

Head, Neck, Lymphatics, Eyes, Ears, Nose, and Throat

Clinical Conditions Lecture Notes

Lymphatics: Anatomy and function review

- First we must begin with a review of the lymphatic system and its anatomy
- Lymphatic systems includes:
 - Fluid
 - Collecting ducts
 - Lymph nodes
 - Spleen
 - Thymus
 - Tonsils
 - Adenoids
 - Peyer's patches

Lymph tissue is also found in other body parts, like stomach, appendix, bone marrow, and lungs

Function of lymphatic system

- Maintenance of fluid balance
- Production of lymphocytes
- Production of antibodies
- Phagocytosis
- Absorption of fat and fat-soluble substances
- Manufacture of blood when primary sources are compromised
- Unfortunately, it also plays a role in the spread of malignancy

Lymphatic system and CV system

- The fluids and proteins of lymphatic fluid originally move from the blood into the interstitial spaces
- The fluid is then collected by microscopic tubules, which later form to make larger ducts
- The large ducts carry the lymph to the lymph nodes around the body
- The lymph nodes pass the fluid onto vessels that eventually lead to the subclavian veins

Drainage points

- Lymph has 2 major drainage points
- The right upper body (right half of face, neck, right upper extremity and right chest to mid abdomen) is drained by the **RIGHT LYMPHATIC DUCT**, which empties into the right subclavian vein
- The rest of the body is drained by the **THORACIC DUCT**, which empties into the left subclavian vein
- This process then closes the loop between the CV and lymphatic systems

How does lymph move?

- The lymphatic system has no built-in pumping mechanism to move the lymph
- It depends on the CV system to move (passively)
- As fluid volume increases, the capillary pressure increases, leading to greater permeability of vessels and increased flow
- It also depends on physical activity, metabolic activity and massage for flow
- Lymph can also be obstructed along any of these paths, leading to fluid collection or to the development of collateral connecting channels

Lymph nodes

- Occur in groups, some superficial in the subcutaneous tissues, and some deep to the fascia of muscles and in cavities
- **Most nodes are tiny**, but could be as large as 1 cm

Thymus

- Superior mediastinal structure, extending into the lower neck
- It is largest in the child and is essential to the development of immune function
- In the adult, it shrinks significantly and has little or no demonstrated function

Spleen

- Situated in the LUQ between the stomach and diaphragm
- Highly vascular and is made of white pulp (lymphatic tissue) and red pulp (venous sinusoids)
- The spleen is hematopoietic early in life and serves to filter the blood
- We'll examine more in the Abdomen section

Peyer patches

- Peyer patches are small areas of lymphoid tissue on the mucosa of the small intestine

Palatine, pharyngeal, and lingual tonsils

- The palatine tonsils are commonly known as "The tonsils"
- They are located between the palatine arches on either side of the pharynx, just beyond the base of the tongue
- They are composed mostly of lymphoid tissue
- Pharyngeal tonsils are AKA "adenoids" and are located at the nasopharyngeal border
- The lingual tonsils are located near the base of the tongue

Adults vs. kids

- Thymus is at its largest weight at puberty
- Palatine tonsils are much larger during early childhood
- Enlarged tonsils in children is not necessarily indicative of infection
- Palpation of occipital, postauricular, and inguinal lymph nodules is common in a child under 2
- Cervical and submandibular nodes are uncommon prior to age 1
- Supraclavicular nodes are not usually found in children, and may indicate malignancy if present

Older adults

- The number and size of lymph nodes may decrease with increasing age
- The nodes are more likely to be fibrotic and fatty
- Histological changes can lead to diminished function of the lymph system

HPI for Lymphatic Red Flags

- Delayed healing
- Bleeding:
 - Nose, mouth, gums, rectal (frank or occult with color change), petechiae, easy bruising, blood in vomitus
- Enlarged nodes:
 - ? with pain, fever, redness, warmth, red streaks, itching
- Swelling of extremity:
 - Unilateral or bilateral; Hx of renal or CV disease, surgery, infection, trauma
- Medications:
 - Chemotherapy, antibiotics

PHH for Lymphatic Red Flags

- Chest x-rays
- TB and other skin testing
- Blood transfusions, use of blood products
- Chronic illness: CV, renal, malignancy, HIV
- Surgery: trauma to or removal of nodes
- Recurrent infections

