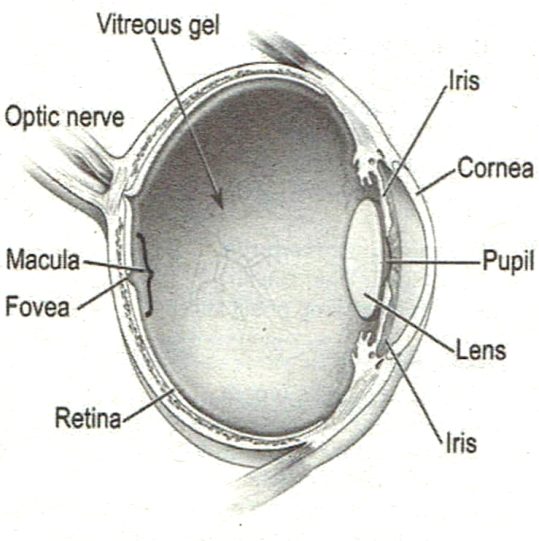
SENSES

EYES AND EARS

EYES

ANATOMY OF THE EYE

- **Cornea**- transparent, avascular, dome-like structure that serves as the main refracting surface of the eye
- **Aqueous Humor**- Produced by the ciliary body that nourishes the cornea
- **Uvea-** Consists of iris, ciliary body and choroid
- **Iris**- Colored part of the eye
- **Pupil-** A space that dilates and constricts in response to light
- **Lens**- Colorless and biconvex structure that enables focusing for near vision and refocusing for distance vision(accommodation)
- **Choroid**- A vascular tissue, supplying blood to the portion of the sensory retina closest to it.
- **Vitreous Humor**- Occupies 2/3 of the eye's volume and helps maintain the shape of the eye.
- **Retina**- Composed of 10 microscopic layer
  - It is a neural tissue, an extension of the optic nerve
  - **Macula** is the part of the retina that is responsible for central vision
  - **Rods** - responsible for night vision
  - **Cons**- responsible for bright light and color vision



TESTING VISION

- **Snellen Chart**
  - Composed of series of progressively smaller rows of letters that is used to test distance vision
  - **20/20** is considered standard of normal vision
  - A person whose vision is 20/200 can see an object from 20 feet away that a person with 20/20 vision can see from
    200 feet away
- **Ophthalmoscope**
  - Examines fundus, optic cup, periphery of the retina and macula
- **Slit Lamp**
  - Binocular microscope that examines the eye with magnification of 10 to 40 times the real image
- **Tonometer**
  - Measures IOP by determining the pressure necessary to indent or flatten small anterior area of the eye
  - Normal IOP is 10-21 mmHg
- **Perimetry**
  - A tool that evaluates the field of vision or the area or exent of physical space visible to an eye in a given position

- **Ishihara Color Plate Test**
  - Use to identify color vision deficit/ color-blindness
  - Dots of primary colors are integrated into a background of secondary colors which is arranged in simple patterns
    such as numbers or shapes
- Amsler Grid
  - Test often used for patients with macular problems, such as macular degeneration
  - Consists of a geometric grid of identical squares with a central fixation point
  - The patient is instructed to stare at the central fixation spot on the grid
  - For patients with macular problems, some of the squares may look faded, or the lines may be wavy

TERMS

- **Aphakia**- without lens
- **Astigmatism**- irregularity in the curve of the cornea
- **Blindness-** Best corrected visual acuity (BCVA) ranges from 20/400
- **Legal Blindness**- BCVA that does not exceed 20/200
- **Diplopia-** double vision
- **Emmetropia**- Normal vision
- **Hyperopia**- far sighted
- **Myopia-** near sighted
- **Hyperemia** - red eye
- **Nystagmus** - involuntary oscillation of the Eyeball
- **Proptosis** - downward displacement of the eyeball
- **Ptosis** - drooping eyelid
- **Papilledema** - swelling of the optic disc
- **Strabismus** - a condition in which there is deviation from perfect ocular alignment
- **Enucleation** is the removal of the entire eye and part of the optic nerve
- **Evisceration** involves the surgical removal of the intraocular contents through an incision or opening in the cornea or sclera
- **Exenteration** is the removal of the eyelids, the eye, and various amounts of orbital contents

CONDITIONS OF THE EYELIDS AND CONJUNCTIVA

- **Blepharitis**
  - An inflammatory reaction of the eyelid margin or seborrheic skin condition
  - Caused by bacteria (usually **Staphylococcus aureus**)
- **Clinical manifestation**
  - Flaking
  - Redness
  - Irritation
  - Recurrent styes
- **Management**
  - If S. aureus is likely, antibiotic ointment is prescribed 1 to 4 times per day to eyelid margin
- **Nursing Intervention**
  - Teach patient to scrub eyelid margin with cotton swab to remove flaking
  - Apply ointment with cotton swab as directed.
- **Hordeolum (stye)/Chalazion**
  - The term **stye** refers to an inflammation or infection of the glands and follicles of the eyelid margin
  - **External hordeolum** involves the hair follicles of the eyelashes
  - **Chalazion** is a granulomatous (chronic) infection of the meibomian glands.
- **Etiology**
  - Caused by bacteria, usually staphylococcus, and seborrhea are the causes
- **Clinical Manifestations**
  - Pain
  - Redness
  - Foreign body sensation
  - Pustule may be present.
- **Treatment**

