanced.

Changes which can be seen in association with inflammation of the iris (anterior uveitis) include:

- **Generalized reddening** (hyperemia) and thickening of the iris.
- **Frank hemorrhage** from the iris surface.
- Fibrinous exudation resulting in **cream to red-colored solid opacities** in the anterior chamber, or over the surface of the iris.
- **Miosis**.
- **Grayish nodules** on the iris surface which represent localized aggregations of lymphoid cells.
- Gray to tan, dot-like, or sometimes coalescing opacities on the endothelial surface of the cornea (called **keratic precipitates**).
- **Cloudiness** of the aqueous fluid (called aqueous flare).
- Deposits of pigment or inflammatory cell debris on the anterior lens capsule. Adhesions of the pupil margin to the lens may occur (called **posterior synechiae**). If synechia are extensive, there may be anterior bowing of the iris (called iris bombé) and a shallow anterior chamber.
- Anterior cortical **cataract**.
- **Iris cysts**, either attached to the pupillary margin or free floating in the anterior chamber.
- **Anterior vitreous opacity** due to inflammation of the pars plana of the ciliary body ("pars planitis"). This change is especially associated with feline immunodeficiency virus (FIV) infection.
- **Corneal vascularization**.
- Engorgement of the deep episcleral vessels.
- **Lens subluxation or luxation**. This is usually due to inflammatory destruction of ciliary zonules, but may result from secondary glaucoma, which causes globe enlargement and zonule stretching.

WHERE?

Diseases which alter iris appearance can arise in and be confined to the iris, they can result from disease processes involving other parts of the eye, or they can be a localized manifestation of systemic disease.

WHAT?

Most diseases which alter iris appearance are inflammatory. Investigation of many cases of anterior uveitis for a possible infectious cause may not identify an etiologic agent, and so **many cases of uveitis in the cat are regarded as "idiopathic"**. Most cases of idiopathic uveitis probably involve an autoimmune response to an unidentified endogenous antigen.

Severe inflammation in a young cat is more likely to have an infectious etiology and **feline infectious peritonitis (FIP)** should be considered as one of the more likely possibilities.

A change in pigmentation in an older cat is more likely to be due to **neoplasia**.

Iris atrophy secondary to degenerative changes is a common incidental finding in may old cats.

Congenital abnormalities such as persistent pupillary membranes or iris colobomas are seen far less commonly.

DISEASES CAUSING ABNORMAL IRIS APPEARANCE

FELINE INFECTIOUS PERITONITIS VIRUS***

Classical signs

- Severe anterior fibrinous uveitis, usually bilateral, in a young cat.
- Other signs of FIP such as anorexia, weight loss, pyrexia, abdominal or chest effusions, multifocal neurological disease.

See main references on page 372 for details (The Pyrexic Cat).

Pathogenesis

Infection is thought to be acquired by inhalation or ingestion.

The virus replicates in the tonsils, epithelial cells of pharynx, respiratory mucosa and small intestine then infects monocytes, which disseminate the virus throughout the body.

The effusive form of the disease is thought to occur in cats with poor cell-mediated immune (CMI) responses, and the non-effusive form in cats with partial cell-mediated immunity.

The effusive form is associated with **immune complex-mediated vasculitis**.

The non-effusive form is characterized by **pyogranulomatous and granulomatous lesions in many organs** in particular eyes, brain, liver and kidney.

Clinical signs

Initially mild upper respiratory tract signs may occur, but usually go unnoticed.

Generally the disease is seen in young cats less than 1–2 years of age.

Anorexia, pyrexia, weight loss and malaise are typical. Other signs including icterus, abdominal distention, dyspnea and multifocal neurological signs are variably present.

In the eye, the most common presenting sign is a fibrinous uveitis. Fibrinous exudation results in **cream to red-colored solid opacities** in the anterior chamber, or over the surface of the iris.

Other signs of anterior uveitis such as blood or cloudiness in the anterior chamber, miosis, general reddening or thickening of the iris, and injection of deep episcleral vessels may be evident.

Diagnosis

A presumptive diagnosis is initially based on a combination of the clinical signs and laboratory findings. FIP should be **suspected especially when a bilateral fibrinous uveitis occurs in a young cat**.