Accessible lymph nodes

- Cervical “Necklace” Nodes:
 - Occipital
 - Postauricular and preauricular
 - Retropharyngeal (a.k.a. tonsillar)
 - Parotid
 - Submandibular
 - Submental
 - Sublingual (a.k.a. facial—under the tongue)
 - Superficial anterior cervical
 - Superficial posterior cervical
 - SCM (part of posterior cervical)
 - Supraclavicular (a.k.a. Virchow’s nodes)

Accessible Lymph Nodes

- Arms:
 - Axillary
 - Epitrochlear (cubital)
- Legs:
 - Superficial superior inguinal
 - Superficial inferior inguinal
 - Popliteal (occasionally)

Head and Neck Evaluation

HPI for Head & Neck Red Flags

- Head injury: hx of LOC, predisposing factors (seizures, syncope), associated symptoms (pain, vision changes, nasal discharge, nausea), medications
- Headache
- Stiff neck: hx of injury, swelling, fever, medications
- Thyroid problems: change in temp preference, dysphagia, pain, hair or skin changes, lethargy, menstrual flow problems

PHH for Head & Neck Red Flags

- Head trauma, lumbar puncture
- Radiation therapy
- Headaches
- Regional surgery
- Seizure disorder
- Known thyroid dysfunction

The Head and Neck Examination: Inspection

- Head and neck position (tremor, torticollis, hearing or vision loss, symmetry of SCMs and traps, position of trachea, masses)
- Facial features (shape and symmetry)
- Tics
- Edema, coarsened features, prominent eyes, hirsutism, coloring
- Skin and hair (to be discussed in another section)

The Head and Neck Examination: Palpation

- Skull should be symmetrical and smooth
- Suture sites generally not prominent
- Hair should be smooth, evenly distributed
 - Coarse hair = ? Very fine hair = ?
- Temporal arteries should be smooth with palpable pulse, without thickening, tenderness, or hardness
- Trachea should be midline

Tracheal tug

- A tracheal tug is a downward displacement of the cricoid cartilage with each ventricular contraction
- Pt is seated with head extended
- Examiner grasps the cricoid cartilage and applies a gentle upward pressure
- A downward tug of the trachea, synchronized with systole, reveals the presence of an aortic arch aneurysm

Campbell's Sign

- Campbell's sign is the downward displacement of the thyroid cartilage during inspiration
- It is not due to an aortic arch aneurysm, but to COPD
- Place the tip of the index finger over the thyroid cartilage and look for downward displacement
- This sign is an accurate indicator of COPD and the degree of displacement correlates well with the severity of compromise of the FEV
- It is due to the strong diaphragmatic contractions of COPD patients

Thyroid Gland

- The thyroid gland may not be the most important organ or system in the body, but it is second only to the heart in # of errors in examination technique and lack of confidence among primary care physicians

Thyroid disorders

- A goiter (Latin *gutter* = throat) is a chronic enlargement of the thyroid
- A goiter is not a neoplastic or inflammatory process—it is the result of hypertrophy or degeneration of the gland
- Functionally, the goiter could be euthyroid or dysthyroid (hyper or hypo)
- Thus, the presence of a goiter does not necessarily reflect the functional status

Goiters and pregnancy

- A true goiter is uncommon, but mild hypertrophy during pregnancy is not uncommon as a result of the changed hormonal environment
- It is so common, that the fathers of ancient Rome used to observe and measure the necks of their young daughters to gauge their “purity”

Pure trivia—but interesting anyway

- Normal size depends on the region—mountainous regions are endemic
- Large thyroid goiters were so common among mountaineers of Switzerland and northern Italy that they became part of the local folklore
- For example, among the masks of Italian Commedia dell’Arte was a mountaineer named Gioppino

More trivia

- The word *cretin* (endemic or congenital hypothyroidism) is also related to the goiters of mountaineers
- A group of Christians was allowed to settle in the French Pyrenees to escape religious persecution
- They all developed hypothyroidism and the mental defects associated with the condition
- When traveling to different villages, they were easily recognizable and immediately referred to as *cretins* (Chretien = French for Christian)

What is the precision and accuracy of physical exam of the thyroid gland?

