

Lids, Lacrimal & Orbit Disorder

Objective

- Orbit:
 - Anatomy and evaluation techniques.
 - Orbital trauma.
 - Proptosis.
- Lids:
 - Anatomy and evaluation techniques.
 - Trauma.
 - Lesions.
 - Malpositions.



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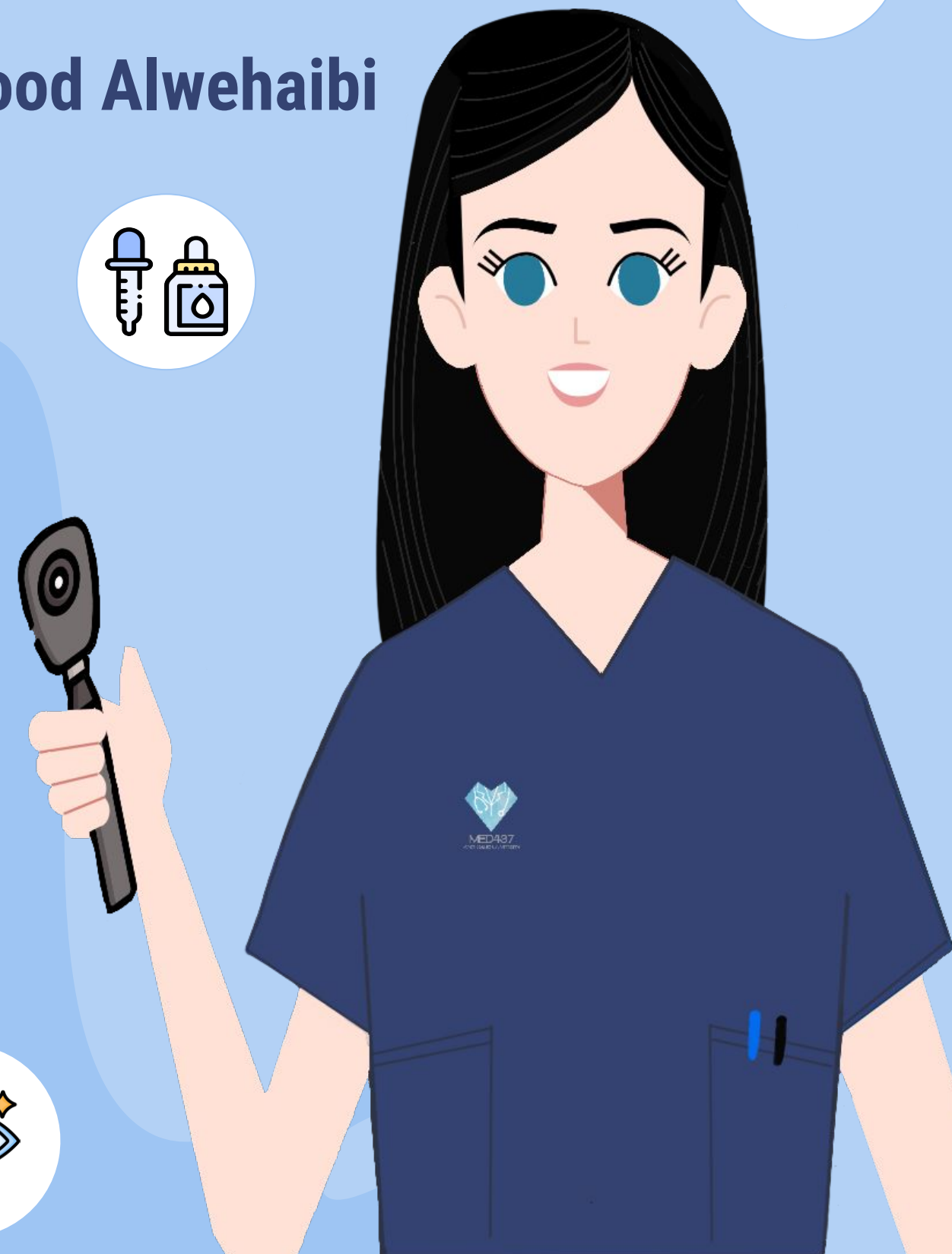
Resources :

Dr. Alsuhaibani slides and notes, 436 teamwork
435 teamwork, Book (Lecture notes in Ophthalmology)

- Editing file

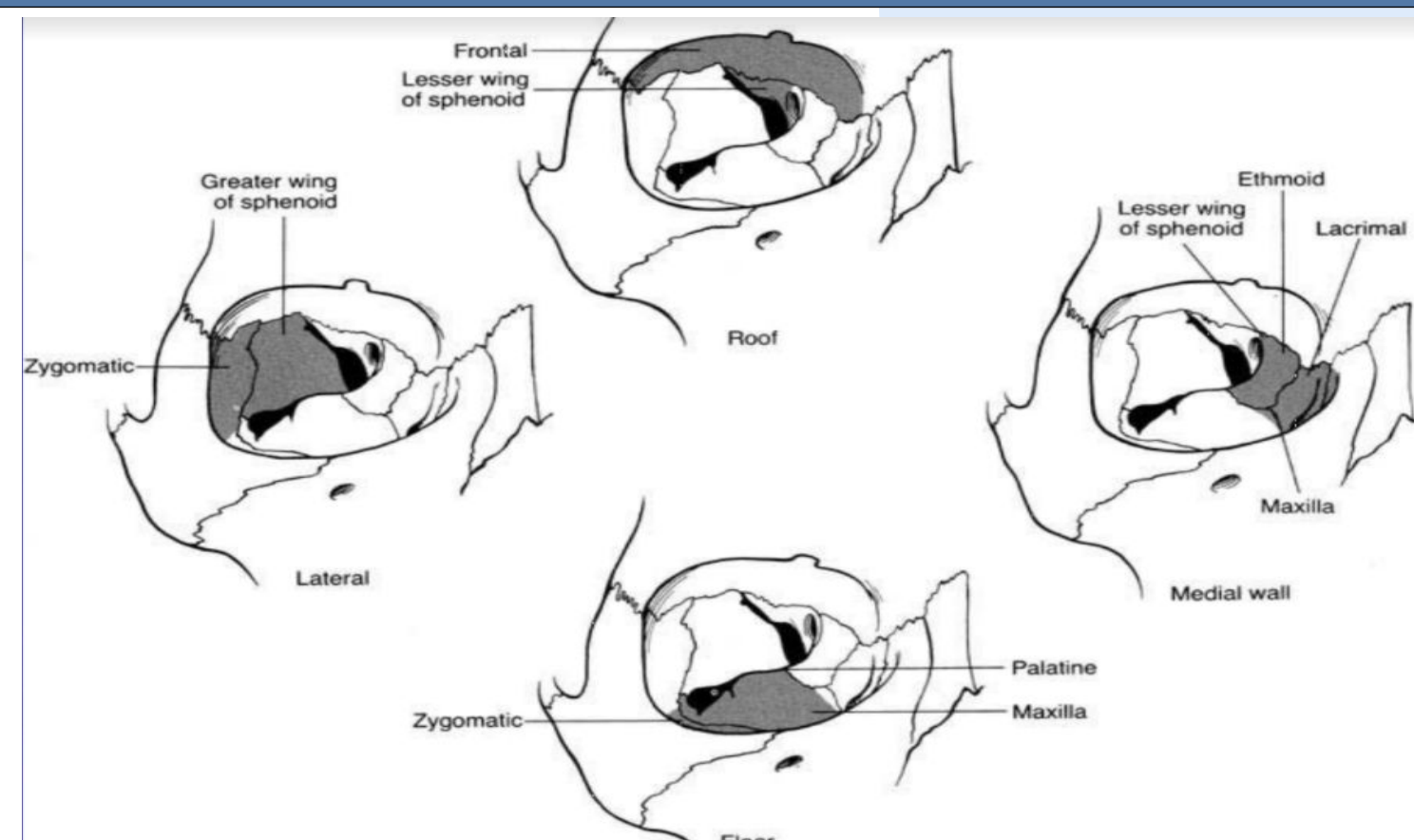
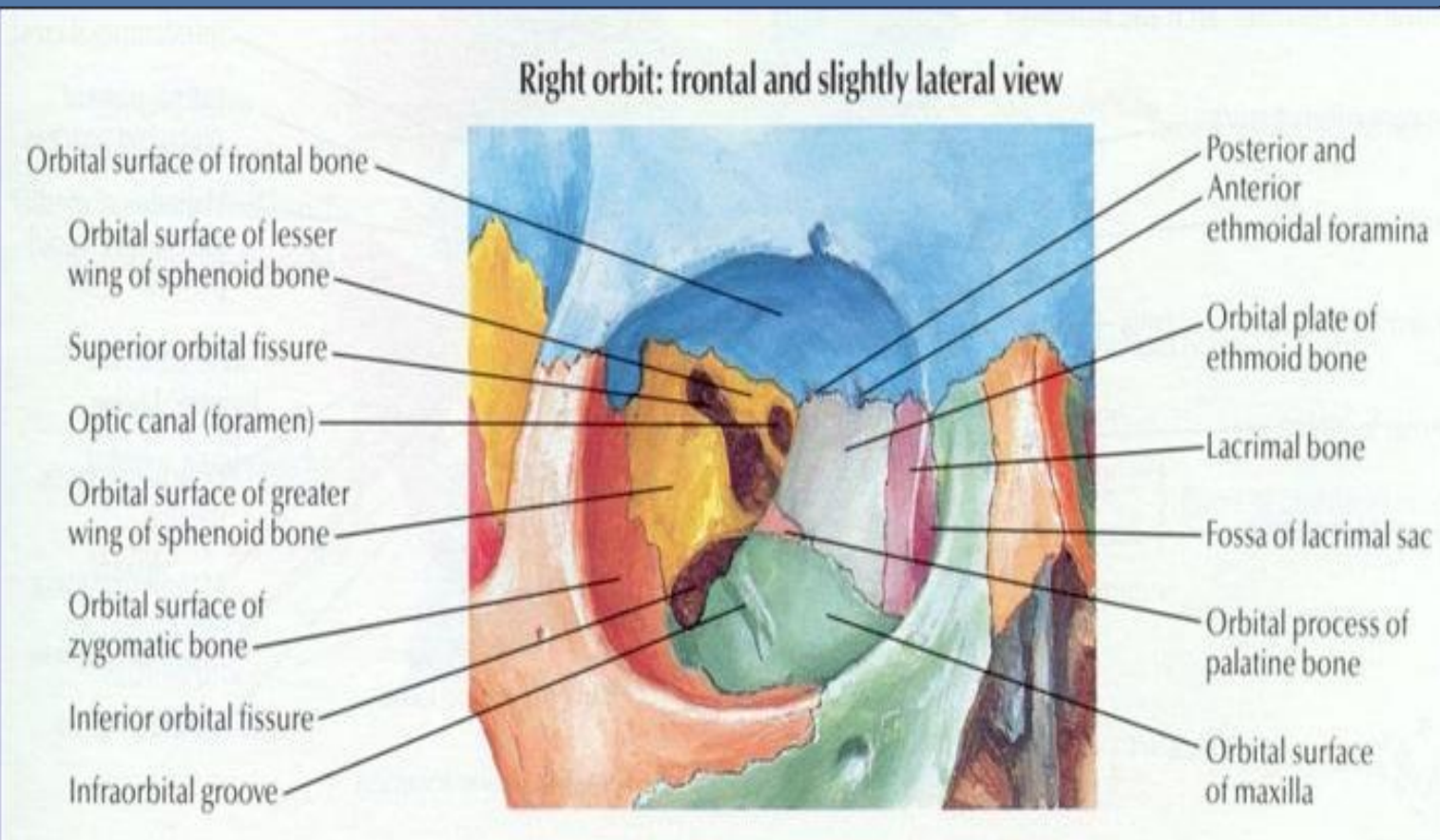
Color index

