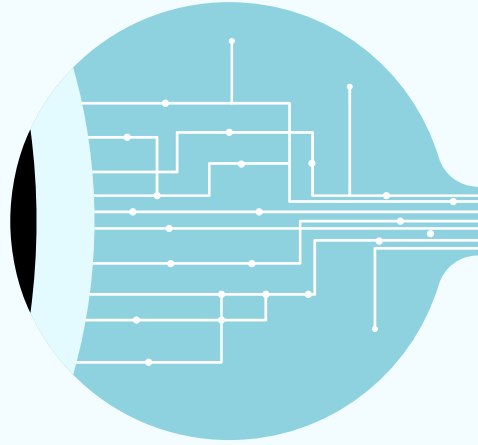


Lecture 1



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History and physical examination

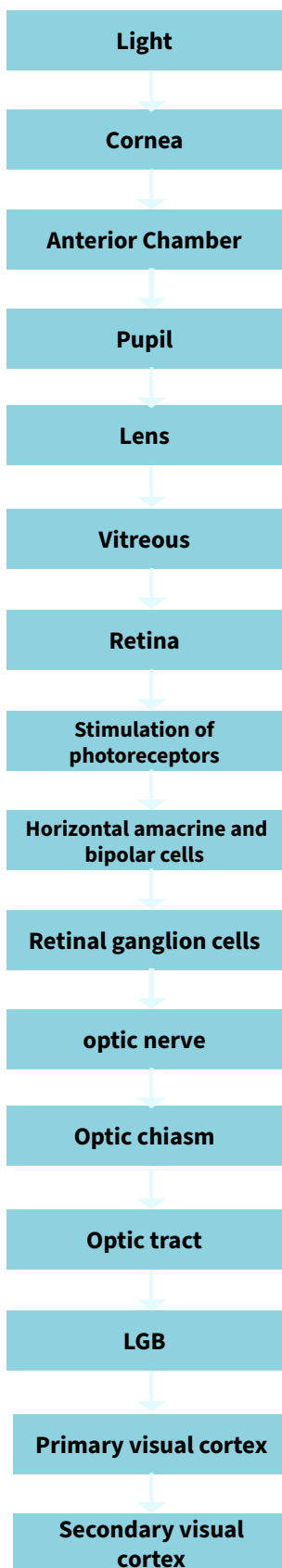
Presented by: Dr. Maan Alkharashi

Objectives of the course:

- To know the basic ophthalmic anatomy and physiology.
- To know how to assess and manage common ophthalmic diseases.
- To know how to triage and treat common ophthalmic emergencies.
- How to use simple ophthalmic diagnostic instruments.
- To acquire basic knowledge of some common ophthalmic operations.

Color index:

The visual pathway



Each visual cortex receives visual information from the ipsilateral nasal field and contralateral temporal field (don't mix up fibers and field)

Nasal fibers sees the temporal field



The visual pathway:

- In order to have the cornea properly clear, it has to have proper lubrication by the tears distributed by the eyelid.
- The pupils control the amount of light entering the fundus by dilatation & constriction.
- The function of the lens is to refract light.
- The convex lens will converge the light to fall on the retina (specifically on the fovea).
- Neurones of the Visual pathway:
 - **1st order neuron: bipolar cells**
 - **2nd order neuron: retinal ganglion cells**
 - **3rd order neuron: Lateral geniculate body in thalamus**
 - 3rd order neuron axons end in: Primary visual cortex
- Light enters the eye via the refractive media, namely the cornea, anterior chamber, lens and vitreous, and stimulates the retina posteriorly.
- Light stimulates the photoreceptors, ie., the rods and cones. Through a series of other retinal nerve cells, the end result is that the retinal ganglion cell (RGC) is stimulated. The RGC sends its axon, or fiber, in the nerve fiber layer to the optic disc and then down the optic nerve.
- **Phototransduction: by photoreceptors (rods and cones):**
 - **Cons** are responsible for photopic vision, **bright, color vision** and central visual field & are present mainly in the macula.
 - **Rods** are responsible for scotopic vision, dim light, **night vision and peripheral visual field** & are distributed on the periphery of the retina. each might be affected separately in a disease process or rods first then cones like retinitis pigmentosa. Some pathologies can affect the cones more than the rods, and other pathologies can affect the rods more than the cones.
- Image processing: by horizontal, bipolar, amacrine and RGCs.
- Output to optic nerve: via RGCs and nerve fiber layer.
- From the optic nerve, the nasal fibers (half of the fibers) cross over at the chiasm to the opposite optic tract, and the other half remain on the same side. The fibers in the optic tract synapse in the lateral geniculate nucleus of the thalamus.
- Neurons in the lateral geniculate nucleus then project to the occipital lobe, to the primary visual cortex. From there, there is further processing with projections to other cells in the visual cortex and elsewhere, resulting in conscious visual perception..
- **Rods transduction pathway (bleaching of visual pigment):**
 - Opsin and retinal in rhodopsin are essential for light vision.
 - light strikes the rhodopsin → rhodopsin breaks into opsin and all-trans-retinal → All-trans retinal is reduced to all-trans-retinol by the photoreceptor to be absorbed by the retinol pigment epithelium → All-trans-retinol will undergo many reactions to turn into 11-cis-retinal
 - 11-cis-retinal can turn back to rhodopsin and the cycle continues
 - Some pathologies affect the protein synthesis and decrease the vision during night such as العشى الليلي

The visual pathway and visual cycle

- **The visual pathway:**

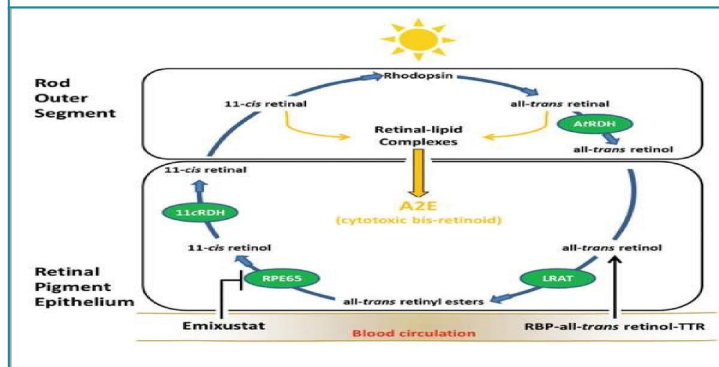
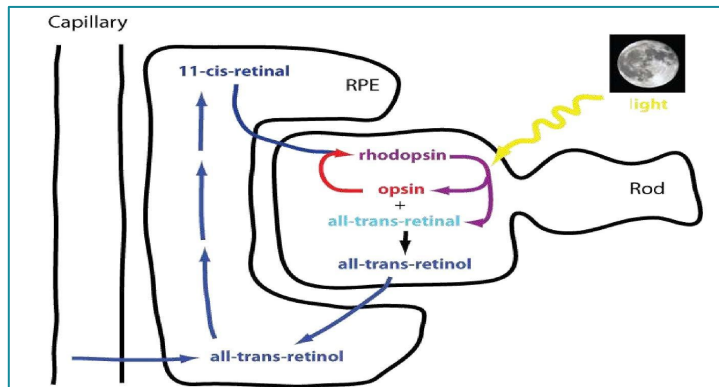
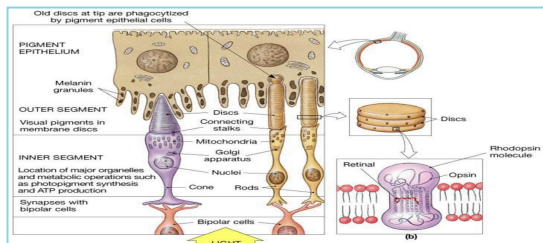
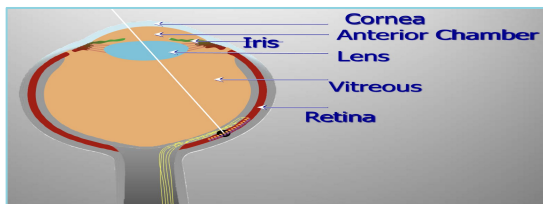
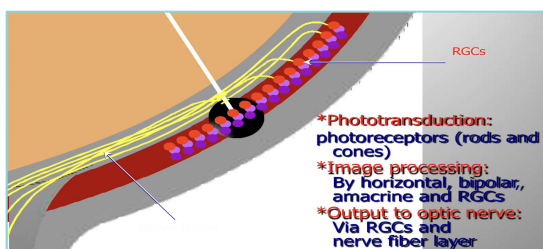
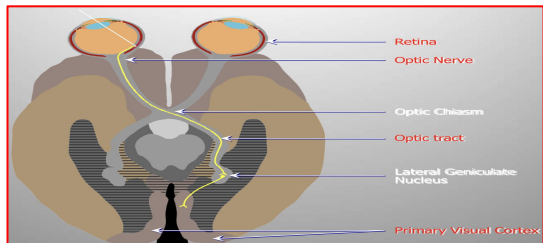
- Light direction is from anterior to posterior
- Common pathology near the site of optic chiasm is pituitary adenoma which results in bitemporal hemianopia
- Any pathology posterior to the LGB will not present on the fundus and as a result funduscopy will be normal (in cases of cortical blindness for example there is no optic atrophy). (ocular vs cortical)
- Pathology from the LG and anterior may manifest as optic atrophy on funduscopy.