- Despite the concern for mistakes, interobserver variability for estimating the presence or absence of a goiter and in estimating the size is .77 k
- Intraobserver variability for inspection is $k=.73$ and $k=.65$ for palpation
- The sensitivity of detecting a goiter with physical exam is 70% and the specificity is 82%

Auscultation of the thyroid

- You should auscultate the thyroid in patients with a goiter and those with findings suggestive of hyperthyroidism
- In those patients, a bruit may be heard, indicating increased vascularity
- This is a highly specific finding for Grave's thyrotoxicosis
- A bruit is rarely found in any other thyroid condition

43 y/o female with CC of "decreased energy"

- This patient complains of fatigue, inability to finish tasks, increased sleeping, but "always tired". She has noticed a decreased cold tolerance, constipation, and dryness of the skin. She comments that she is always cold, even in the summer. She has a FH of thyroid problems, but doesn't know the details.

Primary hypothyroidism

- Occurs when a disorder of the thyroid gland prevents it from producing adequate amounts of thyroid hormone
- Symptoms vary from mild to severe and from nonspecific to very specific
- Generally, all metabolic processes slow down
- Fatigue, depression, decreased intellectual function, cold intolerance, dry skin, constipation
- Heart rate is slowed and the DTR are diminished
- High cholesterol, mild anemia, high serum enzymes
- The T4 and Free T4 is low and the TSH is always high
- T3 may be normal

35 y/o female with CC of fatigue

- She has noticed a decrease in energy for about two years. She recently closed her business because of an inability to keep up with the work. She has noticed an intolerance to cold.
- ROS: frontal headaches for 6 months; LMP was 7 months ago
- Physical Exam: pale, without acute distress; visual field assessment shows homonymous hemianopsia; skin is dry and axillary and pubic hair is reduced.

Secondary Hypothyroidism

- AKA: Hypopituitarism
- Failure of the thyroid gland due to inadequate production of TSH. Can be due to primary failure of the pituitary gland or as the result of hypothalamus dysfunction (tertiary hypothyroidism).
- Pituitary failure can result from tumor, trauma, radiation, infarction, or idiopathic
- Symptoms are generally less severe than primary hypothyroidism, but may be complicated by deficiencies of other hormones and the mass effects of the tumor
- This patient MUST be evaluated for a pituitary or hypothalamic tumor. How can this be done?

48 y/o female in for a routine check up

- She denies any symptoms of hyper or hypothyroidism, but has a strong family history of thyroid disease
- Physical exam reveals a small diffuse goiter on the right
- The right lobe measures approximately 3 cm by 3 cm

“Subclinical” hypothyroidism

- AKA: Compensated hypothyroidism
- Occurs when the patient's Total and Free levels of thyroid hormone are normal, but the TSH is slightly elevated.
- May be a situation when a damaged thyroid gland is able to meet the needs of the body only with excess stimulation of the pituitary gland
- Patients usually do not have symptoms of hypothyroidism and do not feel better after most allopathic treatments
- Thyroid gland may be normal to palpation or may have a goiter
- Some will progress to overt hypothyroidism over time, particularly those with a family history of thyroiditis

10 y/o female with CC of growth failure

- She was a good student who had grown normally until the age of seven
- The patient and the parents deny other symptoms
- Physical exam reveals a child in the 5th percentile for height and 90th percentile for weight; her skin is dry and thick
- DTRs are diminished in return phase
- Thyroid is 3 X normal size on palpation
- Skeletal maturation is 8 years of age

Juvenile Hypothyroidism

- Thyroid hormone is essential for normal growth and for bone maturation; thus, growth failure, short stature, and delayed bone age is almost always present
- Before the age of 2, thyroid hormone is essential for normal brain development
- Other signs and symptoms may be absent
- Occasionally, the sella may be enlarged in severe and prolonged juvenile primary hypothyroidism; this is presumably due to hyperplasia of the thyrotrophs (produce TSH)
- Rarely, precocious puberty may be seen (?)

44 y/o man who is cared for by his mother

- He is severely mentally retarded and cannot communicate
- Physical exam reveals a man only 40" tall with very thick, dry skin; his tongue is thick and he has a “saddle nose”; his primary teeth are still present and the secondary teeth have not erupted
- Radiographic exam reveals open physes

Congenital hypothyroidism

- A relatively common disorder which is screened for at birth
- Again, thyroid hormone is necessary for brain development in the first 2 years and is necessary for linear growth
- If absent, severe brain damage and skeletal retardation occur