- Warm soaks to help promote drainage
- Good hand washing and eyelid hygiene
- Application of antibiotic ointment
- In some cases, incision and drainage in may be necessary
- Teach patient how to clean eyelid margins and not to squeeze the stye.

❖ **Conjunctivitis**
- Inflammation or infection of the bulbar (covering the sclera and cornea) or palpebral (covering inside lids) conjunctiva
- The term **pink eye** usually refers to infectious conjunctivitis.

❖ **Etiology**
- **Bacterial Conjuctivitis** are caused by Streptococcus pneumoniae, Haemophilus influenzae, and Staphylococcus aureus
- **Viral Conjunctivitis** are caused by adenovirus and herpes simplex virus
- **Allergic** conjunctivitis is a hypersensitivity reaction that occurs as part of allergic rhinitis (hay fever) or allergic reaction due to pollens or other environmental pollutants

❖ **Clinical Manifestations**
- Foreign body sensation in the eyes
- Scratching or burning sensation
- Itching and photophobia

❖ **Nursing Intervention**
- Warm soaks (10 minutes four times per day) is used when crusting and drainage are present for bacterial conjunctivitis
- Cold compress for viral conjunctivitis
- If topical antibiotic (broad spectrum) is ordered, teach patient instillation technique
- Urge good hand washing to prevent spread of infection
- Allergic conjunctivitis treated with topical or oral antihistamines. vasoconstrictors, and mast cell stabilizers.

❖ **Corneal Abrasion and Ulceration (Keratitis)**
- Loss of epithelial layers of cornea due to some type of trauma, contact with fingernail, tree branch, spark or other projectile, or overwearing contact lens
- May lead to corneal ulceration and secondary infection into cornea (keratitis), which may lead to blindness

❖ **Clinical Manifestations**
- Pain and redness
- Foreign body sensation
- Photophobia
- Increased tearing
- Difficulty opening the eye

❖ **Diagnostic Procedures**
- Fluorescein staining
- Woods lamp or slit lamp

❖ **Management**
- Treatment is urgent
- Fortified (high concentration) antibiotic eyedrops may be instilled and eye patched for 24 hours _
- Cycloplegics are administered to reduce pain caused by ciliary spasm
- Abrasion heals in 24 to 48 hours.
- Ulceration should be followed by an ophthalmologist
- Make sure that patch is secure enough so patient cannot open eyelid
- Teach patient to use topical antibiotic (or antiviral in cases of herpes simplex dendritic keratitis) after patch is removed, and follow up as directed
- Review safety practices such as wearing protective eye shields and washing hands frequently.

❖ **Iritis/Uveitis**
- Inflammation of the intraocular structure
- Involved structures:
  - ✓ Anterior uveitis iris (iritis) or iris and ciliary body (iridocyclitis)
  - ✓ Intermediate uveitis structures posterior to the lens (pars plantis or peripheral uveitis)

- ✓ Posterior uveitis choroid (choroiditis), retina (retinitis), or vitreous near the optic nerve and macula
- Anterior uveitis is most common and is usually unilateral
- Posterior uveitis is usually bilateral

❖ **Etiology**
- Immune-mediated disorders.
- May be idiopathic
- Ankylosing spondylitis
- Crohn's disease
- Reiter's syndrome
- Lupus
- Trauma

❖ **Clinical Manifestations**
- Onset is acute with deep eye pain
- Photophobia
- Conjunctival redness
- Small pupil that does not react briskly

❖ **Nursing Management**
- Urgent ophthalmology evaluation is Needed
- Inflammation is treated with a topical corticosteroid and a cycloplegic agent
- Teach patient how to instill medications and adhere to dosing schedule to prevent permanent eye damage
- Suggest sunglasses to decrease pain from photophobia
- Encourage follow-up for intraocular pressure (I0P) measurements because corticosteroids can increase I0P.

DISORDERS OF THE EYES

CATARACT

- Clouding or opacity of the crystalline lens that impairs vision.