- **The visual cycle:**

- when someone flashes light on your eyes there is 1-2 seconds where you are temporary have hard time seeing, why is that? because all the rhodopsin at that particular moment is exhausted and your retinal pigment epithelium are trying to replenish the rhodopsin.

The visual pathway (IMP)
 1st pic Basic anatomy lecture question may ask about a lesion
 1-pituitary tumor → in optic chiasm → bitemporal hemianopia
 2-Lesion on optic tract → homonymous hemianopia

The visual cycle



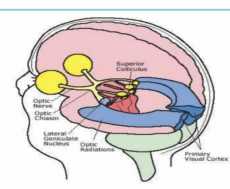
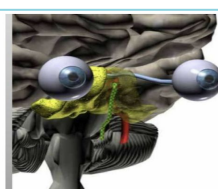
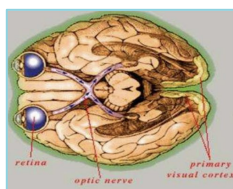
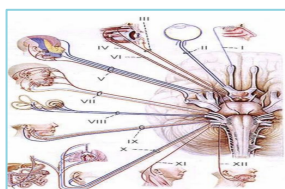
The importance of the eye & neurological connections

Importance of eyes: “The eye is the window to the body”

- The eye is so intimately connected with the rest of the body (vascular and neurological connections) that it reveals enormous amount of general information.
- Eye is the **only part of the body** where blood vessels and central nervous system tissues can be viewed directly.
- **90% of our information** reaches our brain via sight.
- Unfortunately, of all the parts of the body, the eye is the **most vulnerable** to minor injury.

Neurological connections:

- The 12 cranial nerves provide us with a large part of our information about the brain, Of these, the eye examination evaluates **CN II, III, IV, V, VI, VII, VIII (7 CNS)**.
 - **CN 2 (optic nerve)** is a sensory nerve responsible for the vision.
 - **CN 3 (oculomotor nerve)** from its name is a motor nerve responsible for the movement of the eye. (supplies the muscles around the eye) Opens the eye by LPS muscle.
 - **CN 4 (trochlear nerve)** is a motor nerve innervates superior oblique muscle (SO4)(it's common to have congenital 4th nerve palsy)
 - **CN 5 (trigeminal nerve)** is a sensory nerve the ophthalmic branch is responsible for the sensation of the globe, eyelids & forehead. Gives sensation and to the cornea (eye pain + reflex)
 - **CN 6 (abducent)** is a motor nerve innervates lateral rectus muscle.
 - **CN 7 (facial nerve)** is a motor nerve responsible for closure of the eyelid(**orbicularis oculi muscle**); in facial nerve palsy, patient is unable to close the eye increasing the risk of dryness and exposure keratitis.
 - **CN 8 (vestibulocochlear nerve)**; Responsible for balance, eye movements & hearing. (the vestibular part is responsible for controlling the eye movement, and trochlear part is responsible for hearing)
- In addition, it provides information about the autonomic pathways (sympathetic/parasympathetic) by looking for pupillary reaction:
 - pupil constriction → (para-sympathetic)
 - pupil dilation → (sympathetic).
- The retina and optic nerve are physical extensions of the brain.
 - For example CNS lymphoma could involve the retina and the patient might present with eye problems
- The visual pathway, which extends from front to back across the brain can be studied easily and safely using **perimeter**. It can differentiate accurately between lesions of the **temporal, parietal, and occipital lobes**. The **perimetry is visual field study**
- The optic nerve is the best known connection between the brain and the eye.
- **In addition, the optic nerve** has important clinical relationships to the **pituitary gland** (the optic nerve decussation at the chiasm is on top of the pituitary stalk, so any pathology in the pituitary will affect the visual field; in pituitary adenoma and craniopharyngioma), **the middle ventricles**, the **venous sinuses** (in venous sinuses thrombosis or idiopathic intracranial HTN there will be increase in the pressure inside the brain that will affect the optic nerve causing papilledema or swelling of the optic N.), and bony structures of base of the skull patients with meningitis, venous sinus congestion or skull base fractures can manifest with either cranial nerve palsies or optic nerve abnormalities) Visual field can be used for follow up after **Pituitary adenoma removal**
- The normal optic nerve head has distinct margins, a pinkish rim and, usually, a central, pale, cup.
- The central retinal artery and vein enter the globe slightly nasally in the optic nerve head, referred to ophthalmoscopically as the optic disc.
- In optic disc edema there is unclear disc margin



Neurological connections

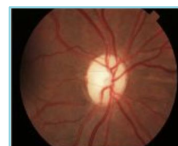
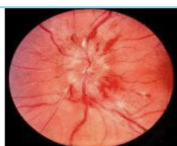
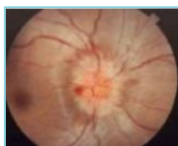
Optic nerve swelling

- The optic nerve has the diagnostically useful capability of swelling (congested veins + disc) with \uparrow ICP (papilledema).
- Venous sinus obstruction with \uparrow ICP will reflect on the optic nerve with swelling.
- Optic nerve could be swollen due to many causes such as ischemic or inflammatory optic neuropathy but we don't call this papilledema bc it wasn't caused by the high ICP!
- **If not treated it might cause optic atrophy**
- **CN 6 is susceptible to compression due to its anatomical position**
- **Papilledema** is the term given to **bilateral disc swelling associated with raised intracranial pressure (ICP), accelerated hypertension and Brain tumor or hemorrhages.**
- Visual loss is uncommon with the papilledema of hypertension and/or raised intracranial pressure.
- If you don't see papilledema it doesn't rule out elevated ICP do spinal tap!