Hematology and biochemistry may be helpful but are not definitive. Changes typical of FIP include a mild normocytic, normochromic anemia, neutrophilic leukocytosis and lymphopaenia, elevated total serum proteins, and a **polyclonal gammopathy** due to elevated alpha-2 globulins and gamma globulins.

Serology is usually regarded as being of dubious benefit in the diagnosis, as the FIP coronavirus cross-reacts with enteric forms of coronavirus.

Diagnosis can only be confirmed on characteristic histopathology of affected tissues on biopsy or necropsy examination. Typical change is described as a pyogranulomatous vasculitis. Necrosis and a fibrinoid response are seen in some cases.

Treatment

No treatment will cure the disease, which is invariably fatal. There is no prognosis for long-term survival, especially for cases with the effusive form. Cases with uveitis only may have a slightly better long-term prognosis.

Recent interest has been shown in the use of recombinant **alpha interferon** at doses ranging between 10 000–30 000 IU/kg given SQ daily for **short-term remission of signs**.

Palliative therapy traditionally has included the use of corticosteroids, including **topical 0.5% prednisolone** acetate applied to the eyes q 6–8 h for cases with uveitis.

Cats which are anorexic and depressed, and do not respond to supportive therapy, should be euthanized.

TOXOPLASMA GONDII INFECTION***

Classical signs

- Fever, weight loss, inappetence, malaise.
- +/– Muscle or joint pain.
- +/– Signs of respiratory, hepatic and/or neurological disease.
- Typical signs of anterior uveitis.

See main references on page 375 for details (The Pyrexic Cat) and page 958 (The Cat With Generalized Weakness).

Pathogenesis

Infection occurs by:

- Ingestion of tissue cysts (bradyzoites) from an intermediate host (most common) or
- Ingestion of sporulated oocysts from soil or water (far less common) or
- Transplacental transmission (rare).

After ingestion a **gut replication cycle occurs**. The cat is the definitive host and is the only species in which this occurs. This results in the production of unsporulated (non-infective) oocysts which are passed in feces. The oocysts **sporulate in the environment after 1–5 days** and become **infective**. Intestinal replication will also result in the formation of **tachyzoites** (**active acute infection**) or **bradyzoites** (**inactive latent infection**).

Activation of bradyzoites, typically found in muscle, brain and liver, may occur because of other disease states such as FIV, which act as stressors or immunosuppressors. High-dose corticosteroid use has been known to activate dormant *T. gondii* infections.

When bradyzoites are activated, they undergo rapid replication causing destruction of tissue and inciting an inflammatory response in various tissues, notably the **central nervous system, uveal tract of the eye, liver and lungs**.

Clinical signs

Signs may be acute, or chronic and intermittent. The acute fatal form occurs mostly in kittens.

Fever, anorexia, depression, weight loss.

Muscle or joint pain may be evident.

Dyspnea is common in kittens and cats with the acute form, and is associated with pneumonia.

Multifocal neurologic signs.

Signs of liver disease such as jaundice, enlarged liver, ascites or elevated liver enzymes.

Ocular signs, especially anterior uveitis, chorioretinitis and optic neuritis. The organism may cause a lymphocytic-plasmacytic uveitis evidenced by gray to tan-colored nodules on the iris surface.

Diagnosis

Diagnosis may be based initially on the clinical signs, but obtaining supportive laboratory data is essential in making a definitive diagnosis.

Serology.

- Demonstration of a **rise in IgM titers** indicates a recent active infection.
- **Comparison of levels of aqueous humor *T. gondii* antibody levels with serum levels** (Goldman–Witmer coefficient or C-value) has been advocated to determine that anterior uveitis has been caused by *T. gondii*, although the use of C-values is still controversial.

Definitive diagnosis requires demonstration of the organism **in inflamed tissues or fluid samples by histology, immunohistochemistry, or polymerase chain reaction (PCR) techniques**.

Treatment

Clindamycin (Antirobe, Upjohn) at a dose rate of 12.5 mg/kg twice daily for 3–4 weeks is usually effective against the organism. If no response is evident after 3 weeks of antibiotic therapy, reconsider the diagnosis.

Concurrent anti-inflammatory therapy decreases the anterior uveitis, e.g. topical 0.5% **prednisolone** acetate drops applied bid–qid.