32 y/o man with CC of heat intolerance and weight loss

- His symptoms started about 3 months ago and have been getting worse
- He has lost 10 pounds in the last 6 weeks, but has a normal appetite
- He states he is “always hot”, even in an air-conditioned room
- Upon questioning, he admits to increased nervousness, trouble concentrating, and palpitations; it is difficult for him to complete fine motor tasks due to tremors
- Physical exam reveals a patient with warm, smooth, moist skin and a diffuse goiter with a palpable thrill and bruit
- Neurological exam shows a fine tremor and fast return for DTRs

Hyperthyroidism

- Hyperthyroidism is due to an excess amount of free thyroid hormone
- There is a generalized increase in metabolic activity, including O₂ use
- Symptoms include: heat intolerance, nervousness, irritability, palpitations, weight loss, increased defecation
- Women may have decreased frequency of menses
- Physical exam may reveal hyperkinesia, warm and moist skin, prominent stare, and lid lag
- Neurological exam may reveal a fine tremor, fast return for DTRs
- Cardiac exam may reveal high cardiac output, atrial fibrillation, flow murmurs
- The thyroid gland may be diffusely enlarged, nodular, or normal size
- Lab tests almost always show low TSH and high T₃ and T₄

45 y/o female with CC of nervousness

- She has a one-month history of increased nervousness associated with a short temper, crying easily, and tremor
- She states she has lost 25 pounds without dieting over the last 2 months and is “always hot”; she reports that her eyes “feel dry”
- Physical exam reveals prominent eyes

Grave's Disease

- Grave's disease is an autoimmune disease in which the immune system produces antibodies which stimulate the TSH receptors of the thyroid gland
- The result is non-suppressible overproduction of thyroid hormone, leading to the clinical manifestations of hyperthyroidism
- Grave's is frequently associated with exophthalmos and swelling of the periorbital tissues
- It causes an infiltrative ophthalmopathy, leading to increased mass of the retrobulbar and extraocular muscles (leading to proptosis)
- Patients often complain of dry, burning eyes
- Rarely, there may be skin thickening on the legs (pretibial myxedema)
- Often a FH of both Grave's and autoimmune thyroiditis

3 major manifestations of Grave's disease

- Hyperthyroidism with a diffuse goiter
- Dermopathy
- Ophthalmopathy
- When the three occur together, the dx is easy
- However, the manifestations have different courses, making the dx more challenging

Hashimoto's Disease/Hashimoto's thyroiditis

- Characterized by an insidious symmetrical enlargement of the thyroid, which becomes firm but not painful
- Antithyroglobulin antibody and antimicrosomal antibody titers are usually high
- Thyroid acini are almost replaced by B lymphocytes
- Unlike Grave's disease, there is no antibody against TSH receptors
- Gradually, affected patients develop hypothyroidism

Thyroid acropachy

- Autoimmune disease that may cause digital clubbing and periostitis (other diseases also cause digital clubbing, so this sign is not pathognomonic)
- It is usually asymptomatic

Additional cervical masses

Parotitis and Parotid cancer

- Parotitis is usually due to infection with the mumps virus, but may also be bacterial
- Acute parotitis may cause such swelling to push the earlobes forward and laterally
- In severe cases, it may limit jaw movement

- Parotid cancer is a rapidly developing, uncomfortable swelling in the parotid region associated with facial palsy
- Pleomorphic adenoma is the most common parotid tumor
- Mucoepidermoid carcinoma tends to cause skin ulceration, whereas lymphomas most commonly present with facial palsy

Frey's syndrome

- AKA: auriculotemporal syndrome
- Encountered in patients who have suffered either injury or surgery to the parotid gland
- Characterized by sweating, flushing, feeling of warmth in the auriculotemporal nerve distribution
- Usually triggered by eating

Thyroglossal duct cyst

- A freely movable cystic mass lying high in the neck at the midline; the bulk of the mass lies at the level of the thyroid cartilage
- It is a remnant of the thyroglossal duct, which connects the thyroid with the tongue in the embryo
- It usually disappears, leaving only a pit at the point of origin—the foramen cecum
- Because of the convexity of the hyoid and thyroid cartilages, the mass may be pushed laterally in some patients
- It does rise with deglutination, just like any other thyroid mass
- So, how do you differentiate from other thyroid masses?