❖ **Etiology**
- Senile cataract commonly occurs with aging
- Congenital cataract occurs at birth
- Traumatic cataract occurs after injury

❖ **Risk Factors**
- Diabetes
- Ultraviolet light exposure
- High-dose radiation
- Corticosteroids
- Phenothiazines
- Some chemotherapy agents

❖ **Clinical Manifestations**
- Blurred or distorted central vision
- Glare from bright lights
- Gradual and painless loss of vision
- Previously dark pupil may appear milky or white

❖ **Diagnostic Evaluation**
- Slit-lamp examination to provide magnification and visualize opacity of lens
- Direct and indirect ophthalmoscopy to rule out retinal disease
- Perimetry to determine the scope of the visual field (normal with cataract)
- Snellen visual acuity test

❖ **Management**

General
- Surgical removal of the lens is indicated.
- Cataract surgery is usually done under local anesthesia
- Preoperative eyed drops produce decreased response to pain and lessened motor activity (neuroleptanalgesia).
- Oral medications may be given to reduce 10P.

- IOL implants are usually implanted at the time of cataract extraction, replacing thick glasses that may provide suboptimal refraction.
- If intraocular lens implant is not used, the patient will be fitted with appropriate eyeglasses or a contact lens to correct refraction after the healing process.

❖ **Surgical Procedures**

Two types of extractions:

- **Intracapsular extraction** -the lens as well as the capsule are removed through a small incision.
- **Extracapsular extraction**-the lens capsule is incised, and the nucleus, cortex, and anterior capsule are extracted. The posterior capsule is left in place and is usually the base to which an IOL is implanted.

❖ **Procedures for Extraction**:

- **Cryosurgery** -a special technique in which a pencil-like instrument with a metal tip is supercooled (-35° C), then touched to the exposed lens, freezing to it so the lens is easily lifted out
- **Phacoemulsification** - a portion of the anterior capsule is removed, allowing extraction of the lens, nucleus and cortex while the posterior capsule and zonular support are left intact. An ultrasonic device is used to liquefy the nucleus and cortex, which are then suctioned out through a tube

❖ Nursing Interventions

Preparing the Patient for Surgery

- Orient patient and explain procedures and care plan to decrease anxiety.
- Instruct patient not to touch eyes to decrease contamination.
- Obtain conjunctival cultures, if requested, using aseptic technique.
- Administer preoperative eyedrops, antibiotic, mydriatic-cycloplegic, and other medications such as mannitol solution
  I.V., sedative, antiemetic, and opioid as directed.

❖ **Preventing Complications Postoperatively**

- Medicate for pain as prescribed to promote comfort.
- Administer medication to prevent nausea and vomiting as needed.
- Notify health care provider of sudden pain associated with restlessness and increased pulse, which may indicate increased IOP, or fever, which may indicate infection.
- Caution patient against coughing or sneezing to prevent increased IOP.
- Advise patient against rapid movement or bending from the waist to minimize IOP. Patient may be more comfortable
  with head elevated 30 degrees and lying on the unaffected side.
- Allow patient to ambulate as soon as possible and to resume independent activities.
- Assist patient in maneuvering through environment with the use of one eye while eye patch is on (1 to 2 days).
- Wear glasses or metal eye shield at all times following surgery as instructed by the physician.
- Clean postoperative eye with a clean tissue; wipe the closed eye with a single gesture from the inner canthus outward

❖ **Lens Replacement**

Three lens replacement options:

- Aphakic eyeglasses-objects are magnified by 25%, making them appear closer than they actually are
- Contact lenses- provide patients with almost normal vision. Also needs a pair of aphakic glasses
- IOL implants- usual approach to lens replacement
  - ✓ Single-focus lens or monofocal IOL
  - ✓ Multifocal IOL
  - ✓ Accommodative IOL

ACUTE (CLOSE ANGLE) GLAUCOMA

❖ A condition in which an obstruction occurs at the access to the trabecular meshwork and the canal of Schlemm.
❖ IOP is normal when the anterior chamber angle is open, and glaucoma occurs when a significant portion of that angle is closed.
❖ Glaucoma is associated with progressive visual field loss and eventual blindness if allowed to progress.
❖ Rapidly progressive visual impairment
❖ **Clinical Manifestation**

- Periocular pain
- Conjunctival hyperemia and congestion.
- Pain may be associated with nausea and vomiting, bradycardia, and profuse sweating.
- Peripheral visual loss
- Severely elevated IOP, corneal edema.

- Pupil is vertically oval, fixed in a semi-dilated position and unreactive to light and accommodation

❖ **Diagnostic Procedures**
- Tonometry
- Ophthalmoscopy
- Gonioscopy
- Perimetry

❖ **Management**
- **An ocular emergency**
- Administration of:
  - ✓ Hyperosmotic agents such as acetazolamide (Diamox) to reduce 10P by promoting diuresis
  - ✓ Topical ocular hypotensive agents, such as pilocarpine and beta-blockers (Betaxolol)
- Possible laser incision in the iris (Iridotomy) to release blocked aqueous and reduce 10P
- Other eye is also treated with pilocarpine eye drops and/or surgical management to avoid a similar spontaneous attack.