- **Important**
- **Notes**
- **Book**
- **Extra**
- **Golden note**



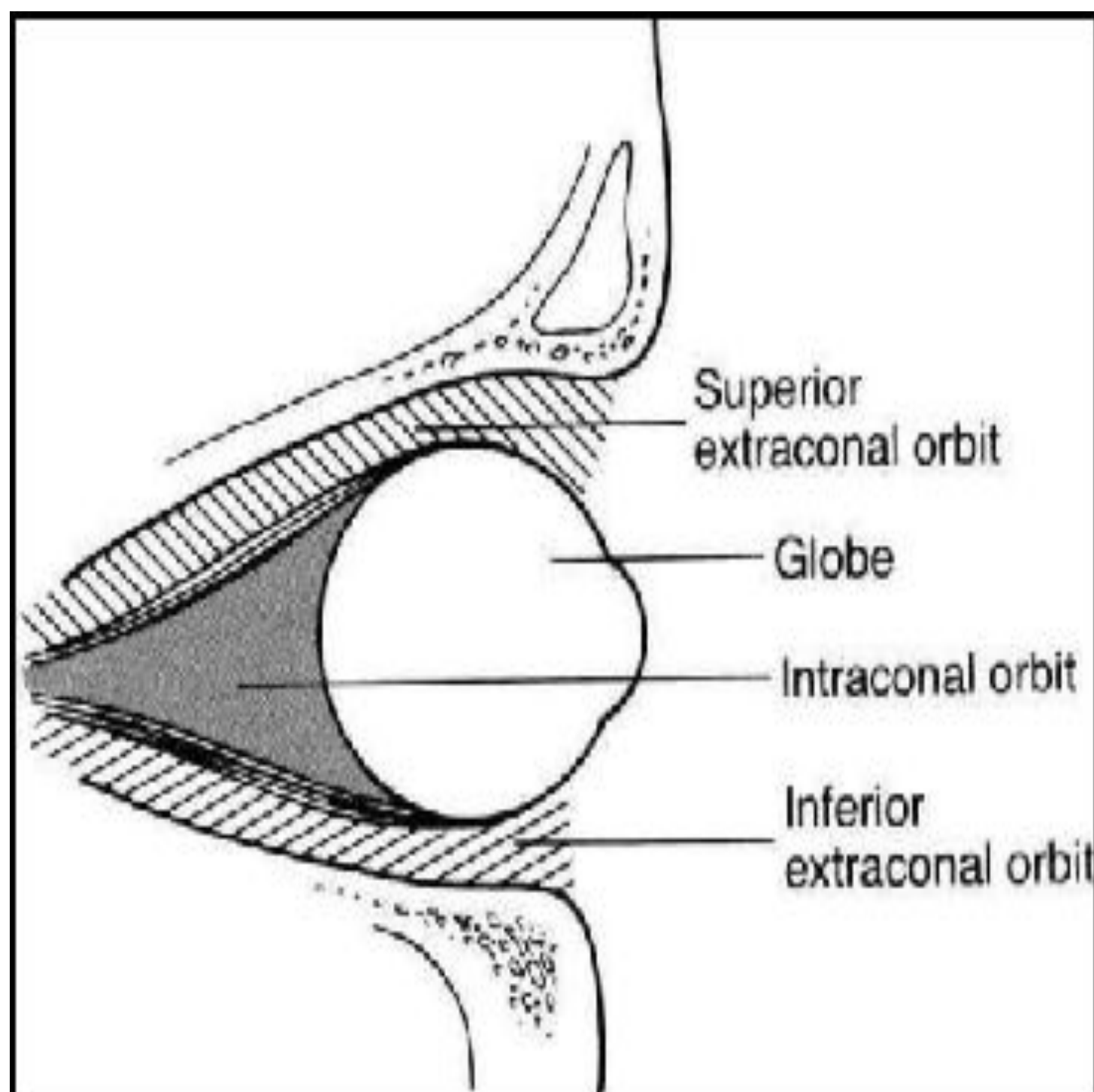
Anatomy of The Orbit

Orbital Walls



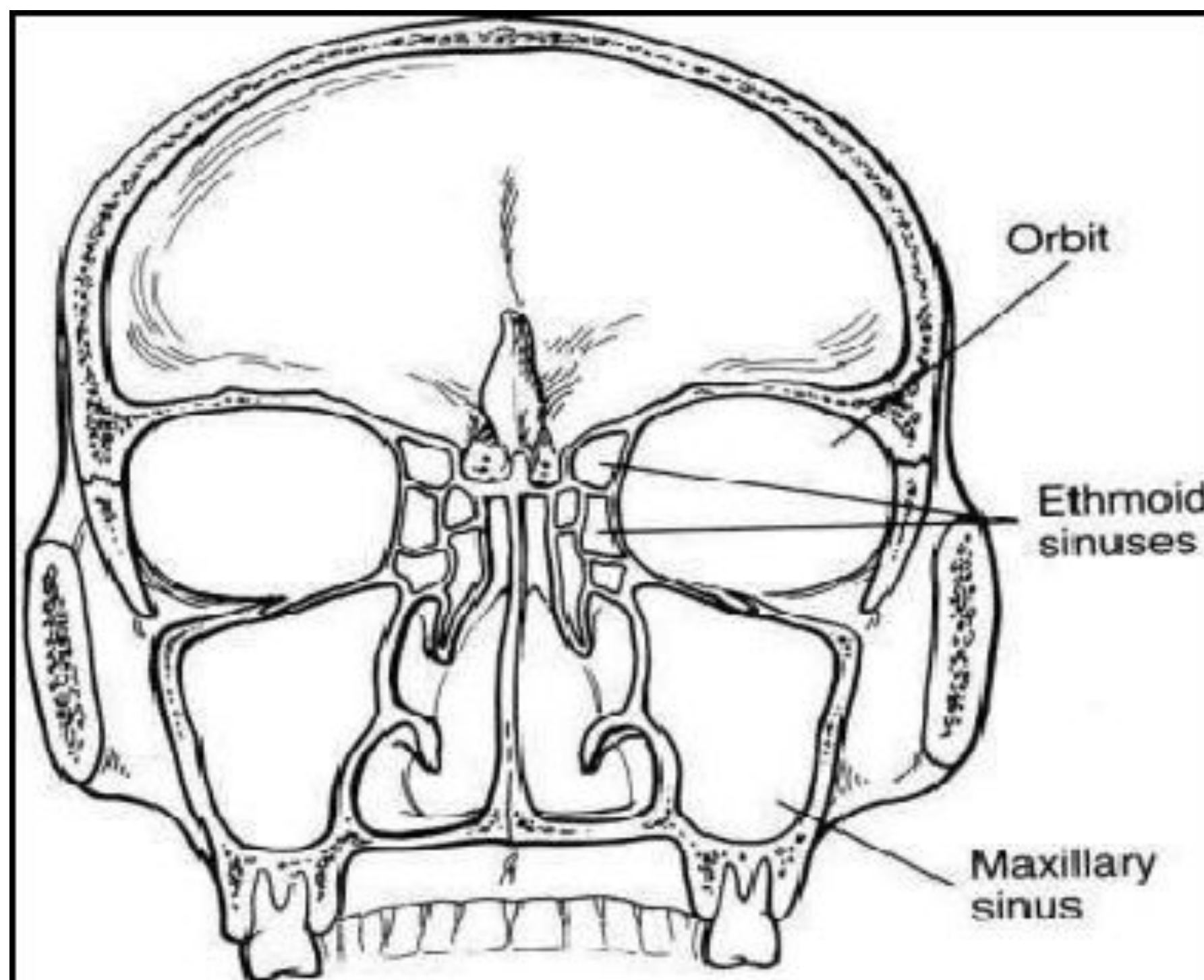
- ❖ The orbit is formed by 4 walls; the orbital floor, orbital roof, medial wall, and lateral wall.
- ❖ The orbital roof is mainly formed by the frontal bone and lesser wing of sphenoid at the back of the roof of the orbit..
- ❖ The orbital floor is formed mainly by the maxillary bone medially and zygomatic bone laterally.
- ❖ The lateral wall is formed by the zygomatic bone anteriorly, and the greater wing of sphenoid posteriorly.
- ❖ The medial wall is formed by the maxillary bone anteriorly, the lacrimal bone in the middle, the ethmoidal bone taking most of the medial wall, and in the far end there's a small piece formed by the lesser wing of sphenoid.
- ❖ **The strongest wall is the lateral wall** and the thinnest **wall** is the medial **wall**.
- ❖ The thinnest bone in the medial wall is the ethmoidal bone which is also called "lamina papyracea" and it is 0.3-.04 mm in thickness (very thin!) which makes it more prone to infections (orbital cellulitis secondary to ethmoidal sinusitis or if there is a fracture in the orbital wall so the air in the sinus will come in the orbit) to cross over from the sinuses to the orbit and for fractures to occur.
- ❖ The thinnest bone in the orbit is the roof of the infraorbital canal.

Orbital components



* In trauma children are more prone to orbital roof fractures, because they don't have frontal sinus, theoretically due to that frontal sinuses are assumed to have cushioning effect on the orbital roof in trauma.

Sinuses



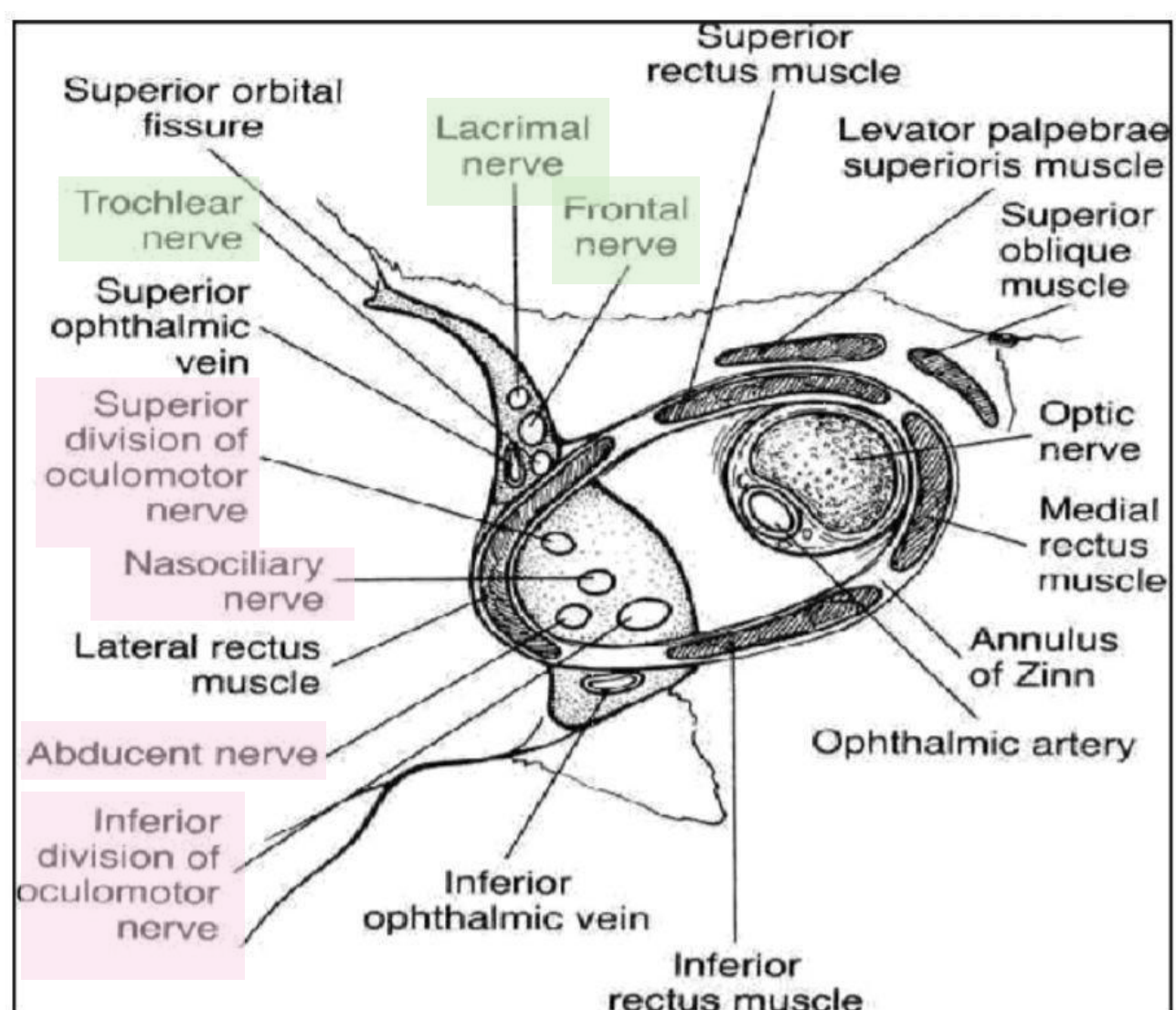
The sinuses surround the orbit from 3 directions:

- ❖ The maxillary sinus is below the orbit.
- ❖ The ethmoidal sinuses and sphenoid sinus are medial to the orbit (beside).
- ❖ The frontal sinus is above the orbit.