Thyroglossal duct cyst

- To differentiate from another thyroid mass, have the patient forcefully stick out his tongue while you grasp the mass between your thumb and forefinger
- Because of the firm attachment to the base of the tongue, the thyroglossal duct cyst will rise with protrusion of the tongue

Thyroglossal fistula

- A thyroglossal fistula is an opening of the thyroglossal duct to the external structures
- Usually appears as a midline pit at the level of the thyroid cartilage
- It is subject to recurrent infections

Dermoids/teratomas

- Dermoids may occur in any line of embryologic fusion
- In the neck, they appear as midline masses, usually above the hyoid in the submandibular region
- May contain hair and epithelial debris
- Are usually soft and fluctuant
- Cannot be transilluminated and are not attached to the skin

Lateral neck swellings

- Laryngoceles
- A laryngocele (Greek = kele = hernia) is a hernia of the larynx that contains air
- It forms as a result of increased intraluminal pressure
- Which patients have increased intraluminal pressure?
- Is usually chronic and asymptomatic
- Sometimes the patient may have hoarseness and stridor and/or a superimposed infection

Branchial cyst

- Branchial cysts are remnants of the branchial arches and clefts—the arches form the lateral and ventral walls of the pharynx in the embryo
- Branchial clefts separate the arches externally and are usually reabsorbed in humans—they remain as gills in fish
- A branchial cyst is usually located near the middle 1/3 of the SCM and presents as a tense globular swelling at the angle of the jaw
- It characteristically bulges around the anterior border of the SCM— never posteriorly
- It does not transilluminate and does not move with deglutition

Neoplastic neck swellings

- Lymphomas—present with enlarged cervical lymph nodes
- Metastatic lymph nodes—may cause Horner's syndrome
- Swellings of neurogenic origin—neurofibromas, neuroblastomas, lipomas
- Paragangliomas or glomus tumors—occur at the bifurcation of the carotid or higher
- Other tumors—ectopic salivary tumors

Summary of Head and Neck Evaluation

- Anatomic landmarks
 - Anterior triangle
 - Posterior triangle
- Abnormal anatomy
 - Buffalo hump
 - Short Neck
 - Klippel-Feil syndrome
 - Sleep apnea syndrome
 - Pterygium colli
 - Noonan's syndrome
 - Turner's syndrome
 - Bonnevie-Ullrich syndrome

Summary

- Swellings of the neck
- Midline neck swellings
 - Thyroid
 - Thyroglossal cysts and fistulas
 - Dermoids
- Lateral neck swellings
 - Laryngoceles
 - Branchial cysts and fistulas
 - Branchial hygromas (fluid-filled bursa or sac)
- Inflammatory neck swellings
 - Lymph nodes
 - Abscesses (usually caused by suppurative of lymph node)
 - Neoplastic
- Masseter muscle hypertrophy
- Torticollis

Summary

- Salivary glands
 - Anatomic landmarks
 - Parotitis
 - Parotid cancer
 - Frey's syndrome
- Trachea
 - Palpation
 - Deviation
 - Campbell's sign
 - Tracheal tug

Eye pathologies

- AV ratio
- Cupping
- Xanthelasma
- Ptosis
- Ectropion
- Entropion
- Hordeolum (acute) Chalazion (chronic)
- Blepharitis-inflammation of lash follicles
- Cataracts

- Glaucoma
- Pterygium
- Conjunctivitis/red eye
- Senile hyaline plaque
- Drusen bodies
- Corneal ulcer
- Band keratopathy
- Corneal ulcer
- Strabismus
- Amblyopia
- Optic atrophy
- Retinoblastoma

- Coloboma
- Nystagmus
- Arcus cornealis
- Corneal light reflex
- Sty
- Blue sclera
- Viral conjunctivitis and preauricular node
- Arcus senilis
- Leukocoria

Hordeolum and Chalazion

- Hordeolum is also known as a sty (sty)
- Hordeolum is an inflammation of the lash follicle
- A chalazion is a plugged meibomian gland
- DDX: hordeolum is painful; chalazion is nontender (usually)

Blepharitis

- Blepharitis is a common condition that causes inflammation of the eyelids
- It is difficult to manage because it commonly recurs
- Anterior blepharitis affects the outer lid and is commonly caused by bacteria (staph) and scalp dandruff
- Posterior blepharitis affects the inner lid and is caused by problems with the oil or meibomian glands, acne rosacea, and scalp dandruff

Arcus cornealis

- An opaque, grayish ring at the periphery of the cornea, just within the sclerocorneal junction
- Frequently occurs in the elderly
- Results from fatty granules in, or hyaline degeneration of, the lamellae and cells of the cornea