❖ **Nursing Intervention**

Patient Education and Health Maintenance
- Instruct patient in use of medications. Stress the importance of long-term medication use to control this chronic disease. Patients commonly forget that eyedrops are medications and that glaucoma is a chronic illness.
- Remind patient to keep follow-up appointments.
- Instruct patient to seek immediate medical attention if signs and symptoms of increased IOP return such as severe eye pain, photophobia, and excessive lacrimation.
- Advise patient to notify all health care providers of condition and medications and to avoid use of medications that may increase IOP, such as corticosteroids and anticholinergics (such as Akineton, Benadryl, Cogentin), unless the benefit outweighs the risk.

CHRONIC (OPEN-ANGLE) GLAUCOMA

❖ Disorder of increased IOP, degeneration of the optic nerve, and visual field loss. Open-angle glaucoma makes up 90% of primary glaucoma cases and its incidence increases with age.

❖ Usually bilateral, but one eye may be more severely affected than the other

❖ The anterior chamber angle is open and appears normal

❖ **Clinical Manifestations**
- Mild, bilateral discomfort (tired feeling in eyes, foggy vision).
- Slowly developing impairment of peripheral vision but **central vision is unimpaired.**
- **Progressive loss of visual field.**
- **Halos** may be present around lights with increased ocular pressure.
- Optic nerve may be damage

❖ **Diagnostic Evaluation**
- **Tonometry**
- **Ocular examination** to check for clipping and atrophy of the optic disk
- **Visual fields testing**

❖ **Management**
- Commonly treated with a combination of **topical miotic** agents (increase the outflow of aqueous humor by enlarging the area around trabecular meshwork) and **oral carbonic anhydrase inhibitors** and **beta-adrenergic blockers** (decrease aqueous production).
- If medical treatment is not successful, surgery may be required, such as **Laser trabeculoplasty** but is delayed as long as possible.

❖ **Nursing Interventions**
- Make sure that the patient understands that, although he may be asymptomatic, IOP could still be elevated, and damage to the eye could be occurring. Therefore, ongoing use of medication and follow-up are essential.
- Teach patient the action, dosage, and adverse effects of all medications
- Alert patient to avoid circumstances that may increase 10P such as straining, heavy lifting, bending, etc.
- Instruct the patient to have a low sodium diet

RETINAL DETACHMENT

- Detachment of the sensory area of the retina (rods and cones) from the pigmented epithelium of the retina.
- A break in the continuity of the retina may first occur from small degenerative holes and tears, which may lead to detachment.
- Spontaneous detachment may occur due to degenerative changes in the retina or vitreous body
- **Etiology**
  - Trauma, inflammation, or tumor causes detachment by forming a mass that mechanically separates the retinal layers.
- **Clinical Manifestations**
  - The patient notes sensation of particles moving in line of vision (person can see floating across field of vision when looking at a light background).
  - Delineated areas of vision may be blank.
  - A sensation of **a veil-like coating** may be present if detachment develops rapidly.
  - Unless the retinal holes are sealed, the retina will progressively detach; ultimately there will be a loss of central
    vision as well as peripheral vision, leading to legal blindness
- **Diagnostic Evaluation**
  - **Indirect ophthalmoscopy** - shows gray or opaque retina.
  - **Slit-lamp examination and three-mirror gonioscopy**
  - **Optical coherence tomography and ultrasound** are used for the complete retinal assessment, especially if the
  - view is obscured by a dense cataract or vitreal hemorrhage.
- **Surgical Management**
  - **Scleral Buckling**
    - ✓ The retinal surgeon compresses the sclera (often with a scleral buckle or a silicone band) to indent the scleral wall from the outside of the eye and bring the two retinal layers in contact with each other.
  - **Pneumatic Retinopexy**
    - ✓ A gas bubble, silicone oil, or perfluorocarbon and liquids may be injected into the vitreous cavity to help push the sensory retina up against the RPE (Retinal Pigment Epithelium)
  - **Cryosurgery or retinal cryopexy**
    - ✓ Super cooled probe is touched to the sclera, causing minimal damage; as a result of scarring, the pigment epithelium adheres to the retina.
- **Preventing Postoperative Complications**
  - Caution patient to avoid bumping head.
  - Encourage patient not to cough or sneeze or to perform activities that will increase [OP.
  - Assist patient with activities as needed.
  - Encourage ambulation and independence.
  - Administer medications for pain, nausea, and vomiting as prescribed.
  - Provide sedation, diversional activities such as radio and audio books.
- **Patient Education and Health Maintenance**
  - Encourage self-care at discharge (Avoid falls, jerks, bumps, or accidental injury.)
  - Instruct patient about the following:
    - ✓ Rapid eye movements should be avoided for several weeks.
    - ✓ Driving is restricted.
    - ✓ Within 3 weeks, light activities may be pursued.
    - ✓ Within 6 weeks, heavier activities and athletics are possible. Define such activities for the patient.
    - ✓ Avoid straining and bending head below the waist.
    - ✓ Use meticulous cleanliness when instilling eye medications.
    - ✓ Apply a clean, warm, moist washcloth to eyes and eyelids several times a day for 10 minutes to provide soothing and relaxing comfort.
    - ✓ Symptoms that indicate a recurrence of the detachment: Floating spots, flashing light, progressive shadows. Recommend that the patient contact health care provider if they occur.
    - ✓ Advise patient to follow up. The first follow-up visit to the ophthalmologist should occur in 2 weeks.