Anatomy of The Orbit

Blood Supply

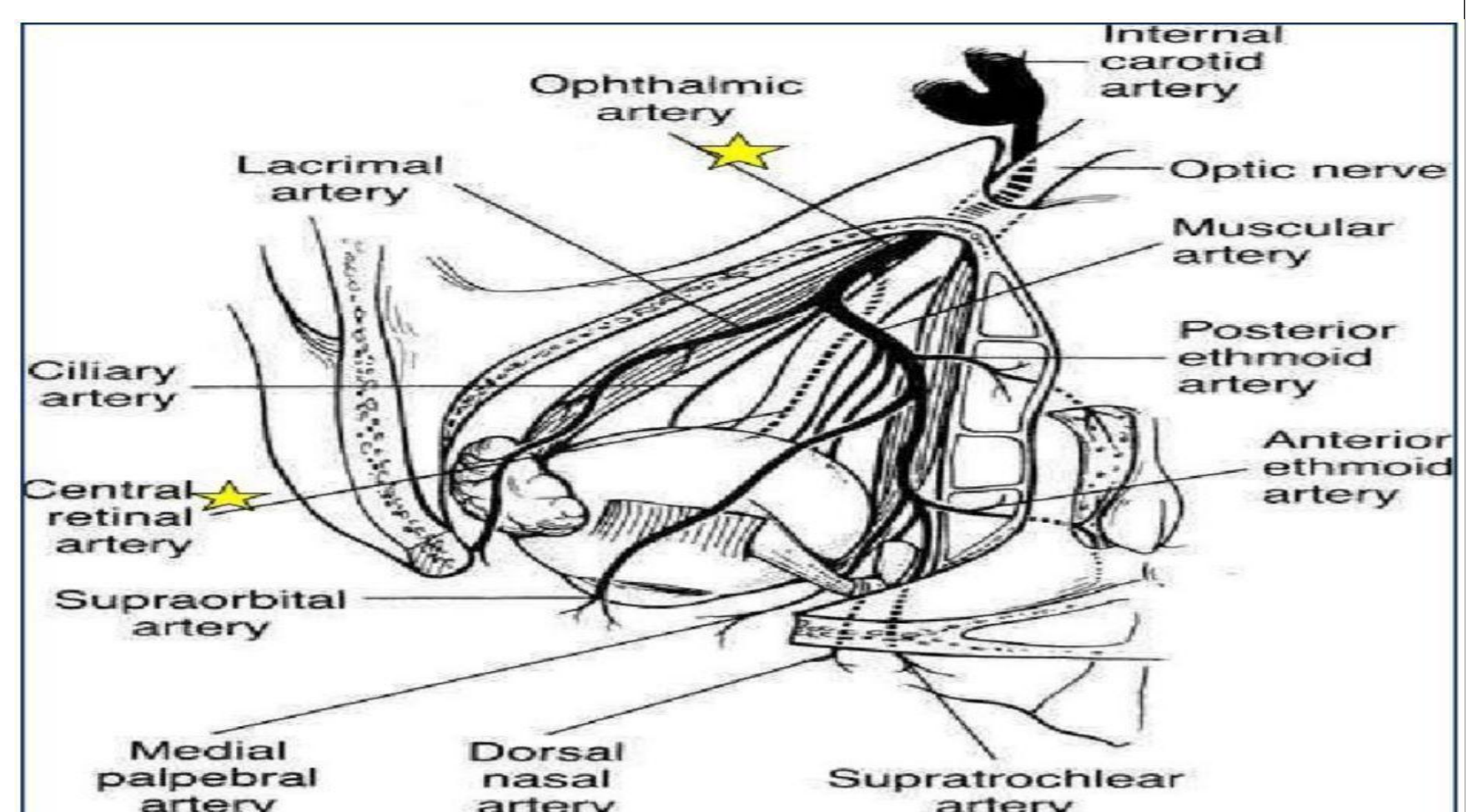
- ❖ The main blood supply for the orbit comes from the internal carotid artery specifically from its ophthalmic branch.
- ❖ The ophthalmic artery gets inside the orbit along with the optic nerve and it gives many branches; The most important branch is **the central retinal artery (because if there is any injury to that branch the patient will lose the vision permanently due to the occlusion).**
- ❖ The main problem with the central retinal artery is that it has no collaterals, so if it gets occluded the patients will immediately lose their vision.



Annulus of Zinn

- ❖ Annulus of Zinn is a ring of condensed fibrous tissue, and it is the origin of all the recti muscles. It also contains the optic canal and the optic foramen.
- ❖ You can see the optic nerve along with the ophthalmic artery (pic 2).
- ❖ Inside the Annulus of Zinn there're also the nasociliary nerve, abducens nerve, and the superior and inferior divisions of oculomotor nerve.
- ❖ The abducens nerve supplies the lateral rectus muscle.
- ❖ The superior and inferior divisions of oculomotor nerve supply the rest of the recti muscles.
- ❖ The nasociliary nerve is a mixed nerve that carries sensation to the cornea and conjunctiva & controls the pupil. Also, it supplies the ciliary muscles & ciliary body as well as the tip of the nose.
- ❖ That's why when a patient presented with a herpetic infection that involves the nose, you must examine the eyes very well.
- ❖ Herpetic infections are transmitted along the nerves, so it could start at the nose and travel through the nasociliary nerve all the way to the eye. This is called **hutchinson's sign**; when involving the tip of the nose and the eye.
- ❖ You can also see the superior orbital fissure. Part of the superior orbital fissure is contained **within the annulus of zinn (abducens, nasociliary and oculomotor)** and the other part is **outside the annulus.**
- ❖ There are multiple vital structures that pass through the superior orbital fissure to get inside the orbit and to exit the orbit. Starting from the top there're the **lacrimal nerve, frontal nerve, and the trochlear nerve.** (remember it as LFT)
 - The trochlear nerve innervates the superior oblique muscle.
 - The origin of the superior oblique is outside the annulus of zinn which is why the trochlear nerve is outside the annulus of zinn.
 - The lacrimal nerve supplies the lacrimal glands.
 - The frontal nerve is a branch of the trigeminal nerve, and it is a sensory nerve. It gives sensation to the forehead and the whole scalp.

Pic 2



1- Pain

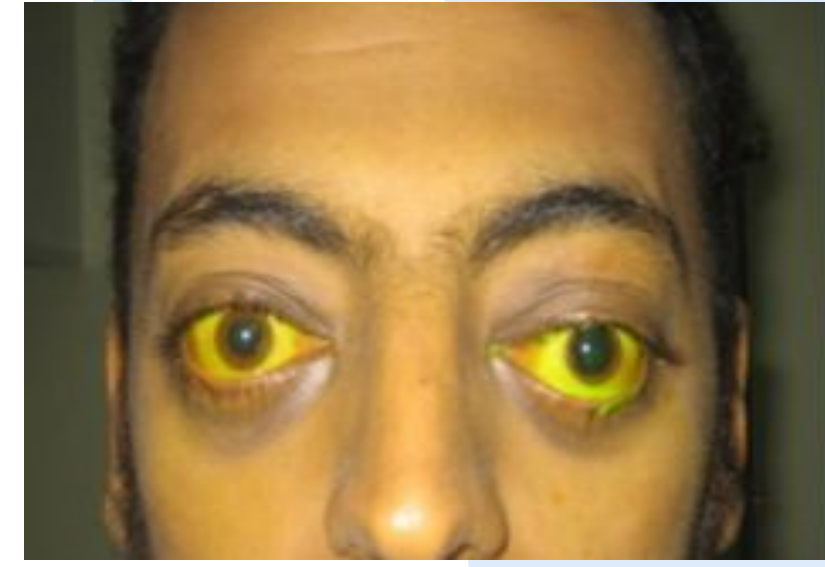
- ❖ Infection.
- ❖ Inflammation.
- ❖ Hemorrhage.
- ❖ Malignant lacrimal gland tumor (most tumors are painless in the orbit).



2- Progression

1- Minutes to Hours (if progression occurred within minutes to hours, there are only a few things that you need to think about)

- ❖ Hemorrhage sudden
- ❖ Orbital emphysema: air in the orbit, usually reduces by itself
 - ◇ It usually occurs due to trauma which results in a communication between the sinuses and the orbit. It increases the pressure in the orbit, and it can cause compression of the optic nerve and most importantly the central retinal artery which could cause blindness.
 - ◇ If a patient presented to the ER with a medial wall or floor fracture, it's important to tell the patient to not blow their nose or cough (Valsalva maneuver) because the air can go from the sinuses to the orbit and it can increase the orbital pressure.
- ❖ Lymphangioma
 - ◇ Congenital hamartoma: abnormal lymphatic vessels that are present in the orbit that tend to bleed, so the patient may present with acute proptosis.
- ❖ Varix (upon Valsalva) occlusion, dilation or thrombosis of venous system
 - ◇ Varicocele in the orbital veins that also tend to bleed & thus patients may present with acute proptosis. Venous system malformed



2- Days to Weeks dr said “you don't need to recognise these examples, just to get an idea”

- ❖ Children: capillary hemangioma, rhabdomyosarcoma, retinoblastoma, neuroblastoma, leukemia.
- ❖ Inflammatory disease: Idiopathic orbital inflammatory disease, thrombophlebitis, thyroid orbitopathy, recurrent inflamed dermoid.
- ❖ Infections: orbital cellulitis, abscess, cavernous sinus thrombosis. 1 day or 2 not hours
- ❖ Trauma, post-surgical, hemorrhage: orbital hemorrhage, lymphangioma.
- ❖ Malignancy: rhabdomyosarcoma, metastasis, granulocytic sarcomas, adenoid cystic carcinoma.
- ❖ Carotid-cavernous (C-C) fistula.