Xanthelasma

- Yellowish, flat plaques that occur commonly near the inner canthus of the eyelid, more commonly on the upper lid than lower lid
- Xanthos = Greek = yellow
- Elasma = Greek = beaten metal plate
- They can be soft or semi-hard and are frequently symmetrical

Xanthelasma

- 50% of these lesions occur with elevated plasma lipid levels
- Some occur with altered lipoprotein composition or structure such as lowered HDL levels
- They frequently occur in patients with Type II hyperlipidemia

Pterygium/pinguecula

- Both are abnormal growths on the surface of the eyes
- A pinguecula does not typically interfere with sight and appears as a thickening lateral to the iris
- A pterygium may grow large enough to cover the iris and pupil and appears as a wedge-shaped growth lateral to the iris
- Both conditions are usually seen in warm, dry climates

Leukocoria

- "White reflex" instead of the red reflex
- Indicates that something is either changing the normal color of the retina (decreased blood supply) or that something is obstructing the normal reflex
- The most common cause is congenital cataract
- Retinoblastoma is the most serious cause of "white eye"

Conjunctivitis

- Viral conjunctivitis is very common; the eyes feel gritty and discharge is possible
- Bacterial conjunctivitis causes yellow, sticky pus in the eyes; it is very common and highly contagious
- It is also known as...
- Allergies and mechanical irritation also cause conjunctivitis

Amblyopia

- Amblyopia is caused by any condition that affects normal use of the eyes and visual development
- There are three major causes of amblyopia:
 - Strabismus
 - Unequal focus
 - Cloudiness of the eye tissues (lens, cornea)

Internal Eye

- The internal eye is composed of three separate layers or tunics
- The **outer tunic** consists of the cornea and sclera
- **Cornea**: transparent, clear, very thin membrane of epithelium in anterior 1/6 of tunic; contains no blood vessels and very few cells, keeping it clear; the cornea focuses entering light rays
 - **Best viewed from the lateral side of the patient**
- **Sclera**: continuous with the cornea and is the white portion of the eye; makes up the posterior 5/6 of the outer tunic and is made up of collagen and elastin; serves as the attachment for extrinsic muscles

Internal Eye

- The **middle tunic** consists of the choroid posteriorly, and the ciliary body and iris anteriorly
- **Choroid**: posterior 5/6 of middle tunic; is very loosely attached to the sclera and contains blood vessels and **melanocytes** to nourish the eye and keep the inside dark
- **Ciliary body**: thickest part of middle tunic; attached to suspensory ligaments, which attach to and change the lens shape
- **Iris**: colored portion of eye that acts as a diaphragm; extends from ciliary body and is the dividing point between the anterior and posterior chambers; the iris contracts in response to light, gaze, and emotions

Internal Eye

- The **inner tunic** consists of the retina
- **Retina (fundus)**: light sensitive with photoreceptors and is continuous with the optic nerve; the retina ends at the ciliary body; it contains rods (peripheral and night vision) and cones (central and color vision)
 - **Macula (fovea centralis or macula lutea)**: contains the highest concentration of cones and therefore is the area of most precisely focused vision; is a yellowish-red area about 1mm by 1mm

- **Retina**:
 - **Optic disk**: head of the optic nerve and is the most prominent structure seen with ophthalmoscopic exam; can vary from white to pink and flat to “scooped out” or cupped
 - **Optic nerve**: axons of ganglion cells of retina, converging to the optic disk; the optic nerve connects the eye to the brain (continuous with the subarachnoid space of the brain)
 - **Central retinal artery and vein**: provides circulation and nourishment to the eye

Internal Eye

- **Other structures**:
- **Aqueous humor**: clear, watery fluid from posterior cavity, through pupil, into the anterior chamber; nourishes the cornea and lens and helps maintain the shape of the anterior eye
- **Anterior chamber**: bordered by the cornea and the iris and is filled with aqueous humor
- **Posterior chamber**: bordered by the iris and the front of the lens
- **Canal of Schlemm**: aqueous humor leaves through veins and the canal

Internal Eye

- Lens: clear, elastic structure immediately behind the iris; it refracts and focuses light onto the retina, which is then carried to the optic nerve and brain; the lens is under constant tension by the ciliary bodies and suspensory ligaments;
 - Near vision: decreased tension, allowing for a more convex shape and accommodation
 - Far vision: increased tension, causing a less convex shape