IRIS NEOPLASIA***

Classical signs

- Diffuse pigmentary change across the anterior iris surface.
- Mass lesions bulging forward from the anterior iris stroma or distorting normal pupil shape.

Pathogenesis

Various tumors occur in the iris such as melanoma, lymphosarcoma, sarcoma and ciliary body tumors.

Diffuse iris melanoma arises as a primary neoplasia of the iris stroma, and is the most common primary intra-ocular neoplasm seen in cats.

Lymphosarcoma results from invasion of neoplastic lymphocytes from the peripheral circulation.

Intra-ocular sarcoma usually occurs as a sequel after (usually years) trauma causing penetrating injury to the lens. It is believed that the sarcoma arises from transformed lens epithelium. This neoplasm forms solid masses within the eye, which metastasize rapidly, usually via the optic nerve.

Ciliary body tumors may represent primary neoplasia or metastatic neoplasia from an extra-ocular site.

Clinical signs

Diffuse iris melanoma typically appears as an enlarging area over months to years of light tan to dark brown pigmentation on the iris surface. Usually the neoplasm does not form an obvious discrete mass, but the iris may become diffusely thickened. The disease is usually unilateral and typically occurs in older cats.

- Presentation may more resemble uveal inflammation than neoplasia.
- Sometimes the disease may present in an advanced state with secondary glaucoma.
- Amelanotic diffuse iris melanomas have also been reported.

Lymphosarcoma and post-traumatic sarcoma more commonly form **discrete masses** within the eye. Lymphosarcoma often presents as bilateral iris swelling, and anterior chamber hemorrhage in a young cat, with or without other signs suggesting multicentric neoplasia.

Ciliary body adenoma is a rare, slow-growing neoplasm, which appears as a whitish to cream mass behind the pupil margin.

Metastatic neoplasia from an extra-ocular primary tumor appears as an intra-ocular neoplasm involving the iris, and is associated with a similar neoplasm remote from the eye, e.g. mammary or uterine adenocarcinoma.

Diagnosis

Diagnosis is based initially on the appearance of the iris and consideration of the history.

Amelanotic diffuse iris melanomas are difficult to diagnose unless the effects of the tumor on angle obstruction and resultant glaucoma are observed.

Definitive diagnosis may be obtained by **fine-needle aspirate biopsies** or anterior chamber centesis and cytology.

Differential diagnosis

Diffuse iris melanoma needs to be differentiated from other causes of pigmentation of the iris and can look similar to:

- **A benign pigmented nevus,** which appears as a flat pigment spot in the iris. A nevus will be observed not to have changed in size with serial examination.
- **Post-inflammatory pigmentation**. A detailed history may reveal previous bouts of anterior uveitis within the eye. This pigmentation will not be progressive.

Treatment

Enucleation of an eye with diffuse iris melanoma is recommended if:

- There is evidence of rapid spread of a diffuse iris melanoma. The eye should be reassessed frequently to determine if the pigmentary change is progressive.
- Pigmentary change is seen near or in the iridocorneal angle on gonioscopy.
- A change in pupil shape or mobility occurs.
- Secondary glaucoma develops.

Evidence of metastasis may still occur as late as 2–3 years after enucleation.

If there is a high suspicion or confirmation of an **intra-ocular sarcoma** it requires **immediate enucleation** with exenteration of orbital tissue. Prognosis is still guarded and most cats will eventually die from metastatic disease within months.

Systemic chemotherapy for **lymphosarcoma** can be attempted unless the eye is already affected by secondary glaucoma. For more detail see main reference on page 432 (The Yellow Cat or Cat With Elevated Liver Enzymes).

PENETRATING INJURIES TO THE IRIS**

Classical signs

- Corneal lacerations.
- Mis-shapen pupil margin and bulging of iris tissue into the corneal defect.
- Visible iris tear.
- Blood and fibrin in the anterior chamber.

Pathogenesis

Injuries to the iris usually occur in conjunction with injuries to the adjacent cornea or sclera.

If the corneal injury is large, the iris may prolapse through the cornea and plug the defect.