A. Infection

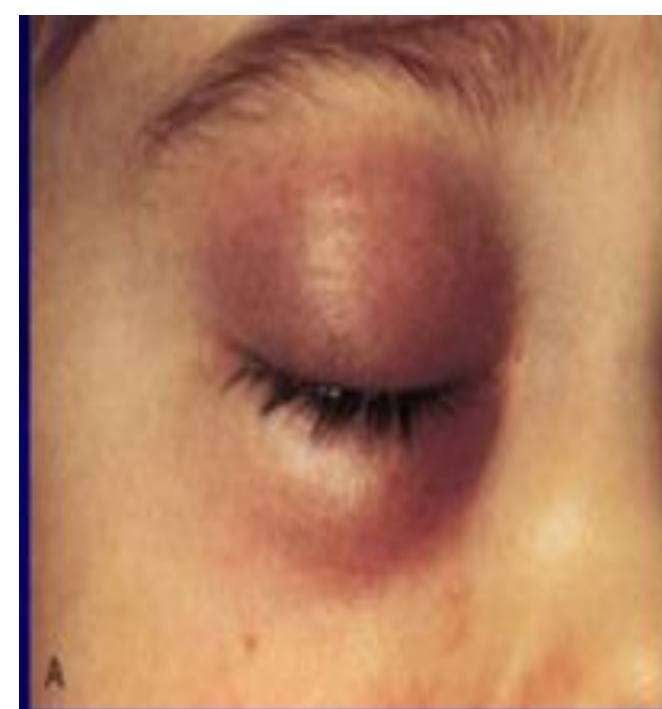
❖ **The orbital septum is the anterior boundary of the orbit, so anything anterior to the orbital septum is considered extra-orbital.**

1. Preseptal Cellulitis: the infection is anterior to the orbital septum (extra-orbital).
 - a. Vision, motility, pupils, VF, disc are WNL (within normal limit).
 - b. Globe itself is not proptotic (the eyeball itself is in a normal position). (usually treat it with oral AB

As an outpatient)

2. Orbital Cellulitis: the infection is behind the orbital septum.

- a. **90% secondary to sinus disease.**
- b. High risk of morbidity and mortality.
 - i. Orbital abscess. **If untreated**
 - ii. Brain abscess. **If untreated**
 - iii. Cavernous sinus thrombosis.
- c. Treatment:
 - i. Admission for close observation.
 - ii. Referral to ENT & infectious diseases.
 - iii. Systemic antibiotics and surgery if needed.



- ❖ Both preseptal cellulitis and orbital cellulitis present with eyelid swelling, redness, and pain.
- ❖ So, how can you differentiate between the two? patients with preseptal cellulitis are typically afebrile, healthy looking, and no signs of abnormalities in the eye and they can be treated with oral abx outpatient; However, patients with orbital cellulitis could be febrile, sick looking, and they have abnormalities in vision, eye motility, eye position (proptosis), or decreased disc.
- ❖ For example, if a patient presented with eyelid swelling, redness, pain, along with proptosis → this is orbital cellulitis.
- ❖ Infections can easily cross-over especially through **the medial wall.**
- ❖ We need to recognize the cause of orbital cellulitis, if it's from the sinuses we need to treat the sinuses with the help of ENT specialist, if it's from somewhere else we need to recognize the cause and treat

SAQ/OSCE



Q1: Which one of these walls is the thickest/strongest bone ? The lateral wall; because the eyes are in most danger from the lateral side.

Q2: Which wall is the thinnest? The medial wall.

Q3: Which bone is the thinnest ?

Ethmoid bone (0.3 mm) that is why it is easy to get fractures in facial trauma, and it is also easy for infections in the sinus to go to the orbit.

Q4: What other name is there for the ethmoid bone?

Lamina papyracea (paperlike), because it is the weakest/thinnest bone.

Anatomy of The Eyelids

The upper eyelid anatomy:

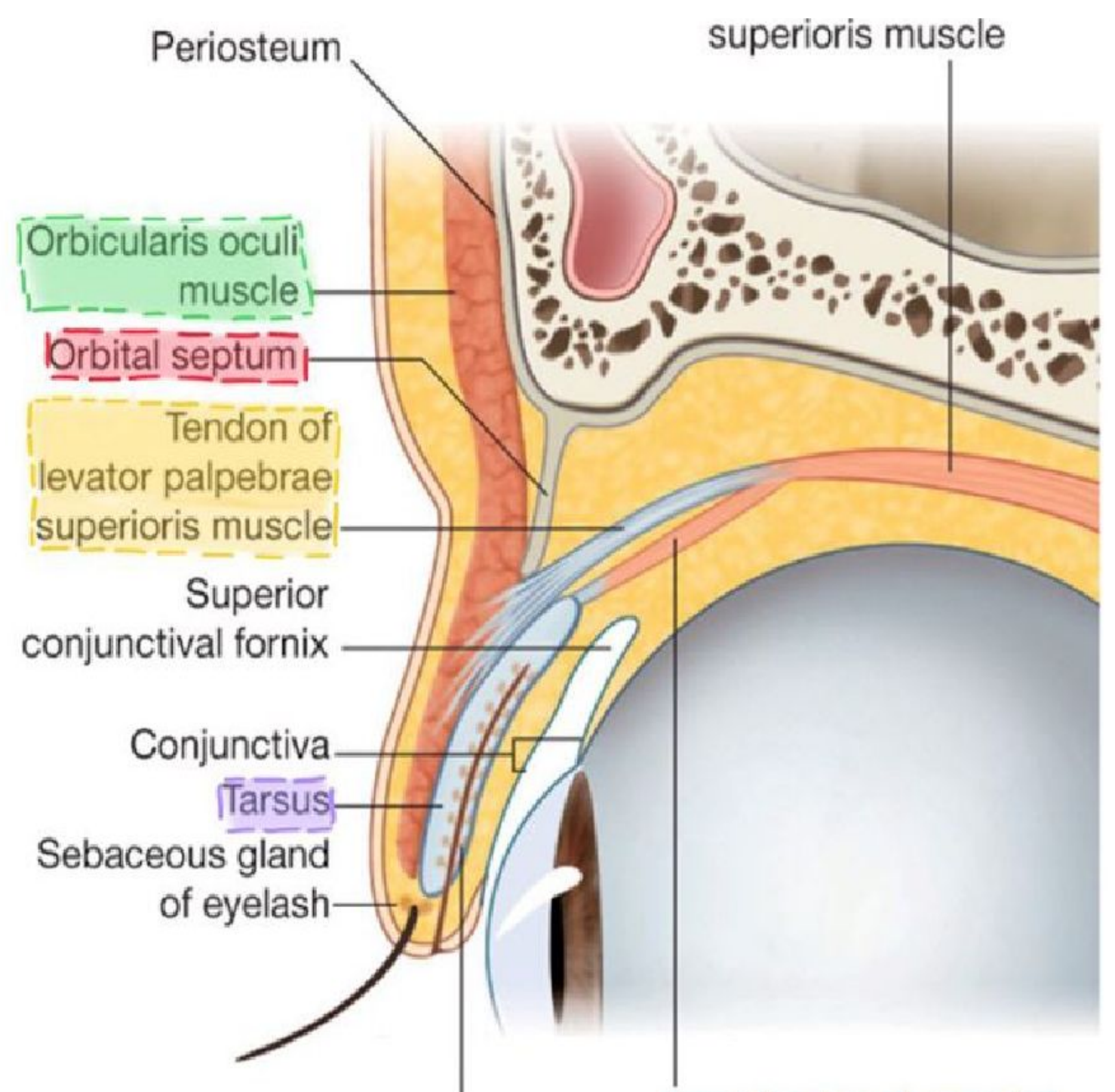
From outside:

skin → (supplied by facial nerve)

→ **orbital septum** (a dense fibrous tissue) → orbital fat (also called preaponeurotic fat) → levator muscle which will be changed to tendon called **levator aponeurosis**, will attach to **tarsals Muller muscle of conjunctiva**.

Tarsal is a condensed fibrous tissue that is forming the skeleton of the eyelid, within tarsals are meibomian glands: fat secreting (sebaceous) glands, opens on the lid margin. forming the fatty layer of the tear film **around 35 in the upper lid and 25 in the lower lid**.

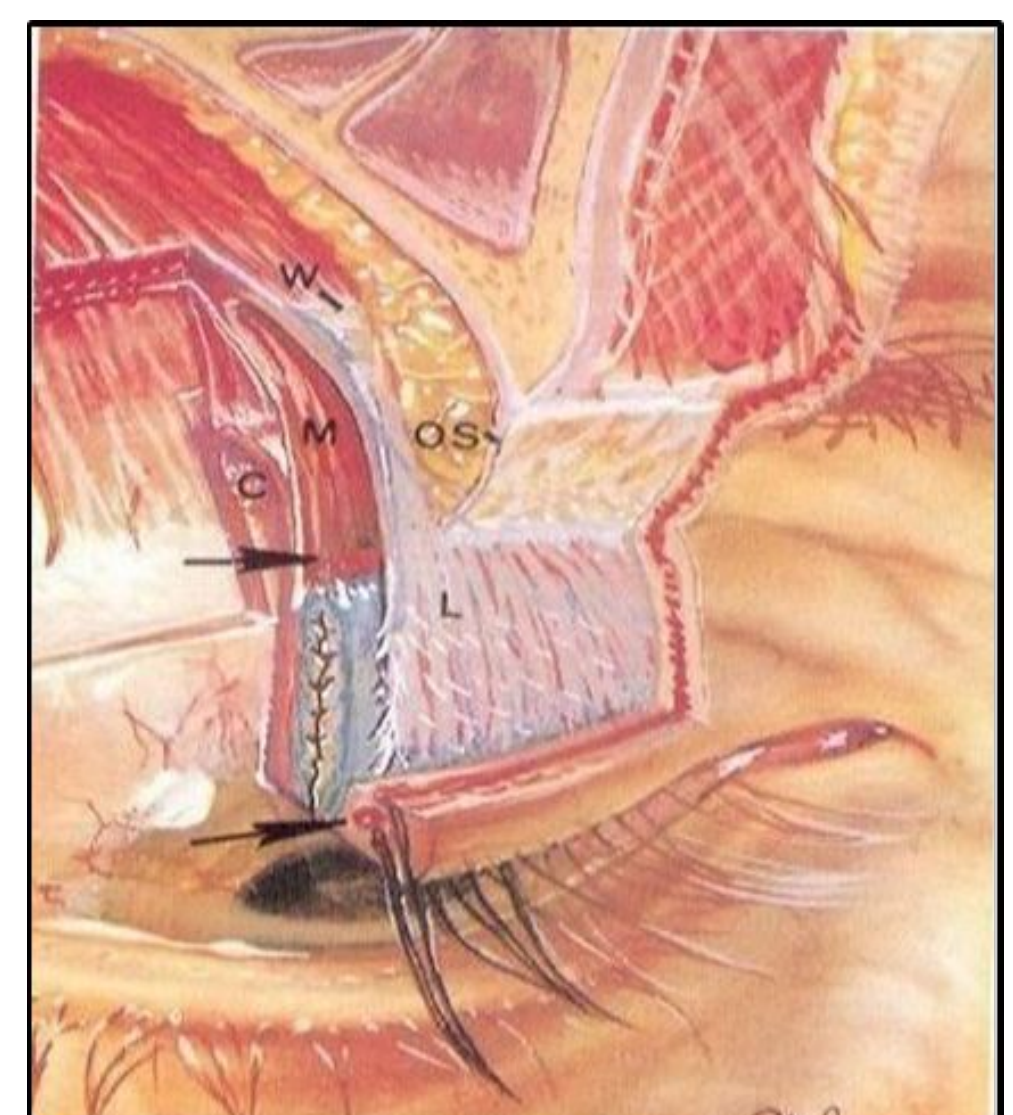
Extra Pic from the web just for u to imagine



- ❖ The important thing in the **orbital septum** (anterior boundary of the orbit).
- ❖ Anything behind the orbital septum = orbit = intra orbital, anything anterior to the orbital septum = extra-orbital = preseptal.
- ❖ **What is the difference between levator muscle and Muller muscle ?**
 - ◇ They both elevate the eyelid. however, they differ in the nerve supply & the type of muscles:
 - ◇ levator muscle is a skeletal muscle supplied by the oculomotor nerve, and **muller** (AKA superior tarsal muscle) muscle is a smooth muscle supplied by sympathetic nerves.

Evaluation

- ❖ **7P's:**
 1. Pain.
 2. **Proptosis**. (cardinal sign of orbital pathology)
 3. Progression.
 4. Palpation.
 5. Pulsation.
 6. Periorbital changes.
 7. Past medical history.