Optic atrophy

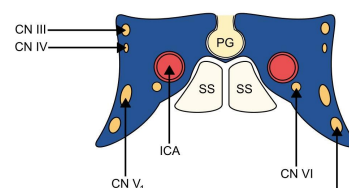
- The optic nerve (normally pinkish) could be visibly pale (**optic atrophy = white yellowish**) when its nerve fibers are damaged at any point from **retina to LGB**.
 - As a result of **optic neuropathy, optic nerve inflammation or long standing papilledema.**
 - E,g, patient with papillary adenoma causing compression and pressure on the chiasm for a long period of time \rightarrow optic atrophy with decreased visual acuity.
 - Any pathology in the visual pathway behind the LGB will not manifest in the optic nerve; for example, if someone has primary cortex infarction, it will not cause optic nerve atrophy. the patient will be blind but optic nerve will be normal.
- A pale optic disc represents a loss of nerve fibers at the optic nerve head.
- The vision is usually reduced, and color vision affected.
- On examination, the usual vascularity of the disc is lost. Comparison of the two eyes is of great help in unilateral cases, as the contrast makes pallor much easier to see.
- A relative afferent pupillary defect will usually be present (RAPD+).

You have to differentiate between the two pictures



- The study of CN III, IV, V, VI can evaluate:
 - the **brainstem**,
 - **cavernous sinus**
 - **apex of orbit.**
- **Structures that go through the cavernous sinus are:** oculomotor nerve, trochlear nerve, 2 divisions of trigeminal nerve (ophthalmic & maxillary branches) & abducent nerve (CN 3, 4, v1, v2 & 6) as well as sympathetic fibers around the **internal carotid artery** innervating the eye & forehead, therefore if someone has cavernous sinus thrombosis or cavernous carotid fistula, they might present with multiple cranial neuropathies & restricted eye movements,

Cavernous Sinus

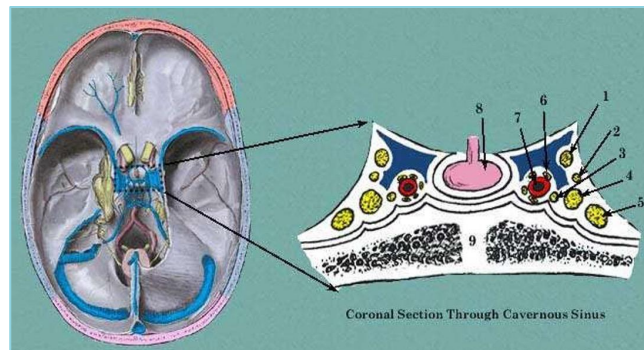


Key
 CN III (oculomotor nerve)
 CN IV (trochlear nerve)
 CN V (ophthalmic branch of the trigeminal nerve)
 CN V (maxillary branch of the trigeminal nerve)
 CN VI (abducent nerve)
 ICA (internal carotid artery)
 PG (pituitary gland)
 SS (sphenoidal sinus)

Lineage ©

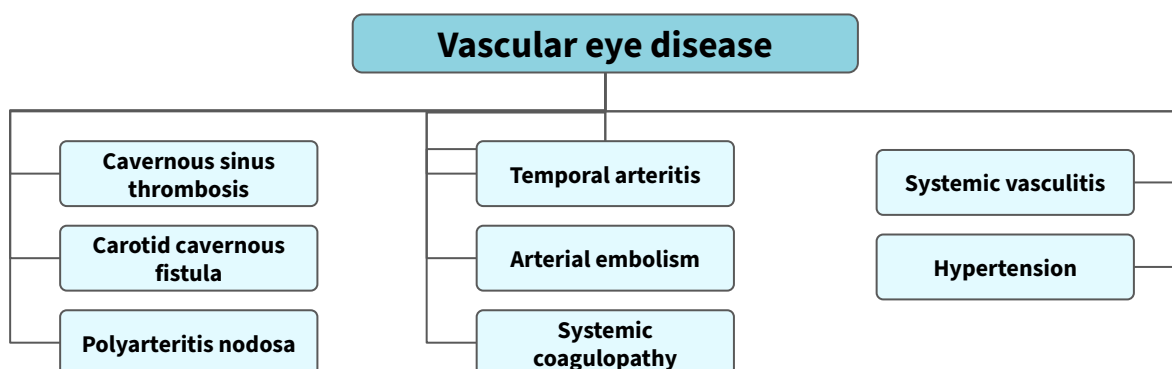
Moises Dominguez

- Possible SAQ questions: (not mentioned by the new doctor)
 - **What are the structures in the wall of the cavernous sinus?**
 - Superior + inferior divisions of CN III
 - CN IV
 - V1 + V2
 - **what are the structures INSIDE the cavernous sinus?**
 - Internal carotid artery
 - CN VI



- **CN III palsy:**
 - A unilateral dilated pupil after a head injury can occur due to pressure on pupil constrictor fibers of CN III. **Due to trauma, uncal herniation pressing the nerve**
 - CN III supplies all muscles of the eye except Lateral rectus (LR6) and superior oblique (SO4)
 - CN III in its structure has: outer visceral fibers and inner somatic ones, if the visceral fibers are affected (pupil dilation), the cause is more likely to be Surgical (tumors, aneurysms..)
 - Cx:
 - Surgical (**pupil involved**): **Brain mass lesion**, Brain Herniation, hemorrhage, **aneurysm** of posterior communicating artery **can compress CN III**, (muscle paralysis + Dilated pupil = surgical emergency)
 - Medical (**pupil usually are not involved**): like **vasculopathy and ischemia** in case of **DM or HTN**.
 - What investigations would you do if you have a patient with 3rd nerve palsy with dilated pupil?
 - order a **CT ANGIO or MRA (angio)**.
 - Palsy of CN III presentation: **Ptosis + Lateral Squint of the affected eye + pupils might be affected.**
 - How do we know if CN IV is involved in addition to CN III? patient will not be able to look down (damaged CN III) and eyes won't intort (CN IV damaged).
- **CN VI palsy** is involved in mastoid infection Abscess (petrous ridge). Patients with inner ear infection or abscess collection may present with ear pain and 6th nerve palsy.
 - **Ear pain + Sings on 6th nerve palsy → Mastoid abscess**
 - Cx: **Commonest cause of abducens nerve palsy? TRAUMA**(most common cranial nerve get affected by high ICP).
Why? because it has a very long course and each course is perpendicular to each other.
- **CN VII palsy** is involved in parotid gland & inner ear disease, Some patients with parotid tumor or infection can present with facial palsy.
- **CN VIII** disease is involved in nystagmus.