MACULAR DEGENERATION

- Most common cause of visual loss in people older than 60 years of age
- Two types:
  - Dry (non-neovascular, nonexudative) type of the condition, in which the outer layers of the retina slowly break down
    - ✓ When the drusen occur outside of the macular area, patients generally have no symptoms
    - ✓ When the drusen occur within the macula, however, there is a gradual blurring of vision that patients may notice when they try to read
  - Wet (neovascular, exudative) type, may have an abrupt onset
    - ✓ Patients report that straight lines appear crooked and distorted or that letters in words appear broken
    - ✓ Results from proliferation of abnormal blood vessels growing under the retina, within the choroid layer of the eye
    - ✓ Affected vessels can leak fluid and blood, elevating the retina
- **Medical Management**
  - There is no known cure for the dry (nonexudative, non-neovascular)
  - Study revealed that use of antioxidants (vitamin C, vitamin E, and betacarotene) and minerals (zinc oxide) in megadoses can slow the progression of AMD and vision loss for people at high risk for developing advanced Macular Degeneration
  - For Wet type Macular Degeneration following drugs are given:
    - ✓ Ranibizumab (Lucentis)
    - ✓ Monoclonal antibody bevacizumab (Avastin)
- **Nursing Management**
  - Amsler grids are given to patients to use in their homes to monitor for a sudden onset or distortion of vision
  - Patients should be encouraged to look at these grids, one eye at a time, several times each week with glasses on. If there is a change in the grid, the patient should notify the ophthalmologist immediately

ORBITAL TRAUMA

- Injury to the orbit is usually associated with a head injury
- The patient's general medical condition must first be stabilized before conducting an ocular examination
- During inspection, the face is meticulously assessed for underlying fractures, which should always be suspected in cases of blunt trauma
- Soft tissue orbital injuries often result in damage to the optic nerve
- Major ocular injuries indicated by a soft globe, prolapsing tissue, ruptured globe, and hemorrhage require immediate surgical attention

SOFT TISSUE INJURY AND HEMORRHAGE (BLUNT OR PENETRATING)

- **Manifestations**
  - Tenderness and ecchymosis
  - Lid swelling, hemorrhage and **proptosis**
  - **Black eye** -closed injuries with subconjunctival hemorrhage
  - Penetrating injuries or a severe blow to the head can result in severe optic nerve damage
- **Management**
  - Soft tissue hemorrhage that does not threaten vision is usually conservative and consists of thorough inspection, cleansing, and repair of wounds
  - Cold compresses are used in the early phase followed by warm compress
  - Hematomas that appear swollen, fluctuating areas may be surgically drained or aspirated
  - If they are causing significant orbital pressure, they may be surgically evacuated
  - Corticosteroid therapy is indicated to reduce optic nerve swelling
  - Optic nerve decompression may be performed

ORBITAL FRACTURE

- **Classifications**
  - Blowout
  - Zygomatic or tripod
  - Maxillary
  - Midfacial
  - Orbital apex
  - Orbital roof fractures

- **Manifestations**
  - Muscles, fat and fascia! attachment, the nerve that courses along the inferior oblique muscle may become entrapped
  - The globe may be displaced inward enophthalmos)
  - Fractures are usually caused by blunt small objects. such as a fist, knee, elbow, or tennis or golf ball
- **Diagnostic Procedure**
  - Computed tomography (CT) identifies the muscle and its auxiliary structures that are entrapped
- **Management**
  - Orbital roof fractures are dangerous because of potential complications to the brain
  - Surgical management (usually non-emergent) of these fractures requires a neurosurgeon and a ophthalmologist
  - Emergency surgical repair is indicated to patient with displaced globe into the maxillary sinus