Diabetic retinopathy

- Diabetes, resulting in retinopathy, is the most common cause of blindness in individuals under the age of 65 (US)
- The duration of diabetes is the most important single risk factor with a 90% prevalence of retinopathy in those with the disease more than 15 years
- Early detection and treatment is currently the best hope of preservation of functional vision

Nonproliferative Diabetic Retinopathy (NDR)

- Most common form of diabetic retinopathy
- After 20 years of diabetes, almost 100% of patients with Type I and 60% of patients with Type II diabetes have some degree of retinopathy
- Clinical features:
 - Microaneurysm, hemorrhages, cotton wool spots, exudates

Proliferative Diabetic Retinopathy (PDR)

- Characterized by growth of new vessels on the surface of the retina
- Clinical features:
 - Progressive loss of vision
 - Fine to severe loops of new vessels that may grow on the optic disk (neovascularization of the disk {NVD} or elsewhere {NVE})
 - New vessels may leak and result in retinal edema
 - Risk factors: duration of diabetes, high cholesterol and LDL, cigarette smoking, alcohol

Cotton wool spots

- Small, yellowish areas of coloration in the retina
- They occur because of swelling of the surface of the retina (microinfarcts)
- The swelling usually occurs because blood to the retina has been impaired; in the absence of normal blood flow, the nerve fibers are injured
- Often the spots will disappear on their own, but will recur with further blood flow impediments
- Cotton wool spots are most commonly due to diabetes and high blood pressure

Microaneurysms

- The microaneurysm is often the earliest recognizable clinical sign of diabetic retinopathy
- They are seen as small, round, dark red dots on the retinal surface (not arising from visible vessels) that are less than the diameter of the optic veins
- They increase in number as the degree of retinal involvement progresses

Hemorrhages

- Retinal hemorrhages have variable shapes, sometimes resembling bundles of straw, or may be round or flame-shaped
- They indicate an increasingly ischemic retina
- As the number of hemorrhages increases, the retinal vessels become more damaged and leaky, leading to exudation of fluid, lipid, and proteins

Exudates

- Exudates represent accumulations of lipid and protein
- They are typically bright, reflective, white or cream colored lesions on the retina
- They indicate increased vessel permeability and an increased risk of retinal edema
- If this swelling occurs on the macula, vision may be lost

Hypertensive retinopathy

- The patient with hypertensive retinopathy may be completely unaware of his or her hypertensive state
- The eye exam may yield the first clue to this asymptomatic disease
- Most commonly, the patient is middle-aged or older
- Hypertension is more common in African-Americans than Caucasians
- Patients with only hypertensive retinopathy are usually visually asymptomatic

Hypertensive retinopathy findings

- Cotton wool spots
- Flame-shaped hemorrhages
- Retinal or macular edema
- In advanced cases, a macular star (ring of exudates from the disk to the macula)
- Disk edema
- Arteriosclerosis is often found concurrently

Hypertensive retinopathy pathophysiology

- All the findings stem from the hypertension-induced changes in the retinal microvasculature
- Hypertension leads to a “laying down” of cholesterol into the tunica intima of medium and large arteries, leading to a decreased lumen size of these vessels and focal closure of the vessels
- This gives rise to the hemorrhages and cotton wool spots
- The mechanism is not fully understood, but it may be related to hypertension-induced increase in the ICP (intracranial pressure)

AV ratio and AV nicking

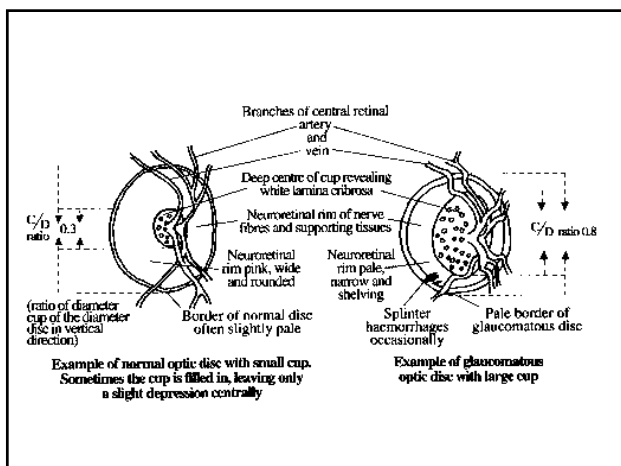
- Remember that the normal arteriovenous ratio is 3:5 to 2:3
- The site of the crossing, the arteriole and vein share a common adventitial sheath
- Vascular sclerosis causes compression of the underlying lumen, resulting in “AV nicking” or a tapering of a venule (“skips”)
- The most common reason for AV nicking is prolonged systemic hypertension