Clinical signs

Trauma to the eye may result in a variety of changes to the iris including:

- **Visible iris tears**.
- **Iris prolapse through the corneal wound**. A black, bulging membrane will be seen with associated fibrin. The pupil margin is mis-shapen associated with the iris moving forward into the corneal defect.
- **Fibrinous adhesions** to adjacent structures.

Fibrin and blood in the anterior chamber (hyphema) are often present with trauma.

Associated **lens injury may occur**, which may be difficult to appreciate without removing fibrin from the anterior chamber and dilating the pupil.

A penetrating foreign body may or may not be evident.

Diagnosis

Diagnosis is based purely on the appearance of the iris on careful examination.

Treatment

Surgical repair is recommended. This might include replacement of iris tissue into the anterior chamber with suturing of the corneal defect. Viscoelastic substances and mydriatics can be used to push the iris away from the cornea.

Partial iridectomy may be necessary if a prolapsed section of iris is badly damaged or atonic.

Intra-ocular surgery may be required to **remove a damaged lens** to prevent destruction of the eye by severe lens-induced intra-ocular inflammation. If the lens is severely traumatized then eye ablation would be recommended to reduce the possibility of later post-traumatic intra-ocular sarcoma development.

IRIS ATROPHY**

Classical signs

- Loss of normal iris color and increased transparency of the iris in an old cat.
- Sluggish pupillary light reflex (PLR).

Pathogenesis

Iris atrophy is an **age-related atrophy and thinning of iris structures**, especially the anterior stroma, pupil margin and associated pupillary constrictor muscle.

Clinical signs

Iris atrophy occurs in old cats, and appears as **loss of normal coloration and increased transparency of the iris because of loss of pigment** in the anterior iris stroma. This may be **especially obvious in old Siamese cats or other color-dilute cats** with blue irides. The iris can become so thin that it may take on a transparent appearance.

There may be **some loss of normal pupillary light reflex** (PLR) associated with atrophy of the pupillary sphincter. In old cats with iris atrophy, pupil shape is often retained, but the PLR is not as brisk as in a younger cat. It is unusual to see atrophy to the degree sometimes seen in old dogs, where notch-like defects occur, with thin connecting strands across the defect.

If the pupil becomes very dilated, the equator of the lens may become visible.

Diagnosis

Diagnosis is based principally on a consideration of age and clinical signs.

Treatment

There is no treatment for iris atrophy.

FELINE LEUKEMIA VIRUS (FELV)**

Classical signs

- Discrete iris or ciliary body masses (FeLV-associated lymphosarcoma).
- Anterior uveitis, fibrin and blood in the anterior chamber.
- Otherwise unexplainable intermittent asymmetric changes in pupil size, shape or response.
- Other FeLV-associated signs, e.g. anemia.

See main references on page 540 for details (The Anemic Cat) and page 350 (The Thin, Inappetent Cat).

Pathogenesis

Following oral or nasal exposure to the virus, there is viral **replication in oropharyngeal lymphoid tissue**. If the immune response to the virus is ineffective in eliminating it, there is **replication of virus in bone marrow**, which leads to viremia, FeLV-related diseases or latent infection.

Infection with the virus is known to **cause a number of neoplasms**, including alimentary, mediastinal, renal, spinal, retrobulbar or lymph node forms as well as a number of hematologic lymphoid malignancies involving different bone marrow precursors.

Malignant lymphoid cells can invade intra-ocular uveal structures, generally as part of a wider syndrome of multicentric lymphosarcoma.

A **viral neuritis** can also be caused by FeLV, and affect parasympathetic or sympathetic efferent fibers to the iris in feline spastic pupil syndrome.

FeLV is also associated with uveitis.

Clinical signs

Discrete iris or ciliary body masses, which cause gross distortion of iris structure, and are usually bilateral.

Fibrin and/or blood may be evident in the anterior chamber indicating the presence of anterior uveitis.

Spastic pupil syndrome is associated with FeLV neuritis. Vision is retained, but one or both pupils are intermittently miotic or dilated over weeks or months, and they do not dilate appropriately with darkness. For more detail see main reference on page 878 (The Cat With Anisocoria or Abnormally Dilated or Constricted Pupils).

Diagnosis

Diagnosis is based on the clinical signs observed in the eye, in association with other signs suggestive of FeLV, e.g. multicentric lymphoma, FeLV-associated anemia.