Vascular connections

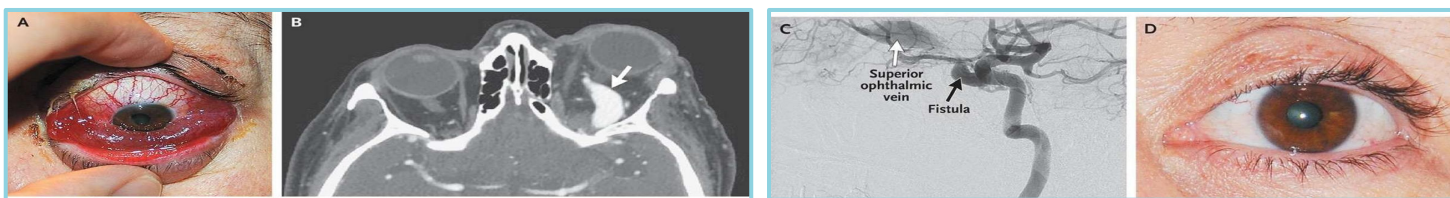


Venous flow disorder:

- All the venous drainage around the eye would go to the superior & inferior ophthalmic vein → cavernous sinus → sigmoid sinus → SVC.
- So if we have a thrombosis in the cavernous sinus or a fistula it will cause venous or vascular congestion
- **Cavernous sinus thrombosis (occlusion).**
 - Cavernous sinus is the venous drainage of the eye. The eye will be bulging, injected & congested sometimes with paralysis because the nerves are in the cavernous sinus.
- **Carotid – cavernous fistula (orbital congestion).** Redness and swelling of the eyelids
 - The eye will be bulging, injected, congested, same as cavernous sinus thrombosis. The difference is that **the eye is pulsating (bruit)**.
 - A fistula may develop between the internal carotid artery, in the cavernous sinus, and the cavernous sinus itself. **As a result, the orbital veins are exposed to a high intravascular pressure.**
- Both cavernous sinus thrombosis and carotid cavernous fistula will cause swelling of conjunctiva, chemosis and increased IOP; due to orbital venous congestion.

Clinical picture:

- In cavernous sinus thrombosis and carotid – cavernous fistula patients usually present with **unilateral proptosis**, unilateral redness, swelling that can be severe to the point that the eye is closed & orbital congestion.
- **The eye is proptosed** and the conjunctival veins are dilated and engorged.
- A bruit may be heard with a stethoscope over the eye, in time with the radial pulse.
- Eye movements are reduced because of extra-ocular muscle engorgement.
- **Increased IOP** secondary to increased pressure in the veins draining the eye.
- The fistula can be closed by embolizing and thrombosing the affected vascular segment.
- **Arterial emboli can reach the retina** from carotid artery, heart valves, subacute **endocarditis**.



Pic A: Bulging (proptosis) and swelling of the conjunctiva

Specific disease of the vessels like:

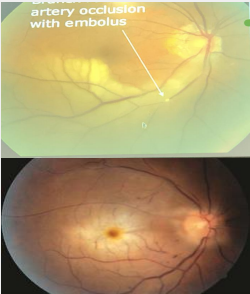
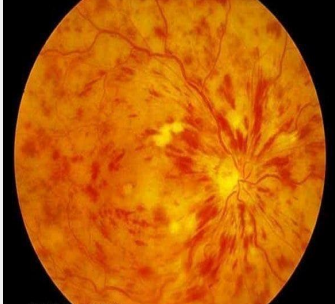


- **Polyarteritis nodosa (PAN), SLE.**
 - Both PAN & SLE can cause scleritis (scleritis is covered in detail in red eye lecture).
- **HTN.**

Vascular connections

- **Temporal arteritis**, also known as giant cell arteritis (GCA). “very important and you have to know it in detail:

<p>This is an autoimmune vasculitis occurring in patients generally over the age of 60. It affects the ophthalmic artery (not retinal). Results in Whitening of the retinal vessels and hemorrhage.</p>	<p>Diagnosis:</p> <ul style="list-style-type: none"> • Elevated erythrocyte sedimentation rate (ESR) & C-reactive protein (CRP) (e.g. ESR = 100 mm/h). • Temporal artery biopsy. If you miss the diagnosis the patient will have loss of vision in the other eye.
<p>Signs & symptoms:</p> <ul style="list-style-type: none"> • Visual symptoms: irreversible and usually sudden loss of vision, diplopia. • Polymyalgia rheumatica symptoms: headache, pain in the shoulders and hips, malaise. • Others: jaw claudication (pain on chewing) & scalp/temporal tenderness (eg. on combing). • Fever and constitutional symptoms. 	<p>Management: IV Steroids to protect the other eye. Steroids will not reverse the visual loss but can prevent the fellow eye being affected.</p>

Question may come from these pics study them well

	<p>Arterial emboli</p> <p>Can reach the retina from carotid artery, calcification of heart valves, subacute endocarditis and traumatic bone fracture. Pale macula - cherry red spot (central retinal artery occlusion)</p>		<p>Systemic coagulopathy</p> <p>Present as vein occlusion in the eye. Thunder cloud appearance</p>
	<p>Systemic vasculitis</p> <p>Manifests in the fundus and cause vasculitis & ischemia Cotton wool spots</p>		<p>Hypertension</p> <p>Chronic or uncontrolled HTN) Macular Star</p>

Extra from 435 team

Carotid-cavernous fistula (orbital congestion) has the same clinical presentation (proptotic, retinal edema) of cavernous sinus except that it has increased IOP, and thrill + pulsating eyes (Bruit) orbital congestion

Came in the exam : central retinal artery occlusion/ history: of multiple bone fractures, what is the diagnosis?
Retinal central artery fat embolism

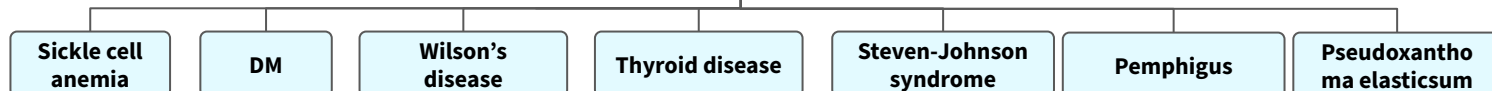
Case: a 60 year old patient with heart disease and using penicillin injections (meaning that he has bacterial endocarditis and might have a possibility of embolism manifestations leading to central retinal artery occlusion)

Best initial investigation in temporal arteritis is ESR, followed by C-reactive protein, then biopsy (a negative biopsy does not rule out the diagnosis due to the focal and segmental nature of the infiltrates)

When a patient complains of any changes in vision, rule out DM first

Disorders

Disease associated with eye manifestation



Hematological disorders:



All types can manifest in the fundus. (e.g. severe anemia, leukemia or lymphoma)

- For example, in sickle cell retinopathy the sickle cells will cause vascular occlusion → ischemia in the retina and inter retinal hemorrhage.
- Signs of sickle cell retinopathy:**
 - Tortuous veins.
 - Peripheral hemorrhages.
 - Capillary non-perfusion.
 - Pigmented spots on the retina.
 - New vessel formation, classically in a 'sea fan' pattern, which may occur as a result of peripheral retinal artery occlusion which may cause vitreous hemorrhage and traction retinal detachment.
- This may require treatment with laser photocoagulation and vitrectomy.

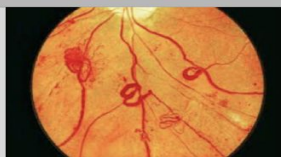
Metabolic disorders:



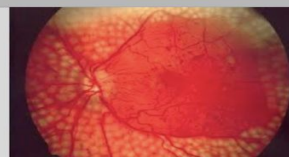
Almost all metabolic disorders can affect the eye:

- Diabetes Mellitus:** diabetic retinopathy (proliferative & non-proliferative), cataract, refractive error caused by hyperglycemia. Sudden increase in blood glucose can affect the lens making it absorb more liquids and it will become swollen which result in changes in refraction, or ophthalmoplegia due to diabetic vasculopathy (it can cause cranial nerve palsies such as 3rd, 4th or 6th cranial nerve palsy. Diplopia is a common symptom)
 - Most eyes problems are because of DM
 - ★ Diabetic retinopathy is the most common cause of irreversible blindness in people **below** 50 years of age.
 - ★ Cataract is most common cause of blindness **after** the age of 50.