PENETRATING INJURIES AND CONTUSION OF THE EYEBALL

- **Clinical Manifestations**
  - Marked loss of vision
  - Hemorrhagic chemosis (edema of the conjunctiva)
  - Conjunctival laceration
  - Shallow anterior chamber with or without an eccentrically placed pupil
  - **Hyphema** (hemorrhage within the chamber)
  - Vitreous hemorrhage
- **Management**
  - No attempt should be made to remove the foreign object
  - The object should be protected from jarring or movement to prevent furtherocular damage
  - No pressure or patch should be applied to the affected eye
  - All traumatic eye injuries should be protected using a metal shield if available or a stiff paper cup until medical treatment can be obtain
  - Prevent bleeding and increased IOP
  - Topical corticosteroids are prescribed to reduce inflammation
  - Antifibrinolytic agent, aminocaproic acid (Amicar) is given to stabilize clot formation at the site of hemorrhage
  - Primary **enucleation** (complete removal of the eyeball and part of the optic nerve) is considered if the globe is irreparable and has no light perception. Enucleation is performed within 2 weeks of the initial injury to prevent the risk of **sympathetic ophthalmia** (an inflammation created in the uninjured eye by the affected eye that can result in blindness of the uninjured eye)
- **Splash Injury**
  - **Management**
  - Eye should be immediately irrigated with tap water or normal saline
  - Manipulation of the eye must be avoided until patient is under general anesthesia
  - Parenteral, broad-spectrum antibiotics are initiated
  - Tetanus antitoxin is administered as well as analgesics
  - In cases of a ruptured globe, cycloplegic agents (agents that paralyze the ciliary muscle or topical antibiotics must be deferred because of potential toxicity to exposed intraocular tissues

EARS

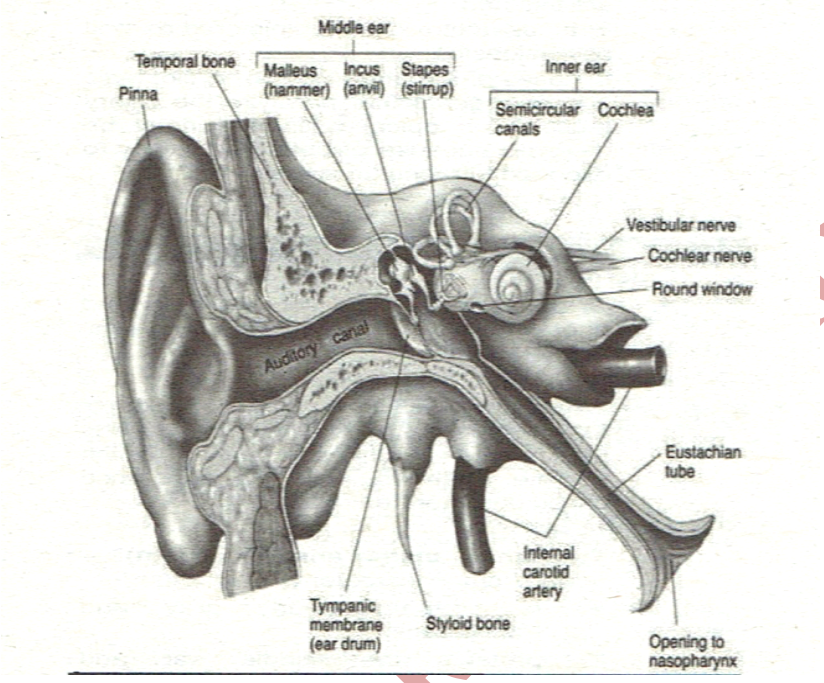
ANATOMY OF THE EAR

- External Ear
  - **Auricle** — collects the sound waves and directs vibrations into the external auditory canal.
  - **External auditory canal**-Approximately 2.5 cm long, the skin of the canal contains hair, sebaceous glands, and ceruminous glands, which secrete a brown, wax like substance called cerumen (ear wax).
- **Middle Ear**
  - **Tympanic membrane (eardrum)** — about 1 cm in diameter and very thin
    - ✓ Normally pearly gray and translucent
    - ✓ protects the middle ear and conducts sound vibrations from the external canal to the ossicles
  - **Ossicles**

- ✓ Contains the three smallest bones of the body: the malleus, the incus, and the stapes
- ✓ Assist in the transmission of sound

❖ **Inner Ear**

- Housed deep within the temporal bone. The organs for hearing (**cochlea**) and balance (**semicircular canals**), as well as cranial nerves VII (**facial nerve**) and VIII (**vestibulocochlear nerve**), are all part of this complex anatomy
- The cochlea and semicircular canals are housed in the bony labyrinth. The bony labyrinth surrounds and protects the membranous labyrinth, which is bathed in a fluid called perilymph
- Organ of Corti - housed in the cochlea, a snail-shaped, bony tube about 3.5 cm long with two and a half spiral turns
  - ❖ Also called the end organ for hearing, transform mechanical Energy into neural activity and separates sounds into different frequencies.
- In the internal auditory canal, the cochlear (acoustic) nerve, arising from the cochlea, joins the vestibular nerve, arising from the semicircular canals, utricle, and saccule, to become the vestibulocochlear nerve (cranial nerve VIII).