Diagnosis is confirmed on **clinical pathology** including hematology and cytology of lymph nodes or aqueous centesis samples which demonstrate neoplasia.

A positive serological test for FeLV antigen suggests association of the neoplasm or spastic pupil syndrome with FeLV infection. For more details of testing see main reference on page 543 (The Anemic Cat).

Treatment

For more detail see main reference on page 544 (The Anemic Cat)

Treatment of the ocular condition in conjunction with systemic chemotherapy might include topical corticosteroids such as **0.5% prednisolone acetate drops** given q 6–12 h. Prognosis for the eye will be poor to guarded if secondary glaucoma has occurred.

FUNGAL INFECTIONS** (*CRYPTOCOCCUS NEOFORMANS*, BLASTOMYCOSIS, COCCIDIOIDOMYCOSIS, *HISTOPLASMA CAPSULATUM*)

Classical signs

- Chorioretinitis progressing to anterior uveitis and endophthalmitis, occurring in a geographical area where fungal infections are known to occur.
- Vision loss and reduced pupil light reflexes in affected eyes.
- Signs of other organ system disease, e.g. renal, CNS, nasal cavity.

See main references on page 16 for details (The Cat With Signs of Chronic Nasal Disease) for cryptococcosis and pages 371, 379, 387 (The Pyrexic Cat) for other fungi.

Pathogenesis

In general, all deep fungal infections enter the body by the **inhalation of aerosolized spores** leading to either **fungal rhinitis** (e.g. *Cryptococcus*) or **pneumonia** (e.g. blastomycosis, histoplasmosis) with subsequent dissemination to other parts of the body, including the eye, by hematogenous or lymphatic spread.

The initial ocular site for establishment of infection is usually the choroid, while the anterior uveal tract is often involved later in the course of the infection.

The different intra-ocular fungi vary in their geographical distribution.

- **Blastomycosis** is caused by a dimorphic fungus, which grows as a yeast in mammalian tissue and as a mycelial form in the environment. Found in the USA (in the midwestern and southeastern states along the Mississipi, Ohio and Missouri Rivers and occasionally mid Atlantic states), Central America, parts of Asia, Africa, Europe and Israel. Close proximity to water may be a factor in its geographical distribution.
- **Cryptococcosis** is caused by a budding capsulated yeast-like fungus with more worldwide distribution. *C. neoformans* is shed in pigeon feces and can be found in soil or in avian excreta. *C. neoformans* var. *gatti* is found in the developing flower of some Australian Eucalypt trees (red river gums and forest red gums). High concentrations of organisms are found in the bark and the accumulated debris surrounding the base of the tree. These trees have been widely exported around the world from Australia.
- **Histoplasmosis** is caused by a dimorphic fungus which forms a free-living mycelial form and yeast-like organisms in mammalian tissues. Found in central USA especially in Ohio, Mississippi and Missouri River basins and in Central and South America. There is association with moist humid conditions, nitrogen-rich soils, and bat and bird excrement.
- **Coccidioidomycosis** is caused by a soil mycelial organism with a natural resevoir in desert soils and around animal burrows. Found in Southwestern USA, Mexico, Central and South America. Animal infection occurs by inhalation of arthrospores, which can transform into spherules and then endospores in lung tissue.

Clinical signs

Typically, there is **anorexia, depression, fever and weight loss** combined with other systemic signs which can involve many other organs, especially the **lungs, brain, nasal cavity but also the orbital tissues, lymph nodes, bones, toenails and skin**.

Most **intra-ocular fungal infections** cause either:

- **Choroidal granulomas** which are typically evident on fundoscopy as a raised area of tapetal hyporeflectivity, or **small swollen brownish discolored areas** in the tapetal and non-tapetal retina.
- **Generalized chorioretinitis** and secondary retinal detachments. This may progress to anterior uveitis and endophthalmitis.
- **Optic neuritis,** which is seen as a red, swollen optic nerve that is hyperemic.
- **Anterior uveitis,** which appears as anterior chamber flare, miosis and an inflamed discolored iris.
- Vision loss and **reduced pupil light reflexes** in affected eyes.