436 team images: very important for exam



Proliferative Diabetic Retinopathy (PDR)
New vessels in the retina due to diabetes. The vessels are fragile and can bleed. If it bleeds it will lead to vitreous hemorrhage and retinal detachment.
(New dilated tortuous proliferative vessel in the retina)



Pan-retinal Photocoagulation (PRP)
Laser treatment of the other picture. Early detection and treatment will change the ischemic retina to anoxic retina. New vessels will be destroyed and central vision will be saved. There will be visual field defect, but the macula will be saved and the vision will be maintained.
(Retinal scars)

- Wilson's disease:** copper accumulation in the body, deficiency of α -ceruloplasmin. (KF ring)
 - Copper accumulation in the cornea will cause Kayser-Fleischer ring in cornea, corneal ring: a green ring around the cornea in the periphery.



Disorders (Cont.)

- **Thyroid eye diseases:** Hyperthyroidism: Graves' disease, The patient may sometimes complain of:
 - A red painful eye (associated with globe exposure caused by proptosis).
 - If the redness is limited to part of the eye only, it may indicate active inflammation in the adjacent muscle.
 - Double vision.
 - Reduced visual acuity (sometimes associated with optic neuropathy).

On examination:

- Bilateral exophthalmos (also known as proptosis which is protrusion of the eye from the orbit “pushing forward”, we call it exophthalmos only if it's related to a thyroid disease. If not related we say proptosis)
- Lid retraction (upper part of sclera is seen) and lid lag.
- There may be restricted eye movements or squint (also termed restrictive thyroid myopathy, exophthalmic ophthalmoplegia).
 - The **inferior rectus** is the most commonly affected; Its movement becomes restricted and there is mechanical limitation of the eye in upgaze.
 - Involvement of the medial rectus causes mechanical limitation of abduction (due to entrapment), thereby mimicking a sixth nerve palsy.
- In severe cases, there will be so much pressure in the orbit that leads to optic neuropathy.
 - Compressive optic neuropathy due to compression and ischemia of the optic nerve by the thickened muscles. This leads to field loss and may cause blindness.
- The commonest cause of unilateral & bilateral proptosis is thyrotoxicosis.

Investigations:

- A CT or MRI scan shows enlargement of the rectus muscle.
- Thyroid function test

Treatment:

- Corneal exposure and optic nerve compression require urgent treatment with systemic steroids, radiotherapy or surgical orbital decompression.
- thyroid eye disease, also known as infiltrative ophthalmopathy “ graves ophthalmopathy“. Since they have increased IOP we perform visual field exam. Thyroid orbitopathy is treated by steroids



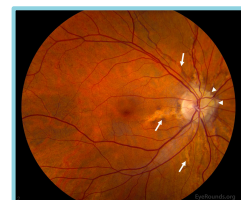
Mucocutaneous disorders:

- **Steven-Johnson Syndrome (SJS)**, pemphigus.
 - Blistering & ulceration of the skin & mucous membranes in reaction to chemicals like drugs and medications or infection.
 - Eyelid and conjunctival ulceration.
 - Scar tissue formation between eye and eyelid.
 - Severe and may require admission to ICU
- Loss of goblet cells occurs in the most forms of dry eyes, but particularly in Cicatricial conjunctival disorders like erythema multiforme (stevens-johnson syndrome). in this there's an acute episode of inflammation causing macular “target” lesions on the skin and discharging lesions on the eye, mouth and vulva. in the eye this causes conjunctival shrinkage with adhesions forming between the globe and conjunctival (symblepharon)



Elastic tissue disorders:

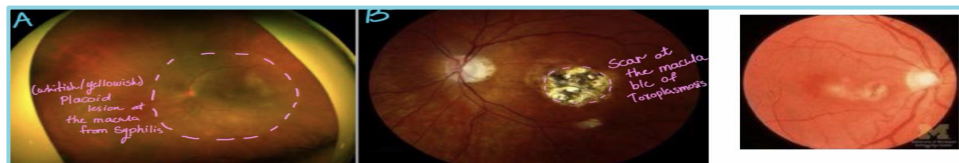
- **Pseudoxanthoma elasticum:** degeneration of the retina in which the patient can develop neovascularization.
 - Sub-retinal neovascular membranes may also grow through elongated cracks in Bruch's membrane called angioid streaks



Disorders (Cont.)



Infections:



- **Syphilis, toxoplasmosis & rubella.**

- Syphilis and Rubella also can cause retinitis (inflammation of the retina).
- Congenital syphilis causes interstitial keratitis which is any vascular keratitis that affects the corneal stroma without epithelial involvement.

- **Toxoplasmosis**

- The retina is the principal structure involved, with secondary inflammation occurring in the choroid (retinochoroiditis).
- An active lesion is often located at the posterior pole, appearing as a creamy focus of inflammatory cells.
- Inflammatory cells cause a vitreous haze, and the anterior chamber may also show evidence of inflammation.
- Thus, the patient may complain of **hazy vision and floaters**, and the eye may be red and painful.
- The clinical appearance is usually diagnostic.
- If it affects pregnant women their children can have congenital toxoplasmosis. It is common to screen pregnant for toxoplasmosis.



Allergies:

- **Vernal keratoconjunctivitis (VKC)**

- A severe form of allergic conjunctivitis could result in Vernal keratoconjunctivitis
- Causes chronic allergic reaction in the eye: chronic mucous discharge, chronic ulceration of the conjunctiva and chronic rubbing of the eye leading to corneal pathology and astigmatism.
- Ig-E mediated; it often affects boys with a history of atopy.
- It is usually seasonal but may be present all year long & may become chronic.

- Signs & symptoms:

- Itchiness.
- Photophobia.
- Lacrimation.
- Papillary conjunctivitis on the upper tarsal plate
 - (papillae may coalesce to form giant cobblestones).
- Limbal follicles and white spots.
- Punctate lesions on the corneal epithelium.



Eye poisoning :

- The eye is a delicate indicator of poisoning:

- **Morphine addict** (opiate intoxication): leads to miotic pupil.
 - Constricted pinpoint pupil = morphine overdose or pontine hemorrhage.
 - Dilated pupil = cocaine or amphetamine.
- They have the same presentation the only difference is hyperpyrexia with pontine hemorrhage.
- **Lead poisoning, vitamin A** intoxication (example for acne treatment) lead to papilledema.
 - After lead poisoning is treated or after taking methanol, patient can manifest with optic atrophy.
- **Methanol, ethanol** intoxication: optic atrophy
- Methanol can cause irreversible blindness



History

What are the components of a comprehensive ophthalmic evaluation?

1. Obtain an ocular and systemic history.
2. Identify **risk factors** for ocular and systemic disease.
3. look for symptoms and signs of ocular or systemic disease.
4. reach a provisional diagnosis
5. Initiate an appropriate response: e.g. further diagnostic tests (**blood, imaging**), treatment, or referral.

History: History by skilled person can arrive at the proper diagnosis in 90% of patients. It gives vital guidance for:

- (a) physical examination
 - (b) laboratory work
 - (c) Therapy
- Failure to take history can lead to missing vision or life-threatening conditions.

Chief complaint: “The patient’s own words”

- **What brought the patient in?** “she can’t see with the Right eye”
- You should not come to conclusion that her problem is nearsightedness and write down “Myopia of RE”.
- The patient needs will not be **satisfied** until he/she has received an acceptable explanation of the meaning of the **chief complaint** and its proper management.