AUDITORY ASSESSMENT

❖ **Inspection of the External Ear**

- External ear is examined by inspection and direct palpation
  The auricle and surrounding tissues should be inspected for deformities, lesions, and discharge, as well as size, symmetry, and angle of attachment to the head
- External otitis is suspected if there is pain upon manipulation of the auricle
- Mastoiditis is suspected if there is tenderness upon palpation of the mastoid area
- Seborrheic dermatitis is suspected if flaky scaliness on or behind the auricle is present

❖ **Otoscope**

- Examines the external auditory canal and tympanic membrane
- Otoscope should be held in the examiner's right hand, in a pencil-hold position, with the examiner's hand braced against the patient's face

❖ **Whisper Test**

- The examiner covers the untested ear then whispers softly from a distance of 1 or 2 feet from the unoccluded ear. The patient with normal acuity can correctly repeat what was whispered.

❖ **Weber test**

- Uses bone conduction to test lateralization of sound.
- A tuning fork is set in motion by tapping it on the examiner's knee or hand, and placed on the patient's head or forehead

❖ **Rinne test**
- Examiner shifts the stem of a vibrating tuning fork between two positions: 2 inches from the opening of the ear canal (for air conduction) and against the mastoid bone (for bone conduction)

Tuning Fork Tests

EAR CONDITION	WEBER TEST	RINNE'S TEST
Normal, no hearing loss	hears the sound equally in both ears	air-conducted sound is louder than bone-conducted sound
Conductive loss	hears the sound better in the affected ear	bone-conducted sound is longer than air-conducted sound
Sensorineural loss	hears the sound in the better-hearing ear	air- conducted sound is longer than bone-conducted sound

❖ **Audiometry**
- used in detecting hearing loss
- **Pure-tone audiometry** -sound stimulus consists of a pure or musical tone (the louder the tone before the patient perceives it, the greater the hearing loss)
- **Speech audiometry** -spoken word is used to determine the ability to hear and discriminate sounds and words.

EXTERNAL EAR PROBLEMS

OTITIS EXTERNA

❖ Refers to an inflammation of the external auditory canal

❖ **Etiology**
- Bacterial causes, usually Pseudomonas, and Staphylococcus aureus
- Fungal infection with Aspergillus and Candida albicans
- Trauma to the ear canal, usually from cleaning the canal
- Stagnant water in ear canal after swimming (**swimmer's ear**)

❖ **Clinical Manifestations**
- Pain and discharge from the external auditory canal
- Aural tenderness
- Fever, cellulitis, and lymphadenopathy.
- Hearing loss or feeling of fullness
- Ear canal is erythematous and edematous
- Discharge may be yellow or green and foul-smelling
- In fungal infections, hair-like black spores may even be visible

❖ **Management**
- If canal is swollen and tender, an antibiotic solution containing a corticosteroid is chosen to reduce inflammation and swelling. If acute inflammation and closure of the ear canal prevent drops from saturating canal, a wick may need to be inserted so drops will gain access to walls of entire ear canal.
- Burow's solution (aluminum acetate solution) or topical corticosteroid cream or lotion is used in otitis externa caused by dermatitis.
- Fungal infection may be treated with a topical antifungal such as nystatin.
- In chronic otitis externa, debris from ear canal may need to be removed through irrigation or suction, after pain and swelling have subsided.
- Tympanic membrane perforation or a current Warm compresses and analgesics may be needed.

❖ **Nursing Interventions**
- Instruct patients not to clean the external auditory canal **with cotton-tipped applicators**
- Avoid events that traumatize the external canal
- Avoid getting the canal wet when swimming or shampooing the hair
- Infection can be prevented by using antiseptic otic preparations after swimming

MIDDLE EAR PROBLEM

ACUTE OTITIS MEDIA

- An inflammation and infection of the middle ear caused by the entrance of pathogenic organisms, with rapid onset of signs and symptoms. It is a major problem in children but may occur at any age.
- Pathogenic organisms gain entry into the normally sterile middle ear, usually through a dysfunctional eustachian tube
- Most common organisms include Streptococcus pneumoniae, Haemophilus influenzae and Staphyloccocus Aureus
- **Clinical Manifestations**
  - May involve one or both ears
  - Progressive conductive or mixed hearing loss
  - May or may not complain of tinnitus
  - Normal tympanic membrane but may also reveals a pinkish orange tympanic membrane because of vascular and bony changes in the middle ear
  - Bone conduction is better than air conduction on Rinne testing
- **Surgical Management**
  - **Stapedectomy**
    - ✓ Involves removing the stapes superstructure and part of the footplate and inserting a tissue graft and a suitable prosthesis.
    - ✓ Balance disturbance or true vertigo may occur during the postoperative period for several days