B. Allergic Eyelid Swelling

- ❖ Allergic swellings are **very common**, mainly due to insect bites and irritants. Not infection. Not inflammation
- ❖ Not every eyelid swelling is infection, so how can you differentiate between swelling due to allergy or infection?
- ❖ By history taking and clinical examination, typically allergic eyelid swelling develop suddenly with sudden onset of huge lid swelling and edema collection which occur few minutes to few hours, preseptal cellulitis develop gradually and take few days to develop and present with severe picture
- ❖ Preseptal cellulitis (infection) presents with redness, warmth, and tenderness.
- ❖ Allergic eyelid swellings (only swelling) are not tender, red, or warm. For example, if a patient suddenly woke up with a huge swelling & Presence of the trigger & Previous episodes (recurrence).most likely due to allergy because preseptal cellulitis takes time to develop.
- ❖ **Treatment:** Antihistamine and cold compressor



C. Capillary hemangioma

- ❖ usually in children.
- Senario:A 4 months old baby, the family noticed something started on his eye at age of 2 months and decreasing? Dx Capillary hemangioma
- ❖ We need to treat it because they can develop amblyopia or vision loss if left untreated. We need for the visual development to have a clear visual axis earlier in life, because if we block the visual axis, they will develop amblyopia and it will be difficult to treat later in life.
- ❖ Treatment: **beta blockers (1st line)**. If they don't respond to beta blockers, we give them steroids injection or systemic steroids > if not laser treatment or surgical excision.
- ❖ It enlarges in size until age 3 or 4 then it regresses by itself by age of 5 or 6 years.



Cavernous Hemangioma

Usually in adults



3-Months to Years (mainly benign conditions)

- ❖ Dermoid Cysts.
- ❖ Benign mixed tumors.
- ❖ Neurogenic tumors.
- ❖ Glioma, lymphoma & meningioma.
- ❖ Cavernous hemangioma
- ❖ Osteoma
- ❖ Lipoma
- ❖ Fibrous histiocytoma



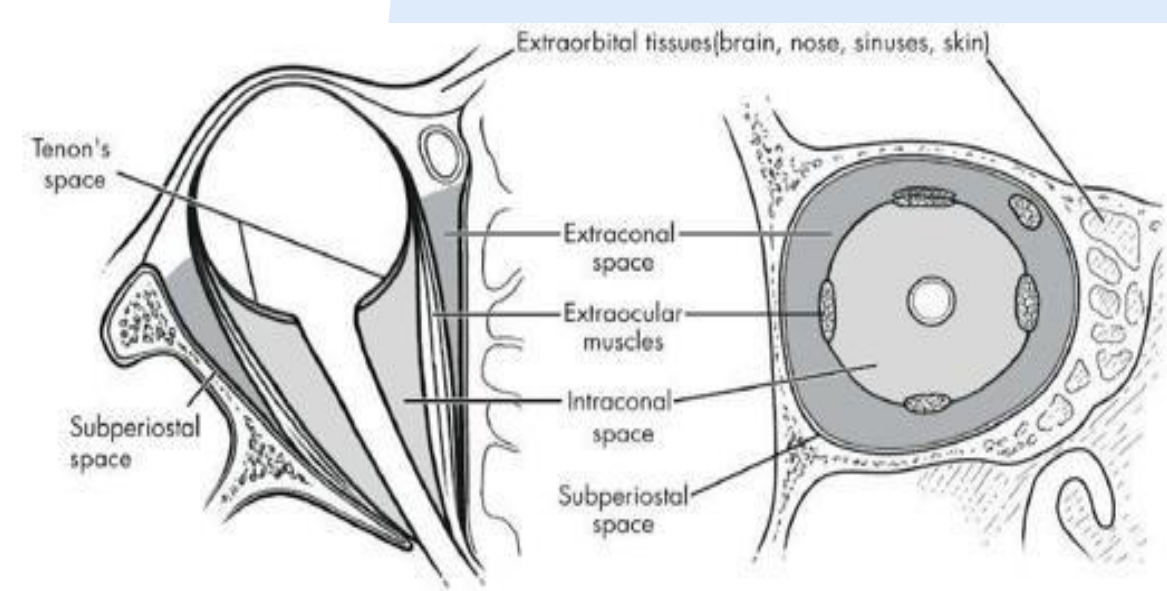
- ❖ a benign tumor of the blood vessels or capillary which leads to the formation of capillary hemangioma

3-Proptosis Cardinal sign of orbital pathology

Bilateral		Unilateral	
<ul style="list-style-type: none"> ❖ Seen in inflammatory conditions (typical condition is thyroid eye disease in Grave's) ❖ Immune processes or systemic diseases 		<ul style="list-style-type: none"> ❖ Primary orbital neoplasms usually unilateral (mass occupying lesion) 	
Causes:			
Inflammatory	Infection	Vascular	Neoplasm
<ul style="list-style-type: none"> ❖ Thyroid disease ❖ Orbital pseudotumor ❖ Wegener granulomatosis 	<ul style="list-style-type: none"> ❖ Orbital abscess ❖ Cellulitis 	<ul style="list-style-type: none"> ❖ Orbital hemorrhage ❖ Lymphangioma (sudden) ❖ C-C fistula ❖ Orbital varices ❖ proptosis with valsalva. ❖ Cavernous hemangioma 	<ul style="list-style-type: none"> ❖ Benign: cavernous hemangioma, lymphangioma ❖ Malignant: adenoid cystic carcinoma, lymphoma, glioma ❖ Contiguous: sinus, intracranial nasopharynx, skin ❖ Metastatic: lymphoma, leukemia, neuroblastoma, Rhabdomyosarcoma

3-Proptosis

- ❖ Proptosis can be either:
(dr skipped it)
- ❖ Axial
- ❖ Non-axial
- ❖ pulsatile.



Pseudoproptosis

(sometimes when the eyes are wide open, you might think that the patient has proptosis but actually they have lid retraction).

- ❖ We differentiate pseudoproptosis and proptosis by using exophthalmometer
- ◇ The most common cause for enophthalmos is trauma. When there's a medial wall or an orbital floor fracture, some of the orbital contents will herniate into the maxillary sinus which will make the orbital space larger, and as a result the eye will sink in.



the patient has lid retraction. You can see the sclera clearly under the upper eyelid.

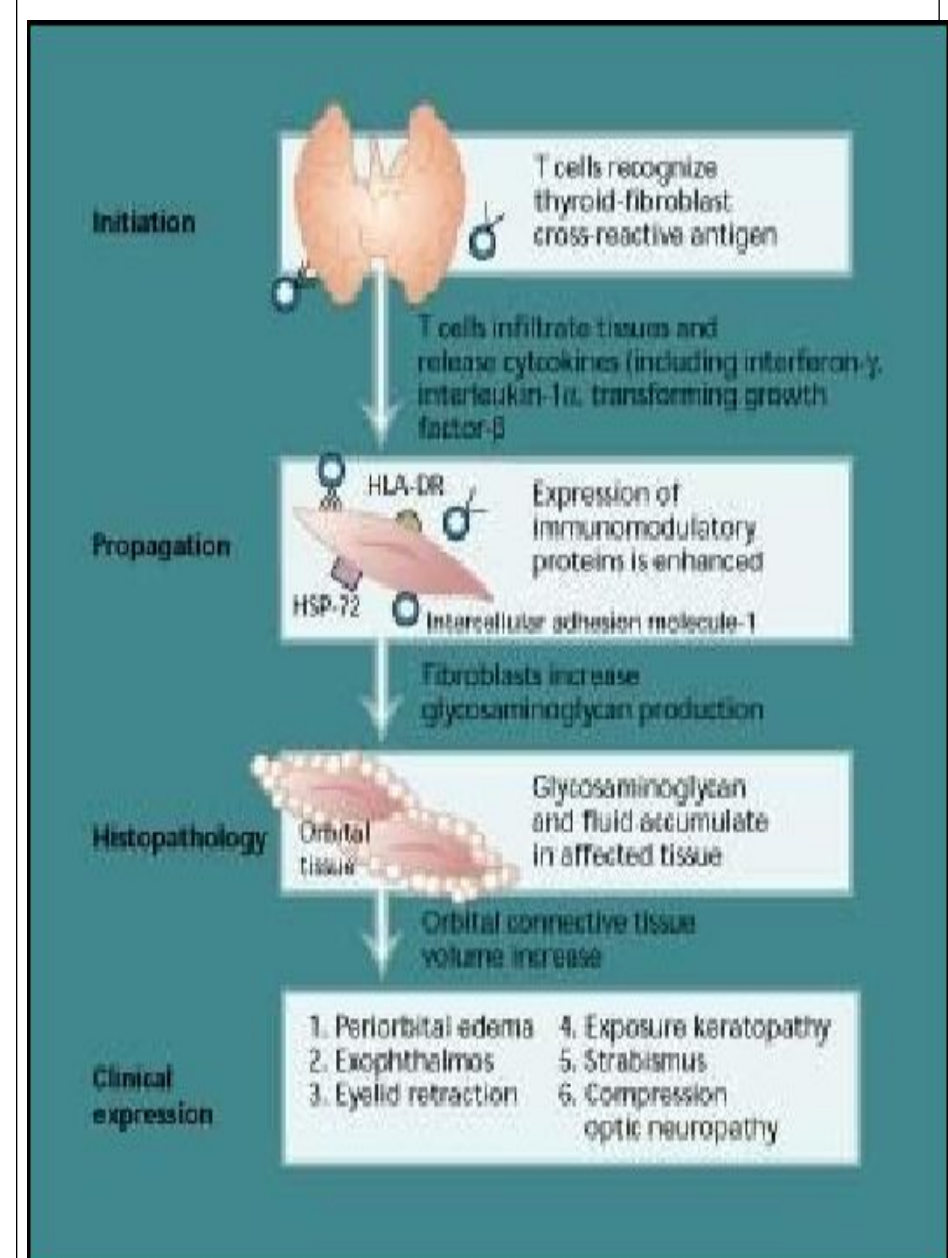


one eye is sunken in → enophthalmos. Of left eye

3-Proptosis (inflammatory)

Graves' disease

- ❖ Most common cause of **unilateral or bilateral proptosis**.
- ❖ May occur with any thyroid status.
- ❖ It can happen with hyperthyroidism, euthyroidism, or hypothyroidism, but most commonly with **hyperthyroidism**.
 - ◇ Eye disease not controlled by thyroid ablation (because Graves' disease is autoimmune disease, there are antibody antigen reaction in the orbit stimulating the thyroid gland, so even if the thyroid is removed there are still antigens in the bloodstream. Thyroidectomy or radioactive uptake won't fix).
 - ◇ Strabismus due to abnormality in the extraocular muscle due to accumulation of the inflammatory changes especially glucose aminoglycan as a result of antigen antibody reaction
 - ◇ lid retraction the eye is wide opened , may occur with upper or lower eyelid , both can be affected.
 - ◇ Lid lag when you ask the patient to look up and down and the eyelid is will be lagging behind the eyeball
 - ◇ visual loss
 - ◇ Cosmetic abnormal inflammation affects the eye (it's a common presentation)
- ❖ Treatment options:
 - ◇ Steroids.(If it is active and severe inflammation)
 - ◇ Radiation (to the orbit to control the inflammatory process).
 - ◇ Optic nerve decompression (isurgery, if failed medical treatment).
 - ◇ Immunomodulators.
- ❖ CT scan: A patient with an active thyroid eye disease has multiple **extraocular muscle enlargement**.
- ❖ The most common muscles to be affected are the medial rectus and inferior rectus. They may develop strabismus, lid retraction, lid lag, and visual loss.
- ❖ Visual loss can occur due to corneal ulceration or exposure keratopathy or compression of the optic nerve that is caused by the huge extraocular muscle → compressive optic neuropathy.
- ❖ Second picture: chemosis (swelling) is seen with lid retraction. Because of severe proptosis, the patient cannot close his eyes.