History of presenting illness : Detailed description of the chief complaint to understand the symptoms and course of the disorder.

Listen and question and then write down in orderly sequence that make sense to you.

- The time sequence, when, How fast, what order did events occur? **A gradual decrease in vision is not as worrisome as a sudden decrease**
 - Gradual painless decrease vision both eyes for 1y
 - Sudden painless decrease vision re for 10 min. (**Vascular injury, Stroke, emergency**)
 - Frequency, intermittency
 - location, Laterality
 - Severity
 - Associated symptoms
 - Documentation (old records, photo) e.g ptosis, proptosis (**compare sides**), VII N palsy. (**Comment on improvement and prognosis**)
- “cannot see with Right eye”!!**
- Only distance vision blurred? **If the patient has difficulty in seeing far and near objects, it’s more concerning.**
 - Blind spot is present in the center of VF? (**Macular pathology, optic nerve pathology, diabetes, hemorrhage**)
 - Right side of VF of the RE lost? **Unilateral field loss is the result of an optic nerve lesion anterior to the optic chiasm.**
 - Right VF of both eyes lost? **Bilateral > posterior pathology such as visual cortex or optic radiation lesion.**
 - A diffuse haze obscures the entire field of RE

Each of these has different diagnostic implication. Most pt. has difficulty providing precise and concise description

Disturbances of vision:

- Blurred or decreased central vision **diabetic retinopathy, macular degeneration**
- Decreased peripheral vision (glaucoma, **tunnel vision**)
- Altered image size. **micropsia** (smaller image), **macropsia** (larger image), crowding of photoreceptor makes the the image bigger and vice versa when there is more spaces between them.
- Diplopia:
 - **monocular** indicative of a problem with the eye itself. Example: corneal opacity
 - **binocular** indicative of a problem with the muscles moving the eye. Example: 6th nerve palsy
- **metamorphopsia** (distorted image). Usually because of both micropsia and macropsia and is seen commonly in Macular degeneration.
- **Floater**s anything floating in the vitreous fluid
 - If acute sudden -> must investigate
- **Photopsia** (flash of light), retinal (you have to do fundus examination) or ON pathology
- Color vision abnormalities when going from light to dark room. Most common inherited disease: retinitis pigmentosa. Acquired: Vitamin A deficiency
- Dark adaptation problems; **مرض العشى الليلي** or vit A deficiency in gastric bypass surgery (rare).
- Blindness (ocular, cortical)
- **Oscillopsia** (shaking of images). can occur in patients with demyelinating or cerebellar diseases.



History



Ocular pain or discomfort:

- Foreign body sensation
- Ciliary pain with ocular inflammation scleritis, iritis, uveitis, corneal abrasion, acute glaucoma.
 - (aching, severe pain in or around the eye, often radiating to the ipsilateral forehead, molar area)
- Photophobia pain on seeing light, due to injury, trauma, corneal abrasion, ocular inflammation.
- Headache around the eye and forehead. -Unilateral headache around the eye + the eye is tender and red + nausea and vomiting = characteristic features of acute glaucoma
- Burning symptom of dryness, esp older people
- Dryness symptom of dryness, esp older people
- Itching: patient rub the eye vigorously (allergy: allergic conjunctivitis) can also be due to drugs.
- Asthenopia (eye strain). common in uncorrected refractive error. Eye Fatigue



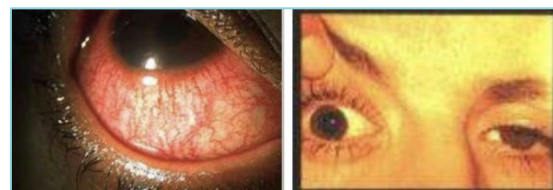
Abnormal ocular secretions:

Lacrimation, **epiphora** (excessive tearing caused by excessive tear production or blocked lacrimal duct.

- Dryness
- Discharge usually associated with conjunctivitis (purulent with **bacterial infections**, mucopurulent or mucoid with allergy, watery with viral infection)
- **Redness** (most likely episcleritis, conjunctivitis.) **opacities, masses**
- **Anisocoria** different sized pupils. can be caused by drugs.
If a patient has Anisocoria and ptosis = 3rd nerve palsy



Purulent discharge in the conjunctiva



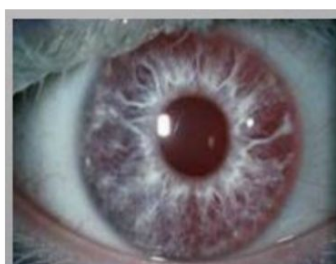
Family history:

Many eye conditions are **inherited** (Refractive error, glaucoma, strabismus, retinoblastoma, neoplasia & vascular disorders)

- Familial systemic disease can be helpful in ophthalmic evaluation and diagnosis (Atopy, thyroid diseases, DM, some malignancies)
- Ask about any eye problem in the family background?
- Ask specifically about corneal diseases, glaucoma, cataract, retinal diseases or other heritable ocular conditions.
- Ask questions designed to confirm or exclude your tentative diagnosis
 - significant positive
 - significant negative
- predict the physical and lab. finding likely to be present.
- any discrepancy between the history and physical examination requires explanation .



oculocutaneous albinism



maldevelopment of macula which could affect their acuity



Ophthalmic examination

- Visual acuity
- External examination
- Motility and alignment
 - Motility is the movement to hit all cardinal movements
 - Alignment is for deviation and we use corneal light reflex.
- Pupil examination (Normally pupil is Round, Regular, Reactive)
- Slit lamp biomicroscopy
- Tonometry for IOP
- Ophthalmoscopy
- Gonioscopy lens to check the iridocorneal angle
- Retinoscopy/refraction
 - Its for refraction not retina



Visual acuity:

- used to determine the clarity or sharpness of central vision at various distances
- It is a **vital sign (MUST)**
- Good vision :



- Subjective this is considered a disadvantage because the patient has to tell you.

How to test vision?

- Display of different sized targets shown at a standard distance from the eye.
- **Snellen chart**
- 20/20, 6/6.
- Uncorrected, corrected

Procedure

-Position the examinee at a predetermined distance from the chart (usually 20 feet/6 meters).

-Ask the examinee to cover one eye and consecutively read the designated chart, beginning with the smallest row that can be read

-Snellen chart: The examinee reads the rows of letters out loud.

E chart: The examinee points or states in the direction that the "legs" of the letter E are pointing (up, down, left, or right).

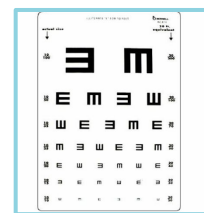
Landolt ring: The examinee points or states in the direction that the gap in the ring is pointing (up, down, left, or right).

-Normal findings: emmetropia (20/20 vision)

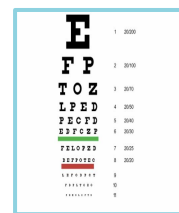
-Abnormal findings :

-Reduced nearsighted vision, reduced farsighted vision, blurry vision, inability to distinguish the charts (only recognizing shadows or fingers)

-Additional diagnostic tests need to be performed (e.g., pinhole test).