Drusen bodies

- Drusen bodies are round yellow deposits which form within a layer under the retina
- The cause is not entirely understood, but atherosclerosis, amount of pigmentation (darker=more), heredity, and exposure to sunlight are all factors
- When the Drusen bodies form in the periphery, usually no visual defect is noted
- When they form in the center (macula), vision is affected

Glaucoma

- Increased pressure within the eye caused by obstruction of the aqueous humor outflow
- The increased pressure leads to destruction of the optic nerve fibers and visual field deficits
- Palpation of the globes can sometimes reveal increased resistance (firmness) of the glaucomatous eye
- Ophthalmological exam reveals “cupping” of the optic disk



Retinal tears

- Retinal tears commonly occur when there is traction on the retina by the vitreous gel
- In a child, the vitreous has an egg-white consistency and is firmly attached to certain areas of the retina
- Over time, the vitreous gradually becomes thinner, more liquid, and separates from the retina (posterior vitreous detachment—PVD)
- PVDs are typically harmless and cause “floaters” in the eye

Floaters

- As the vitreous pulls free from the retina, it is often accompanied by light flashes or floaters
- Floaters are caused by tiny bits of vitreous gel or cells that cast shadows on the retina
- Symptoms:
 - Black spots or “spider webs” that seem to float in the vision in a cluster or alone
 - Spots that move or remain suspended in one place
 - Flickering or flashing lights that are most prominent when looking at a bright background (like the sky)

Retinal detachment

- A retinal detachment occurs when the retina’s sensory and pigment layers separate
- Retinal detachment is considered an ocular emergency because it can cause permanent visual damage
- It occurs most commonly in middle-aged and elderly

3 types of retinal detachment

- Most common type occurs when there is a break in the sensory layer of the retina, and fluid seeps underneath, causing the layers of the retina to separate
- Those who are very nearsighted (eye globes are longer, causing the retina to be thinner), have undergone eye surgery (not Lasik or RK), or have experienced a serious eye injury are more susceptible

- 2nd most common type of retinal detachment occurs when strands of vitreous or scar tissue create traction on the retina, pulling it loose
- Patients with diabetes are more likely to experience this type

- 3rd most common type of retinal detachment occurs when fluid collects underneath the layers of the retina, causing it to separate
- This type usually occurs in conjunction with another disease that affects the eyes

Signs and symptoms of retinal detachment

- Light flashes
- “Wavy” or “watery” vision
- Veil or curtain obstructing vision
- Shower of floaters that resemble spots, bugs, or spider webs
- Sudden decrease of vision
- It is critical that you refer the patient to an ophthalmologist immediately for care to improve the chances for vision preservation

Papilledema

- Papilledema is an optic disk swelling secondary to elevated intracranial pressure (ICP)
- In contrast to other causes of optic disk swellings, vision is usually well preserved with acute papilledema
- It almost always presents as a bilateral phenomenon and may develop over hours to weeks
- The term should not be used to describe underlying infectious, infiltrative, or inflammatory etiologies

Papilledema

- The disk swelling in papilledema is the result of axoplasmic flow stasis with intra-axonal edema in the optic disk area
- The subarachnoid space of the brain is continuous with the optic nerve sheath
- Hence, as the CSF pressure increases, the pressure is transmitted to the optic nerve
- The optic nerve sheath acts as a tourniquet to impede axoplasmic transport
- This leads to a swelling of the nerve head

Papilledema symptoms

- Papilledema may occur at any age, except during infancy before the fontanelles close
- Symptoms:
 - Headache: increased ICP headaches are characteristically worse on awakening, and are exacerbated by coughing or other Valsalva maneuvers
 - Nausea and vomiting: may occur if ICP is high, eventually leading to LOC, pupillary dilation, death
 - Visual symptoms are often absent, but could have: graying, blurring, diplopia, decreased visual acuity

Common Abnormalities: Ear

- Otitis externa (swimmer's ear)
- Acute otitis media
- Middle ear effusion
- Cholesteatoma
- Otosclerosis
- Ménière's disease (vertigo, tinnitus)
- Labyrinthitis