Idiopathic Orbital Inflammation (diagnosis of exclusion)
 Usually present with pain, proptosis, eyelid swelling, involvement of any orbital structures

- ❖ Orbital pseudotumor.
- ❖ Myositis.
- ❖ Prompt response to steroids.
- ❖ OU or systemic think vasculitis (*except in kids).



Sarcoidosis

- ❖ lacrimal gland.

Vasculitis

- ❖ GCA, PAN, SLE, Wegener's granulomatosis, RA.

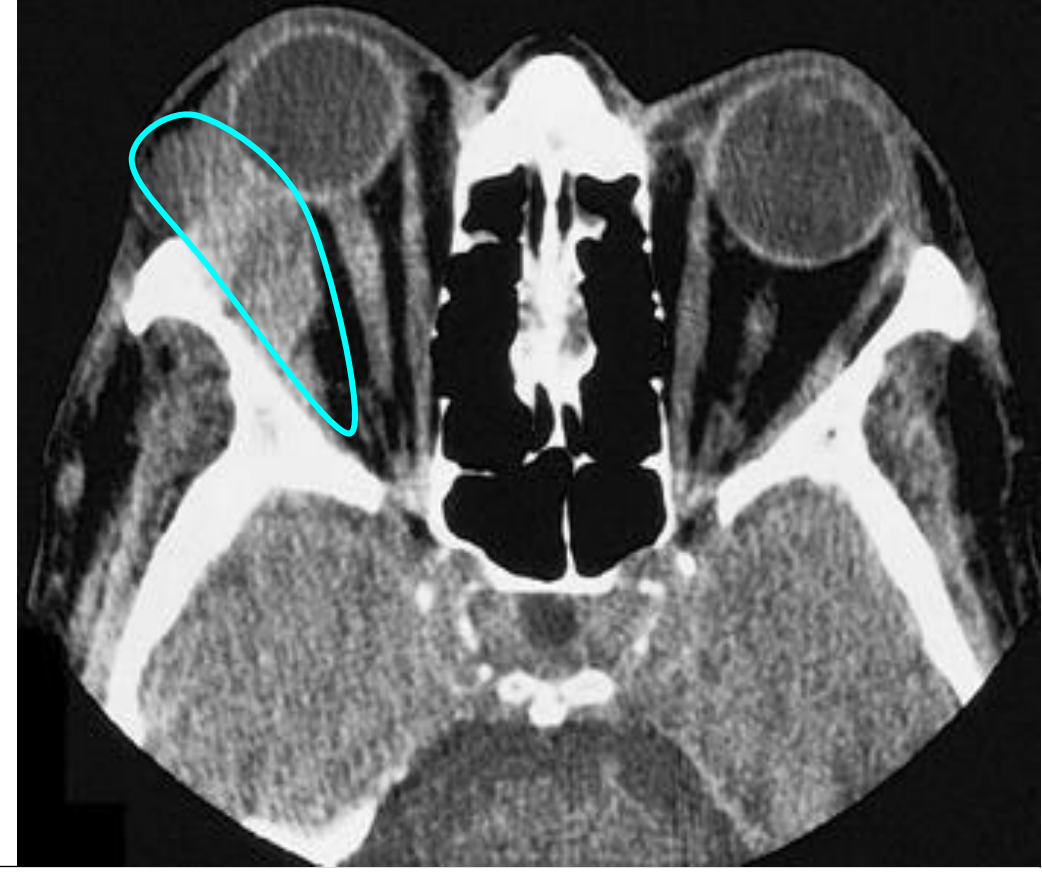
Lymphoproliferative Disorders (space-occupying lesions)

- ❖ Lymphoid hyperplasia and lymphoma (2nd most common cause for orbital pathology)
 - ◇ 20% of all orbital mass lesions
 - ◇ Salmon patch appearance (reddish mass Under the eyelid, in the lacrimal gland usually)
 - ◇ Molds to orbital structures
 - ◇ 50% arise in lacrimal fossa
 - ◇ 17% bilateral
- We usually treat it with chemotherapy (retixemap) and radiotherapy
- ❖ Plasma cell tumors
- ❖ Histiocytic disorders
 - Macrophage based d/o.

Salmon patch Under the eyelid



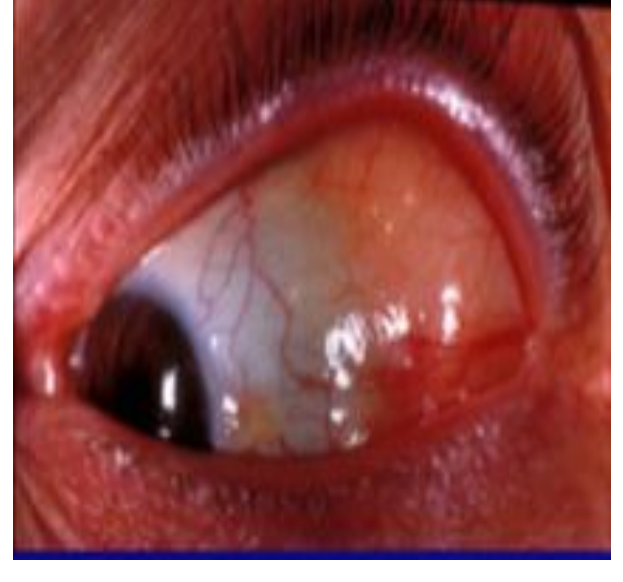
Enlarged lacrimal gland



4- Palpitation



Patient presented with a mass outside the orbit -> dermoid cyst (very common)
 Dermoid cyst tend to occur at the suture line
 TREATMENT: Excision, but we do it later on life not in the first year, I wait for example 2-3 yrs



5- Pulsation

With bruits:

- Cavernous carotid fistula Orbital
- Arteriovenous fistula
- Dural-Arteriovenous (a-v) fistula.

Without bruits:

- Meningoencephalocele.
- Neurofibromatosis.
- Orbital roof defect (condition after surgical removal of orbital roof, sphenoid wing dysplasia).



6- Pre-orbital change



this patient had a tumor (squamous cell carcinoma) removed from the cheek, but he had a recurrence. The right eye is pushed up because of the tumor recurrence.



Encephalocele Right eye

A. Rhabdomyosarcoma (VERY IMP)

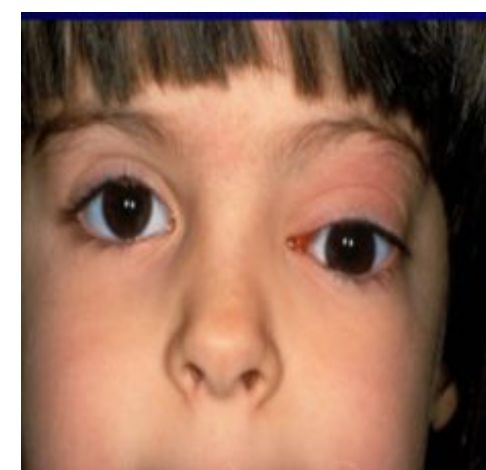
- ❖ Most common primary orbital malignancy of childhood.
- ❖ Average age: 7-8.
- ❖ Sudden onset and rapid evolution of unilateral proptosis (within day to weeks).
- ❖ 90% survival, if you treat it before metastasis happens.
- ❖ **Any child with unilateral proptosis that progressed within a few days** → you need to consider it as a **medical emergency**.
 - ◇ Unilateral proptosis is an important sign for rhabdomyosarcoma, leukemia, and other malignant tumors. In other words, unilateral proptosis is a sign of a bad (malignant) disease.
 - ◇ If a pt presented with pain, swelling, and redness → orbital cellulitis.
 - ◇ **If they don't present with any symptoms except for unilateral proptosis** → **Rhabdomyosarcoma**.
 - ◇ What's the difference between retinoblastoma and rhabdomyosarcoma? retinoblastoma is more common and they only present with proptosis in late stages. Retinoblastoma occurs in the orbit only whereas rhabdomyosarcoma can occur in other parts of the body.
 - ◇ 1st & 2nd picture: This patient was presented with a huge proptosis that developed within 2 weeks. Because the patient came to the hospital early, it was unlikely that she had any metastasis. **A biopsy was taken to confirm** the diagnosis and she was treated with chemotherapy and radiation therapy. The 2nd picture is the same patient after one year. In conclusion, you can save the patient's life if you diagnose them early.



1st pic



2nd pic



3rd pic

7- Past medical history

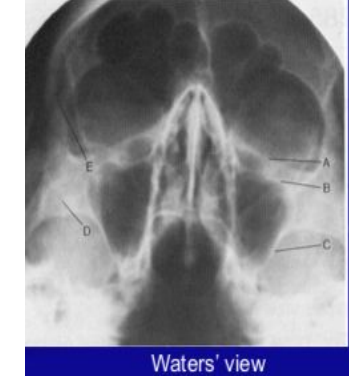
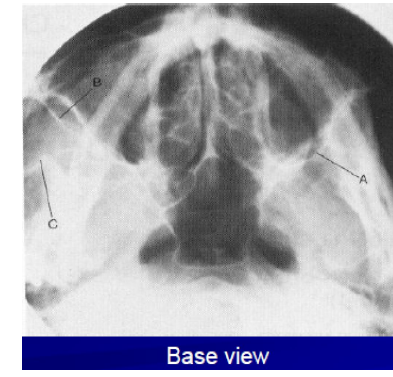
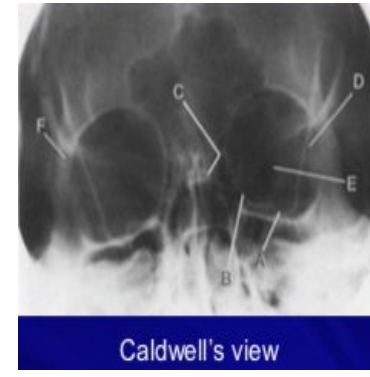
- Past medical history is very important, because for example, if a patient with a known history of Graves' disease was presented with proptosis, then it's most likely related to Graves' disease.
- If a patient with a known history of chronic sinus disease was presented with eyelid swelling and proptosis, then it's most likely orbital cellulitis.

Imaging Option:

- ❖ Plain films **not** used anymore, we only use it if we suspect metallic foreign body in the orbit
- ❖ CT scan **helps** showing the bone and the soft tissue. Most common used
- ❖ MRI **best** to visualize soft tissue
- ❖ Ultrasound **not** as good as MRI and CT scan

Plain film

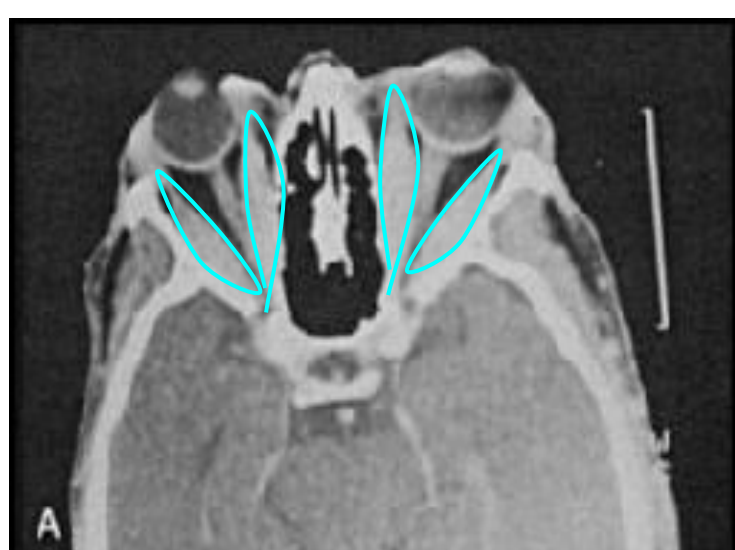
- ❖ Quick In ER
- ❖ R/o foreign bodies
- ❖ Infrequently used



CT Scan (most commonly used)

Strengths	Weakness	Protocols
<ul style="list-style-type: none"> ▪ Spatial resolution. ▪ Bone: fracture, destruction, calcification. ▪ Quick: emergencies trauma. ▪ Cheaper. 	<ul style="list-style-type: none"> ▪ Radiation: 1-2 cGy. Risk for 2dry tumor especially in children ▪ Soft tissue definition. ▪ Contrast iodinated: avoid it in case of allergy. ▪ May need MRI anyway (not cheaper) 	<ul style="list-style-type: none"> ▪ Axial and coronal +/- Contrast.