Tumbling E chart



Snellen's chart



Allen chart used for kids

Testing poor vision:

- If the patient is unable to read the largest letter <(20/200) this means that this patient cannot see at 20 ft what a normal person can see at 200 ft, and patient is termed blind legally.
- **Move the patient closer** e.g. 5/200 this means that this patient can see at 5 ft what a normal person can see at 200 ft
- If patient cannot read: we do these step wise, for example if he cannot count fingers then we test hand motion
 - count fingers (CF) (Better)
 - hand motion (HM)
 - Light perception (LP)
 - No light perception (NLP) (Worst)

Ophthalmic examination



External examination:

- Evaluate by gross inspection and palpation.
- Ocular adnexa. (lid, periocular area)
- Skin lesions, growths, inflammatory lesions.



Ptosis **partial vs complete**

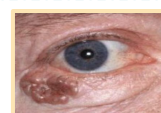


including the eyelids, eyebrows, and skin around the eyes.



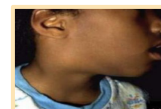
Proptosis, exophthalmos, enophthalmos (seen in large orbital floor fracture)

Palpation of **bony rim**, periocular **soft tissue**



General **facial examination**

Eg. Enlarged preauricular lymph node, temporal artery prominence

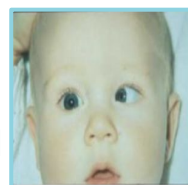


Ocular motility :

Evaluate :

- 1) Alignment: corneal light reflex
- 2) Movements
 - Misalignment of the eyes

★ **PIC MAY COME AS SAQ !**
You will be asked about
hershberg test + Krimski test and
angle of deviation (Explained in
details in the Strabismus,
Amblyopia & Leukocoria lecture)
And which nerve is affected



(Esotropia)



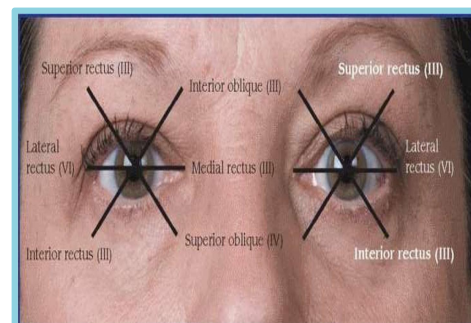
Right Oculomotor nerve palsy
ptosis and exotropia

Movement:

- Follow a target with both eyes in each of the four cardinal directions of gaze.
- Note:
 - Speed
 - Smoothness
 - Range
 - Symmetry
 - Unsteadiness of fixation e.g nystagmus

In CN IV palsy pt complains of difficulty in reading because they lost convergence

Extraocular muscle and direction of movements



Ophthalmic examination

Pupils :

penlight is used to **Examine for size, shape, reactivity** to both light and accommodation.

- Direct response and consensual response.
- **Afferent pupillary defect** ((Marcus Gunn pupil) **pupil dilates instead of constricts**)

Causes of Pupillary abnormalities:

- neurologic disease
- previous inflammation – adhesion
- acute intraocular inflammation - spasm - atony
- prior surgical trauma
- effect of systemic or eye medication
- benign variation of normal **less than 1mm**

Corneal light reflex



Slit lamp examination:

- An ophthalmological examination to evaluate for traumatic and nontraumatic disorders
- Is a table-mounted **binocular microscope** with special illumination source , which allows for a three-dimensional view of the eye
- A linear slit beam of light is projected onto the globe optic cross section of the eye.
- Slit lamp alone, the anterior half of the global (anterior segment) can be visualized.



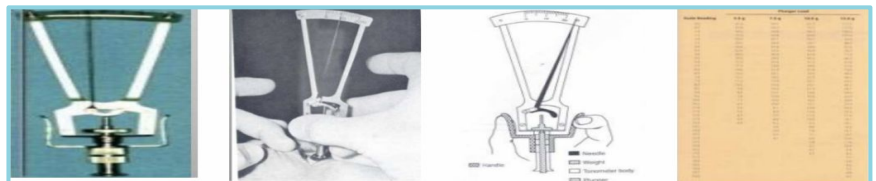
Tonometry:

- **ophthalmologic examination in which a tonometer is used to determine intraocular pressure (IOP)**
- The globe is a closed compartment with constant circulation of aqueous humor.
- This maintains the shape, and relatively uniform pressure within the globe.
- Normal pressure 10 – 21 mmHg , Abnormal findings: values < 10 mm Hg or > 21 mm Hg. Clinical significant > Ocular HTN vs Glaucoma
 - Glaucoma has disc damage (cupping).



Types of tonometry:

Schiotz tonometer
Not used anymore



Goldmann applanation Tonometer
MOST ACCURATE (gold standard)



Tonopen
Easy to use
Available in ER



Ophthalmoscopy

★ You might get MCQs on them ★

You have to differentiate between them, may come as comparison.

Direct ophthalmoscopy:



- handheld instrument.
- Less diameter of field 10 degree
- standard part of the general medical examination
- Portable
- High Magnification 15 time
- No stereopsis
 - Stereopsis is the perception of depth and three-dimensional structure through binocular vision (because you examine by one eye)
- Low brightness
- **Virtual, mirrored (erect) and magnified image**

Can't be used through hazy media

Indirect ophthalmoscopy:



Advantage :

1. **provide much wider field of view** Wide diameter of field 37 degree
2. **less magnification (3.5X with 20D lens)**
3. brighter light source – better view.
4. Binocular – **stereopsis** view.
5. Allow entire retina examination till the periphery
Real, inverted and magnified image

Disadvantage:

1. Inverted retinal image.
2. Brighter light is uncomfortable to the patient.

Can be used through hazy media

Direct Ophthalmoscope:



● Lenses:

- Controlled by diopter dial
 - Black or green numbers - positive numbers - counterclockwise – plus lenses
 - Red numbers – negative numbers – clockwise- minus lenses

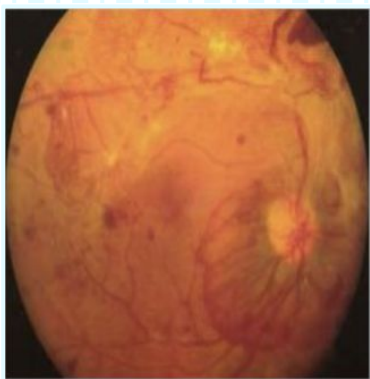
● Light source:

- Brightness controlled by rheostat

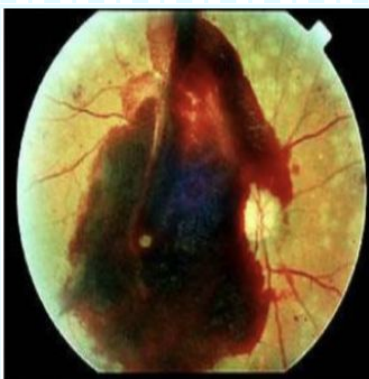
● Various apertures:

- Large – usually use this one
- Small - small pupils
- Red free filter - green beam, optic disc pallor and minute vessels changes
- Slit - Anterior eye, elevation of lesions

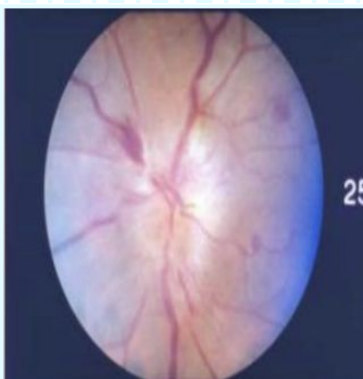
Indirect Ophthalmoscope Images:



Optic disc swelling



Pre- retinal hemorrhage



Hemorrhage + new small vessels + Disc swelling
This is proliferative diabetic retinopathy