MENIERE'S DISEASE

- Abnormal inner ear fluid balance caused by a malabsorption in the endolymphatic sac or a blockage in the endolymphatic duct
- **Clinical Manifestations**
  - Fluctuating, progressive sensorineural hearing loss
  - Feeling of pressure or fullness in the ear
  - Meniere's Triad
    - ✓ Tinnitus or a roaring sound
    - ✓ Vertigo, often accompanied by nausea and vomiting
    - ✓ Sensorineural hearing loss
- **Diagnostic Evaluation**
  - Caloric testing to differentiate Meniere's disease from intracranial lesion
    - ✓ Fluid, above or below body temperature, is instilled into the auditory canal
    - ✓ Will precipitate an attack in patients with Meniere's disease
    - ✓ Normal patient complains of dizziness; patient with acoustic neuroma has no reaction
  - Audiogram shows sensorineural hearing loss.
  - CT scan, MRI to rule out acoustic neuroma
- **Management Medical**
  - Patient can be asked to keep a diary noting presence of aural symptoms (eg, tinnitus, distorted hearing) when episodes of vertigo occur. This may help diagnose which ear is involved and whether surgery will be needed
  - Administration of osmotic diuretics (Diamox)
  - Administration of the vestibular suppressant to control symptoms
    - ☐ Meclizine (Antivert, Bonine) up to 25 mg qid
    - ☐ Diphenhydramine (Benadryl) 25 to 50 mg tid to qid
    - ☐ Diazepam (Valium) 2 mg tid or 5 to 10 mg I.M. or I.V. (addictive potential)
  - Streptomycin (I.M.) or gentamicin (transtympanic injection) may be given to selectively destroy vestibular apparatus if vertigo is uncontrollable
  - Additional antiemetic, such as Promethazine (Phenergan), may be needed to reduce nausea, vomiting, and resistant vertigo

Surgery

- **Endolymphatic Sac Decompression**
  - Theoretically equalize-8" the pressure in the endolymphatic space
  - A shunt or drain is inserted in the endolymphatic sac through a postauricular incision

- **Labyrinthectomy**

- Recommended if the patient experiences progressive hearing loss and severe vertigo attacks so normal tasks cannot be performed; results in total deafness of affected ear

❖ **Vestibular Nerve Section**
- Neurosurgical suboccipital approach to the cerebellopontine angle for intracranial vestibular nerve neurectomy

❖ **Common Complications**
- Irreversible hearing loss
- Disability and social isolation due to vertigo and hearing loss
- Injury due to falls

❖ **Nursing Management**
- Help patient recognize aura so patient has time to prepare for an attack
- Encourage patient to lie down during attack, in safe place, and lie still
- **Limit foods high in salt or sugar**. Be aware of foods with hidden salts and sugars.
- Limit alcohol intake. Alcohol may change the volume and concentration of the inner ear fluid and may worsen symptoms.
- Avoid aspirin and aspirin-containing medications
- Teach about medication therapy, including side effects
- Advise patient to keep a log of attacks, triggers, and severity of symptoms
- Encourage follow-up hearing evaluations and provide information about surgical care

IMPACTED CERUMEN AND FOREIGN BODIES

❖ Accumulated cerumen (earwax) may become impacted due to use of cotton swabs to clean ears and may be a problem for some people

❖ Cerumen becomes drier in elderly people, making impaction more likely

❖ Foreign bodies may be lodged in the ear canal intentionally or accidentally by the patient or other person (usually in children), or the patient may be completely unaware, as in insect obstruction

❖ **Etiology**
- May be underlying seborrhea or other dermatologic condition that causes flaking of skin that mixes with cerumen and becomes obstructive
- Cerumen may be pushed back over tympanic membrane by action of cotton swab
- Insect may fly or crawl into ear, causing initial low rumbling sound; later, feeling that ear is plugged and decreased hearing acuity
- Children who introduce peas, beans, pebbles, toys, and beads

❖ **Clinical manifestations**
- Decreased hearing acuity
- Feeling that ears is plugged
- Pain and fever
- Drainage may occur

❖ **Management**

For Impacted Cerumen
- Cerumen can be removed by irrigation.
- Suction, or instrumentation unless the patient has a perforated eardrum or an inflamed external ear
- For successful removal, the water stream must flow behind the obstructing cerumen to move it first laterally and then out of the canal
- If irrigation is unsuccessful, direct visual, mechanical removal can be performed.
- Instilling a few drops of warmed glycerin, mineral oil, or half-strength hydrogen peroxide into the ear canal for 30 minutes can soften cerumen before its removal
- Use of cerumen curette, aural suction, and a binocular microscope for magnification

For Foreign Objects
- Irrigation for dislodged bodies and insects are contraindicated
- Insect can be dislodged by instilling mineral oil
- Mechanical removal and aural suction can be performed
- Foreign body may have to be extracted in the operating room with the patient under general anesthesia