Diagnosis

Initial diagnosis is based on the clinical presentation of a cat with a rapidly progressive, usually bilateral chorioretinitis progressing to anterior uveitis, with signs of other systemic disease, and occurring in a geographic area where such fungal disease is known to occur.

Imaging techniques can be used to obtain more supportive evidence of a deep fungal infection:

- Thoracic radiography for pulmonary granulomas.
- Nasal cavity radiography.
- Ocular ultrasound for signs of retinal detachment.

Confirmation of the diagnosis is based on the demonstration of the organism in:

- Cerebrospinal fluid.
- Samples taken by centesis of vitreous or subretinal exudate.
- Histopathology of enucleated globes.
- Bone marrow biopsy samples (histoplasmosis).
- Lung or lymph node aspirates or draining tracts.

Serological tests can be performed, looking for elevated:

- Antibodies (blastomycosis, histoplasmosis, coccidiodomycosis).
- Antigen – Cryptococcal capsular antigen in blood, CSF, or urine is sensitive and specific.

Treatment

Antifungal medications. Drug chosen should be based on results of fungal culture and sensitivity where possible. Treatment may need to be prolonged, depending on response.

- Itraconazole 100 mg PO daily with food.
- Fluconazole 50 mg PO q 8 hours.
- Amphotericin B. See page 26 (The Cat With Signs of Chronic Nasal Disease) for description of administration in a subcutaneous infusion of glucose and sodium chloride to reduce the renal toxicity.

Avoid use of systemic corticosteroids in systemic fungal disease.

Topical steroids or non-steroidals may be used to control the anterior uveitis.

Supportive therapy is important until anti-fungal medication is effective.

Enucleation of the eye is recommended if endophthalmitis and/or secondary glaucoma develop.

Prognosis

Guarded to grave in most cases where there is systemic involvement.

FELINE IMMUNODEFICIENCY VIRUS (FIV) INFECTION**

Classical signs

- Signs of uveitis.
- Bilateral iris swelling associated with neoplasia.

See main references on page 330 for details (The Thin, Inappetent Cat) and page 399 (The Cat With Enlarged Lymph Nodes).

Pathogenesis

Ocular disease including uveitis, glaucoma, infiltration of inflammatory cells in the posterior chamber (pars planitis), focal retinal chorioretinitis and retinal hemorrhages have been reported associated with FIV infection.

Neoplasia including lymphoma (often extra-nodal) have been associated with the terminal stage of the disease, although the exact role of FIV in the neoplastic process is unclear.

Clinical signs

Signs of anterior uveitis, e.g. miosis, injected iris surface, anterior chamber flare, fibrin.

Discrete iris or ciliary body masses causing iris swelling, which is associated with lymphosarcoma.

Diagnosis

Diagnosis is based on the clinical signs of uveitis or lymphosarcoma in a FIV-positive cat, and failure to identify any other possible cause.

LYMPHOCYTIC-PLASMACYTIC UVEITIS*

Classical signs

- Gray to tan nodules on the anterior surface of the iris.
- Keratic precipitates.

PATHOGENESIS

Lymphocytic-plasmocytic uveitis stems from an **immune-mediated process**, which results in the formation of **numerous lymphoid nodules within the anterior uveal tract**. It is probably a response to endogenous antigens, and in some cats, *Toxoplasma* is regarded as a possible cause.

Clinical signs

Typically there are **gray to tan nodules on the anterior surface of the iris**.

Opacities occur on the **endothelial surface of the cornea** (keratic precipitates)

Aqueous flare (cloudiness of the anterior chamber due to suspended proteins and cells)

Pre-iridal fibrovascular membranes occur in the chronic stages.

Secondary glaucoma, lens luxation and globe enlargement occur in the chronic stages.

Diagnosis

Diagnosis is based principally on the appearance of the iris.

Cytology of aqueous humor usually reveals lymphocytes and occasional plasma cells.

Treatment

There is no cure for this disease. Once the nodules have been formed they will never go away completely with therapy, however treatment will control the inflammation and reduce the incidence of the secondary sequelae.

Topical corticosteroids.

- **Prednisolone** acetate
  Prednefrin Forte (Allergan - 1%) applied q 8–12 h.
  Sterofrin (Alcon - 0.5%) q 6–8 h reducing to effect.

Topical NSAIDs.