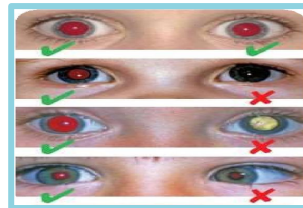


Chua

Ophthalmic examination

Red reflex (ophthalmoscope):

normally it is red, it can be white (**leukocoria**) or absent due to cataract or tumor (such as **retinoblastoma** in new born)



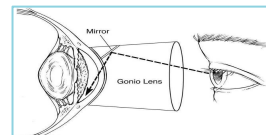
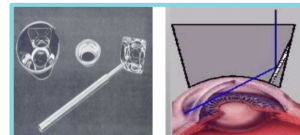
Special lenses:

Gonio lens (Gonioscopy) used to know if its open or closed Angle glaucoma

Wide field contact lenses allow evaluation of the posterior segment

-technique in which a special contact lens and a slit lamp microscope are used to illuminate and directly visualize the anterior chamber of the eye and iridocorneal angle

-Suspected angle-closure glaucoma (gold standard test)



Retinoscope :

Used to check refractive errors in babies (objective refraction)



Pinhole test:

For image to be more focused on retina, can distinguish between organic eye problem and refractive errors

(it is refractive error if vision improve after pinhole test)

The ideal pinhole diameter is 1.2mm



Color vision:

Ishihara color chart

X-linked disease which Affects 15% of Males

-test in which a set of color-dotted plates is used to diagnose deuteranopia (green color blindness) and protanopia (red color blindness)

-**Normal findings:** The examinee distinguishes all the colors, numbers, and/or shapes on the plates.

-**Abnormal findings:**

Failure to differentiate between colors, numbers, and/or shapes

So Additional diagnostic tests need to be performed (e.g., matching tests, retinal examination).

Clinical significance:

color blindness or dyschromatopsia (see "Color perception disorders" in "Diseases of the retina")



Refraction:

ophthalmological examination performed to determine the ability of the eyes to focus

-Types of exam

Objective (using a retinoscope/autorefractor)

Subjective (using a phoropter)

Cycloplegic (using cycloplegic drops)

Phoropter:

used in clinic to estimate refractive error by trying lenses

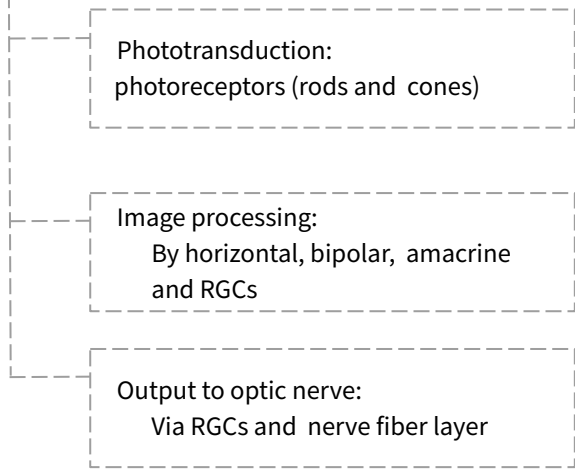
-**Normal findings:** emmetropia (20/20 vision)

-**Abnormal findings:** reduced nearsighted vision, reduced farsighted vision



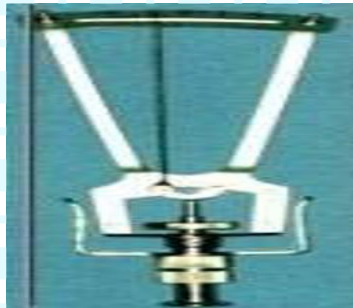
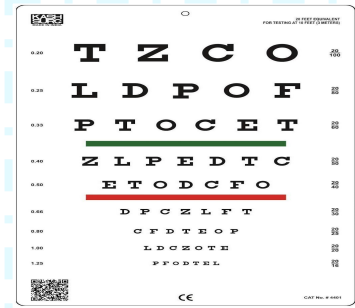
Summary

The visual pathway



Neurologic connections	
CN 4 (trochlear nerve)	innervates superior oblique muscle (SO4).
CN 6 (abducent)	innervates lateral rectus muscle.
(para-sympathetic)	pupil constriction
(sympathetic).	pupil dilation
Structures that go through the cavernous sinus	oculomotor nerve, trochlear nerve, 2 divisions of trigeminal nerve (ophthalmic & maxillary branches) & abducent nerve (CN 3,4,v1,v2&6)

Disorders	
Vascular	<ul style="list-style-type: none"> ❖ Cavernous sinus thrombosis (occlusion). ❖ Carotid-cavernous fistula (orbital congestion).
Hematological disorders:	<ul style="list-style-type: none"> ❖ severe anemia ❖ leukemia ❖ lymphoma
Metabolic disorders:	<ul style="list-style-type: none"> ❖ Diabetes Mellitus ❖ Hyperthyroidism Graves' disease.
Infections:	<ul style="list-style-type: none"> ❖ Syphilis ❖ toxoplasmosis ❖ rubella.
Mucocutaneous disorders:	<ul style="list-style-type: none"> ❖ Steven-Johnson Syndrome (SJS)
Allergies:	<ul style="list-style-type: none"> ❖ Vernal keratoconjunctivitis (VKC)



Lecture Quiz

Q1- A patient known to have pituitary adenoma, what visual field defect is most likely to occur:

- A. Complete loss of the field
- B. Bitemporal hemianopia
- C. Left homonymous hemianopia
- D. Right homonymous quadruple sectoranopia

Q2- Which nerve supplies lateral rectus muscle:

- A. Abducent nerve
- B. Trochlear nerve
- C. Facial nerve
- D. Vestibulocochlear nerve

Q3- Which of the following structures does not go through the cavernous sinus:

- A. CN 3
- B. CN 4
- C. CN 5 V1
- D. CN 5 V3

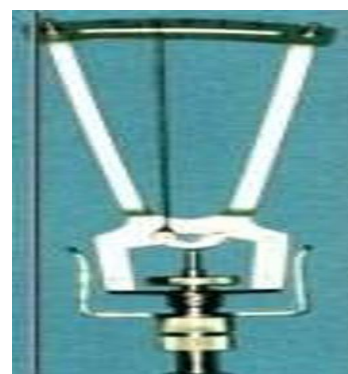
Q4- What is the name of this chart :

- A. Snellen's chart
- B. Tumbling E chart
- C. Allen chart
- D. ishihara chart



Q5- What is the type of the tonometer:

- A. Goldmann applanation tonometer
- B. Schiottz tonometer
- C. Tonopen
- D. Pneumotonometer



Short Answer Questions

Case 1

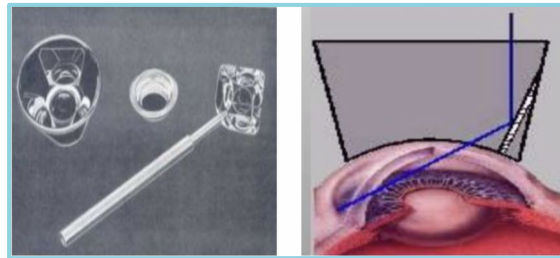


A: Identity the instrument?

B: Mention two features of the image?

C: Magnification power?

Case 2



A: Identity the instrument?

B: What is the use of the instrument?

Answers:

Case 1

A: Indirect ophthalmoscopy

B: Real and inverted

C: 3.5x with 20D lens

Case 2

A: Gonioscopy

B: Measuring the angle between iris and cornea to differentiate between closed and open angle glaucoma

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