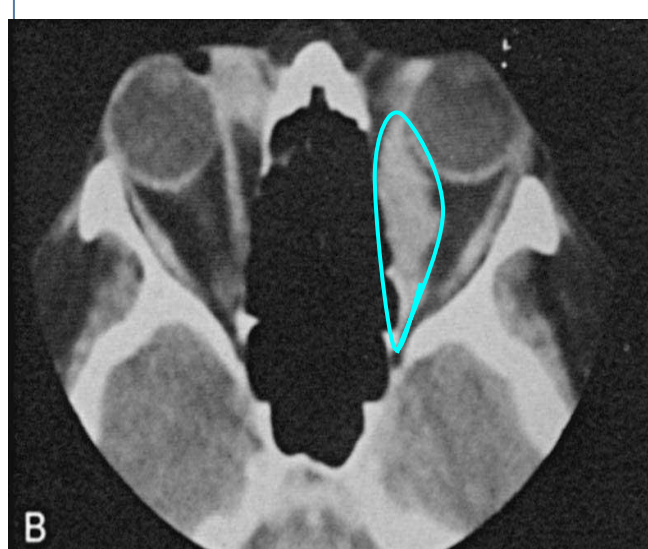
- ❖ This patient has an active thyroid eye disease (Graves). You can see enlargement of the extraocular muscles
- ❖ Axial image



- ❖ Coronal image of enlarged extraocular muscles



- ❖ Single extraocular muscle enlargement. Less likely caused by Graves disease. More likely caused by other inflammatory causes, or a tumor.



- ❖ Multiple fractures are seen. (arrows)



- ❖ This patient has an orbital mass behind the eyeball.

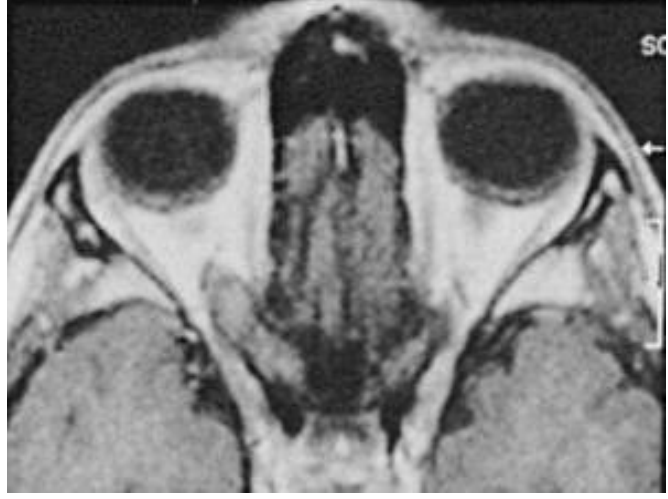
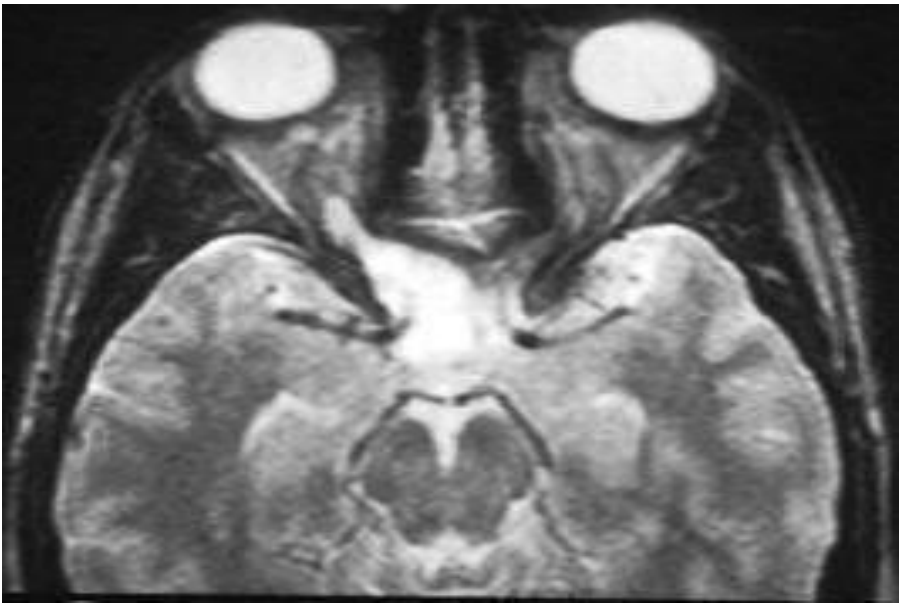



MRI

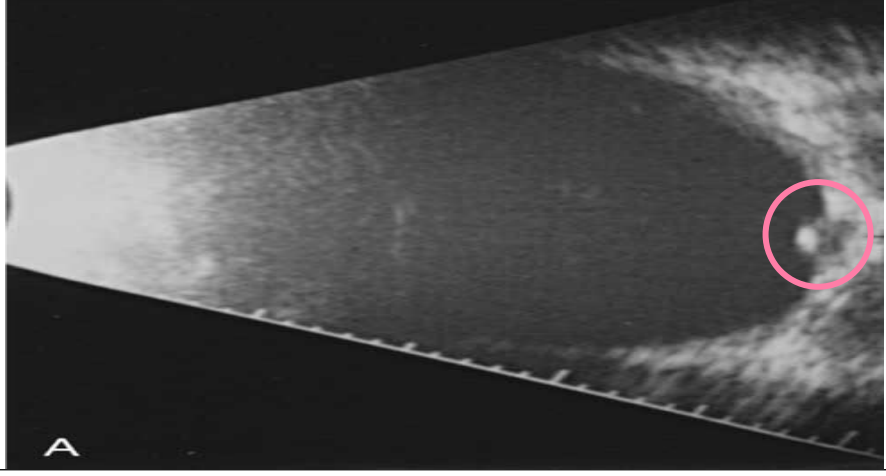
Strengths	Weakness	Protocols
<ul style="list-style-type: none"> ● Tissue. <ul style="list-style-type: none"> ○ T1 anatomy. ○ T2 pathology. ● No radiation. 	<ul style="list-style-type: none"> ▪ Magnetic: pacemakers, surgical clips. ▪ Claustrophobia. 	<ul style="list-style-type: none"> ▪ Axial/coronal/sagittal ▪ Gadolinium contrast <ul style="list-style-type: none"> - Non-iodinated. - Allergies RARE ▪ Orbital lesions. ▪ Fat suppression (allows you to see the structures inside the orbit clearly).

Examples

(how to differentiate between T1 & T2? In T1 the fluid appears dark, which is why the eyeballs are black in T1; In T2 the fluid appears bright, which is why the eyeballs are white in T2).

T1	T2	T1
<p>No fat suppression. Orbital structures cannot be seen. Dark eyeballs = T1.</p> 	<p>Bright eyeballs = T2.</p> 	<p>With fat suppression. The orbital structures can be seen clearly. Dark eyeballs = T1.</p> 

Ultrasound (Orbital Echography)

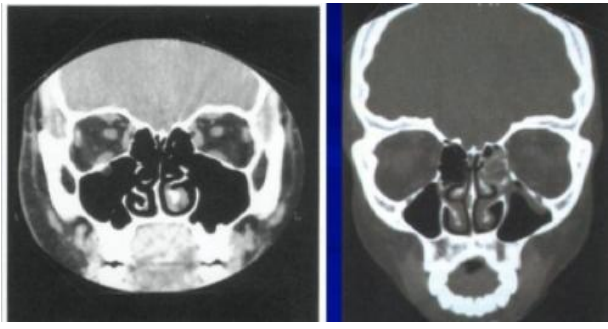
<ul style="list-style-type: none"> ▪ Features: <ul style="list-style-type: none"> - Dynamic. - Less expensive. - +/-Availability variable. 	<p>This is an ultrasound showing an orbital cyst behind the eyeball</p> 
--	---

Facial trauma and fractures

Facial Trauma:

- ❖ Midfacial fractures.
- ❖ Zygomaticomaxillary Complex (ZMC) fracture.
- ❖ Wall and floor fractures:
 - ◇ Medial wall: lamina papyracea.
 - ◇ **Orbital floor: blow out** vs rim involvement (blow out fractures can easily be missed, especially in children).
 - ◇ Lateral wall and orbital roof (less common).
- ❖ Optic canal fractures:
 - ◇ Traumatic optic neuropathy.

Floor Fractures



Blow out fracture with inferior rectus muscle entrapment

1st picture

- ❖ 1st picture: This boy had a trauma in his right eye at school. He was taken to a general emergency room. There was no pain in his eye, no redness, and no swelling. And because of that he was discharged, but the boy was still complaining.
- ❖ In the picture you can see that when he tries to look up, the right eye looks abnormal because there's **entrapment of the inferior rectus muscle caused by a small fracture, so he cannot look up. This type of fracture that causes muscle entrapment typically happens in children more than adults because the bones are more elastic.** This causes small fractures that will cause some of the orbital contents to herniate and then they'll get entrapped.
- ❖ So, it's very important to check the eye motility in every patient that presents with orbital trauma because it's tricky to pick up this kind of fracture if you don't check the eye motility.
- ❖ **This patient needs urgent surgery because if the muscle remains entrapped, there will be necrosis and he'll end up with permanent double vision.** Another thing that can happen if the muscle remains entrapped is oculocardiac reflex, which means that they can develop abnormal cardiac rhythm.