- **Flurbiprofen** (Ocufen 0.03%) applied q 8–12 h.

Mydriatics such as atropine are rarely indicated because of the side effects of salivation seen in cats and the chronic nature of the disease.

Treat glaucoma with:

- Continuing steroid or NSAID therapy.
- Topical carbonic anhydrase inhibitors (Dorzolamide 2% topically tid).
- Topical beta-blockers, e.g. timolol maleate 0.5% applied bid–tid.

Laser cyclo-photo-coagulation in chronic cases non-responsive to medical treatment.

Glaucoma will often be refractory to treatment.

PRE-IRIDAL FIBROVASCULAR MEMBRANES*

Classical signs

- New vessels growing across the anterior surface of the iris giving the iris a pink injected appearance.
- ± Intra-ocular neoplasm, detached retina and/or uveitis.

Pathogenesis

Pre-iridal fibrovascular membrane (PIFM) formation is associated with angiogenic factors released by proliferating intra-ocular neoplasms, retinal hypoxia or chronic inflammation.

Clinical signs

PIFMs appear as **new vessels growing across the anterior surface of the iris**, giving the iris a pink discoloration.

Because PIFM formation is associated with **intra-ocular neoplasms, retinal detachment or chronic inflammation**, these abnormalities may be evident on careful examination of the eye.

PIFMs may be associated with secondary **hyphema or glaucoma**.

Occasionally the vessels in PIFMs may be visible leaving the pupil margin and migrating across the anterior lens capsule.

Diagnosis

Diagnosis is based on the characteristic appearance of the fibrovascular membranes on the anterior stromal surface of the iris.

Occasionally an underlying cause may be apparent, e.g. a ciliary body epithelial tumor at the pupil space or a total retinal detachment.

Differential diagnosis

Iris neoplasia, especially secondary neoplasms of the iris arising in some other part of the body, e.g. lymphosarcoma resulting in hyphema.

Acute inflammation resulting in pinkish injection of the anterior iris surface.

Treatment

There is no treatment for PIFMs except for treatment of the underlying chronic diseases, which may be associated with the condition. Once formed the PIFMs will remain permanently on the iris surface.

IDIOPATHIC UVEITIS*

Classical signs

- Signs of uveitis.
- Extensive laboratory investigations fail to identify possible etiology.

Clinical signs

Idiopathic uveitis is characterized by any signs of anterior uveitis such as miosis, injected iris surface, anterior chamber flare, and fibrin, where **extensive laboratory investigations fails to identify a possible etiology**.

One study showed there may be a significant positive association of idiopathic anterior uveitis with **high aqueous titers to herpesvirus**.

Diagnosis

Diagnosis is based on the clinical signs of uveitis with failure to identify a possible cause.

PERSISTENT PUPILLARY MEMBRANES

Classical signs

- Strands of iris-like tissue arising from the iris collarette and crossing the pupil space, or attaching to the cornea or lens.
- Dot-like gray to black opacities on the endothelial surface of the cornea or the anterior capsule of the lens unassociated with history of previous inflammation within the eye.
- Rare in cats.

Pathogenesis

Persistent papillary membrane is an embryonic structure, and results from **failure of the pupillary membrane to rarify in late fetal life**.

The pupillary membrane is formed from mesoderm, which, until regression, forms a solid sheet of tissue bridging the pupil space from the iris collarette. In normal adult cats, the collarette appears as a slightly raised region halfway between the pupil margin and the iris root.

The condition is seen rarely in cats compared to the frequency with which it is seen in dogs, and rarely seems to affect the pupil light response or pupil shape.

Clinical signs

Persistent papillary membrane appears as **fibrous strands of iris-like tissue** running from the:

- Iris collarette to another region of the iris collarette. The iris collarette is a raised area approximately half way between the iris root and the pupillary margin.
- Iris to anterior capsule.
- Iris to posterior corneal surface (most common).

The strands can be very thin and magnification may be required to visualize them.

Persistent papillary membrane may also appear as **dot-like gray to black opacities on the endothelial surface of the cornea** or the anterior capsule of the lens, unassociated with history of previous inflammation within the eye.

Diagnosis

Diagnosis is based on the characteristic appearance of the PPMs on careful ocular examination.

Differential diagnosis

The gray opacities formed by PPMs which attach to the corneal endothelium should be differentiated from **keratic precipitates**, formed as a result of anterior uveitis. A strand of tissue attaching the opacity to the iris and the absence of other signs of anterior uveitis is diagnostic of a PPM.

Treatment

No treatment is indicated for PPMs.

IRIS COLOBOMA

Classical signs

- Segmental full-thickness defect of the iris with lens visible behind the defect.
- Remaining iris is normal.
- May also cause an abnormal pupil shape.
- Rare in cats.

Clinical signs

The defect is a **rare anomaly** that may be detected in a young cat, and results in a **notch-like or sectorial defect in the iris**.

Iris coloboma appears as **thinned to absent iris stroma in a radial sector of the iris**. The remaining iris appears normal.

Small strands, which are remnants of the iris dilator muscle, may be seen **bridging the space** formed by the defect.

Abnormal pupil shape (dyscoria) may be present.

Diagnosis

Diagnosis is based on the **characteristic appearance** of iris coloboma on ocular examination.

IRIS CYST

Classical signs

- Pigmented cyst-like structures, translucent on illumination, in the anterior chamber or attached to the pupil margin.
- Rare in cats.

Clinical signs

Iris cysts appear as **brown- or black-pigmented cyst-like structures** freely floating in the anterior chamber, or attached to the posterior pigmented epithelium of the iris at the pupil margin. They may be more obvious with pupil dilation.

Iris cysts occur as a congenital abnormality, or occur as a result of inflammation, and are uncommon in cats.

Iris cysts are usually **partly translucent** on focal light illumination.

Diagnosis

Diagnosis is based purely on the characteristic appearance of iris cysts on ocular examination.

CUTEREBRA LARVAL MIGRATION (OPHTHALMOMYIASIS)

Classical signs

- Vision loss.
- Cloudy posterior segment with linear track-like lesions on fundoscopy.

Classical signs—Cont'd

- Typical signs of anterior uveitis associated with larva in the anterior chamber.

Clinical signs

Migration of cuterebra larva through the eye causes vision loss and poor pupillary light reflexs.

Characteristic signs on fundoscopy include **linear hyper-reflective "tracks" in the tapetal fundus**, linear light gray areas of **reduced pigmentation in the non-tapetum** and cloudy posterior segment. The white body of a fly larva is sometimes seen associated with one of the tracks.

Sometimes the larva is seen in the anterior chamber with associated signs of anterior uveitis.

Diagnosis

Diagnosis is based on **appearance of the suspicious fundoscopic lesions**, or on the observation of the parasite in the anterior chamber with the associated uveitis.

OCULAR DIROFILARIASIS

Classical signs

- White filarial worm in the anterior chamber associated with typical signs of anterior uveitis.

Clinical signs

Immature adult dirofilaria are rarely found in the anterior chamber, and are associated with signs of **corneal edema and/or anterior uveitis**.

Diagnosis

Diagnosis is on observation of a filarial-like parasite within the anterior chamber on ocular examination.

BARTONELLA HENSELA (CAT-SCRATCH FEVER)

Classical signs

- Subclinical or mild fever.
- Occasionally ocular signs associated with anterior uveitis.

See main reference on page 366 (The Pyrexic Cat) for more details.

Clinical signs

Naturally infected cats **usually only develop subclinical infection**.

Mild, self-limiting fever **lasting 48–72 hours has been documented in some experimentally infected cats**.

Anterior uveitis was documented in one naturally exposed cat.

Diagnosis

Diagnosis is based on a positive blood culture, however, intermittent bacteremia may occur for longer than 1 year following infection.

The organism is present within erythrocytes, therefore, hemolyzing red blood cells **increases the sensitivity of the culture**.

RECOMMENDED READING

Davidson MG. English RV Feline ocular toxoplasmosis. Vet Ophthalmol 1998; 1: 70–80.

Maggs DJ, Lappin MR, Nasisse MP. Detection of feline herpesvirus – specific antibodies and DNA in aqueous humour from cats with or without uveitis, Am J Vet Res 1999; 60: 932–936.

Malik R, Martin P, Wigney DI, et al Nasopharyngeal cryptococcosis. Aust Vet J 1997; 75: 483–488.