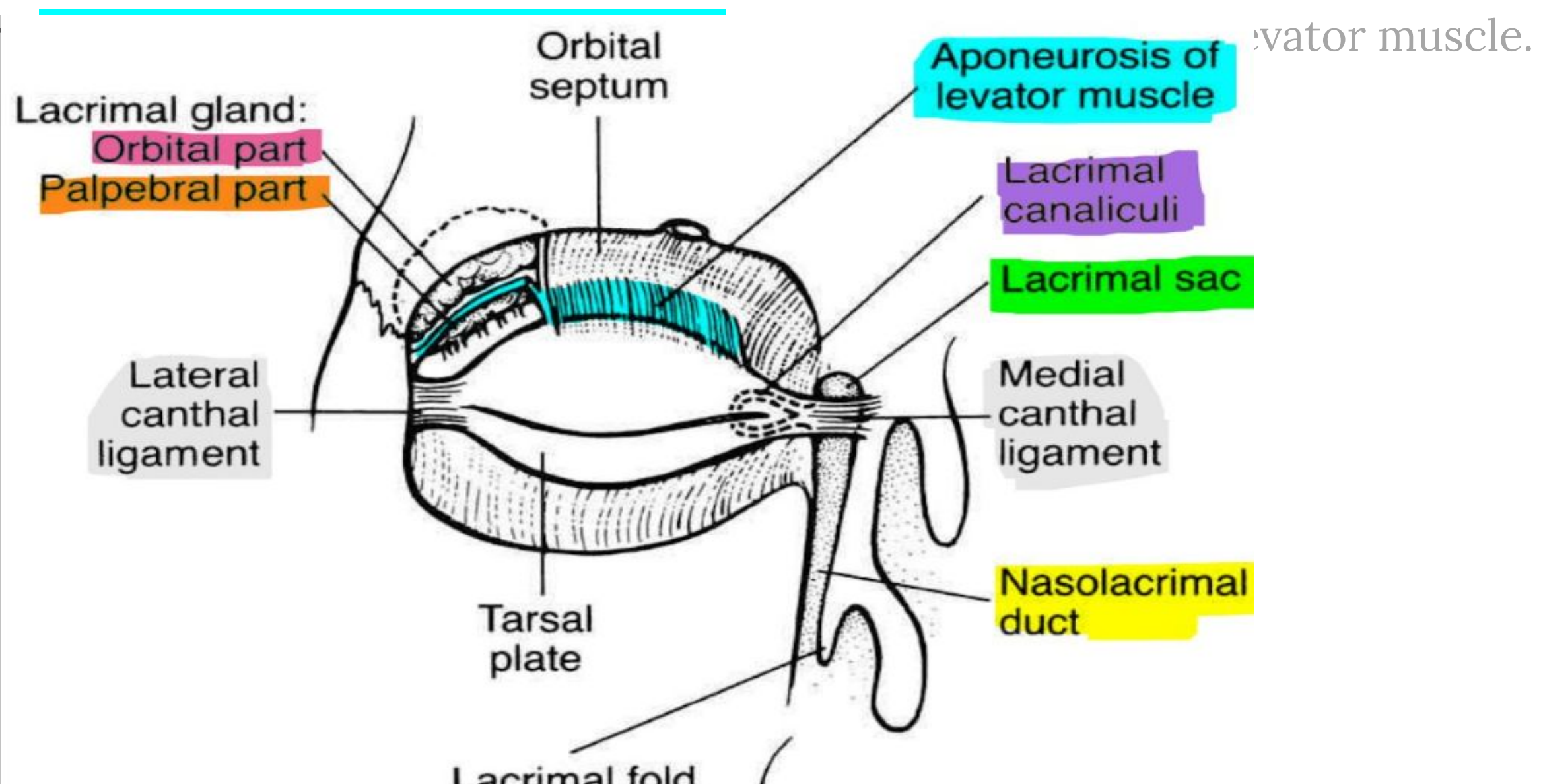
Lacrimal disorders

Structure and Function:

- ❖ The lacrimal gland is approximately 2cm long and it is situated superior-temporally behind the orbital rim.
- ❖ It can be divided into two main parts: **The main lacrimal gland**
 - ◇ **Orbital:** larger and sits on the lateral margin of levator palpebrae.
 - ◇ **Palpebral:** smaller and located along the inner surface of the eyelid.

We have accessory lacrimal gland present in the upper and lower fornix nearby tarsal plate . however, the main tear production comes from lacrimal gland which is present in the anterior lateral superior part of the orbit.

- ❖ The two lobes are



Physiology:

- ❖ From the **palpebral part of the lacrimal gland** there are small ductioles secreting the tears to lubricate the eye, these ductioles open into the superior fornix, the tears will lubricate the cornea, and then will be drained through the lacrimal drainage system starting with the lower punctum which is a small round opening and upper punctum, and from there, there are small ducts called canaliculi (canaliculus).
- ❖ The upper and lower canaliculi will meet to form **common canaliculus**, then it will go inside the lacrimal sac, then from the lacrimal sac the **nasolacrimal duct** will take the tears to the inferior meatus.
- ❖ The canthal ligaments attach the eyelid to the bone. There are two canthal ligaments; the medial canthal ligament, and the lateral canthal ligament. The lacrimal sac is behind the medial canthal ligament.



Congenital Lacrimal Duct Obstruction (common problem)

- ❖ one of the most common conditions that **a child can present with is tearing and chronic discharge. This condition is called congenital lacrimal duct obstruction.** The reason why they accumulate tears and have discharge is because they have delayed canalization of the nasolacrimal duct. Commonly the delayed canalization happens at the valve of Hasner at the distal end of the nasolacrimal duct. The nasolacrimal duct has a membrane that's supposed to be perforated before birth, but some children present with delayed membrane perforation.
- ❖ In congenital lacrimal duct obstruction, the tears will accumulate in the lacrimal sac because of the obstruction, and eventually there will be discharge because the accumulation of tears in the lacrimal sac is a media for infection so the child will present with a chronic low-grade infection.
- ❖ Another cause for the discharge is the lacrimal sac is lined with mucus secreting cells. In children with a perforated nasolacrimal duct, the mucus goes to the nose. Whereas in children with this condition, the mucus cannot go to the nose and, so it will accumulate in the eye. They can be presented with unilateral or bilateral excess tearing and discharge.
- ❖ To treat this condition, we usually ask the parents to massage the area above the medial canthal ligament regularly until the age of 1. If the patient was presented after the age of 1, the chances of opening the duct through massaging the area is really low, so we go for probing to perforate the membrane.
- ❖ If a child presents with tearing but no discharge, you need to think about **congenital glaucoma**, eyelashes rubbing against the cornea, foreign body causing irritation or absence of the punctum of the lacrimal sac.

Congenital Lacrimal Duct Obstruction (common problem)

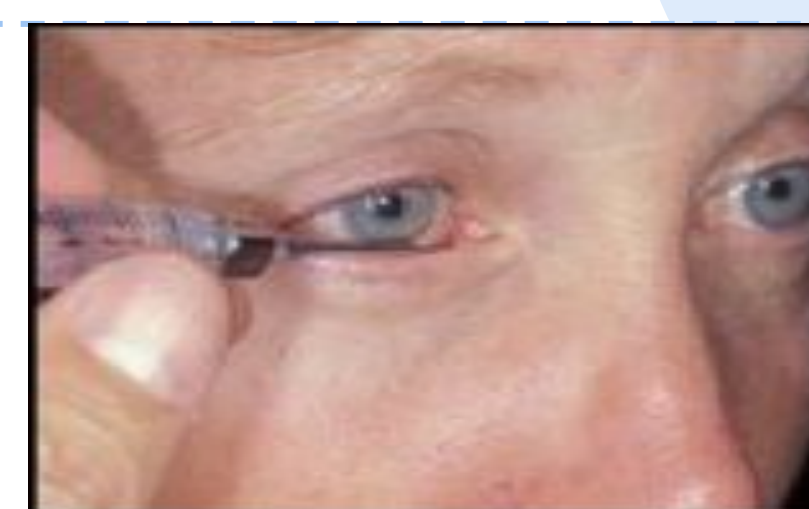
This patient has an acute nasolacrimal duct obstruction, which **wasn't treated** well, so he developed **acute dacryocystitis**, it is a form of an acute infection in the lacrimal sac. If acute dacryocystitis wasn't treated, the patient will develop orbital cellulitis.

Presentation : acute redness, swelling, and pain in the area of the lacrimal sac. Also, tearing and discharge.

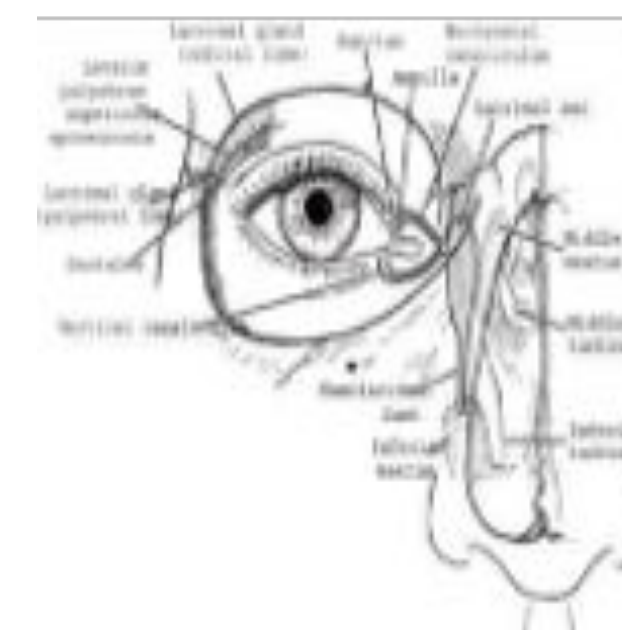
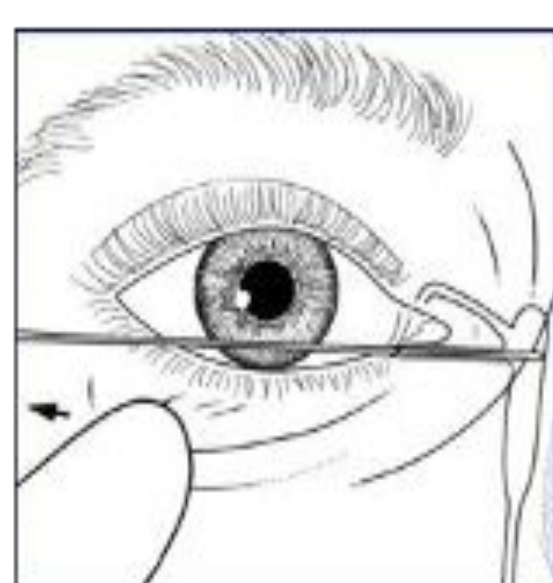
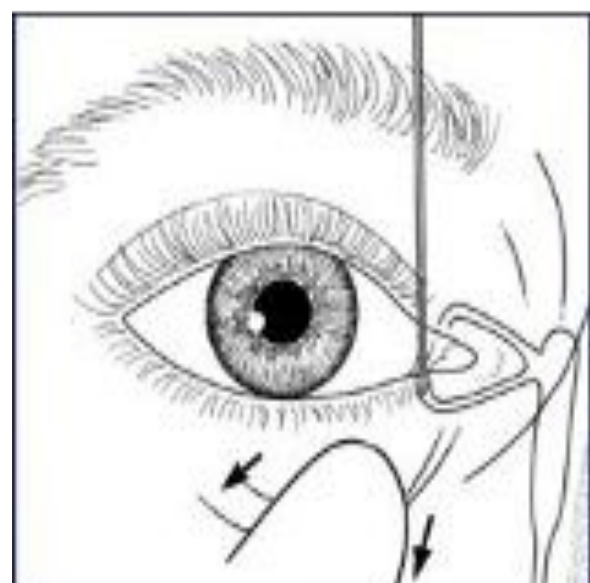
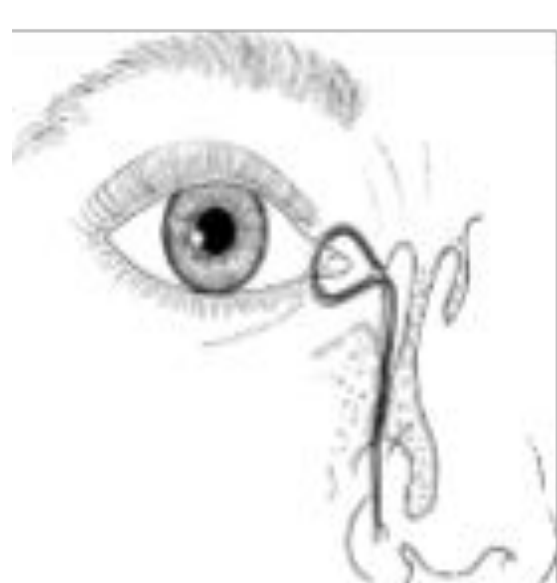
Treated by: system antibiotic plus topical antibiotic and drainage of abscess. after the resolution of infection we need to open the nasolacrimal duct So the infection won't happen again.



In adults with lacrimal drainage problems, we do lacrimal irrigation to detect where the obstruction is, and to introduce a cannula through the punctum all the way to the lacrimal sac. Then push a fluid and if the lacrimal drainage works, the patient will feel a fluid inside their nose and throat. In children, we do a fluorescein dye (diagnostic dye eye drops) and wait 5 minutes; if the dye is still apparent then the lacrimal drainage is compromised.

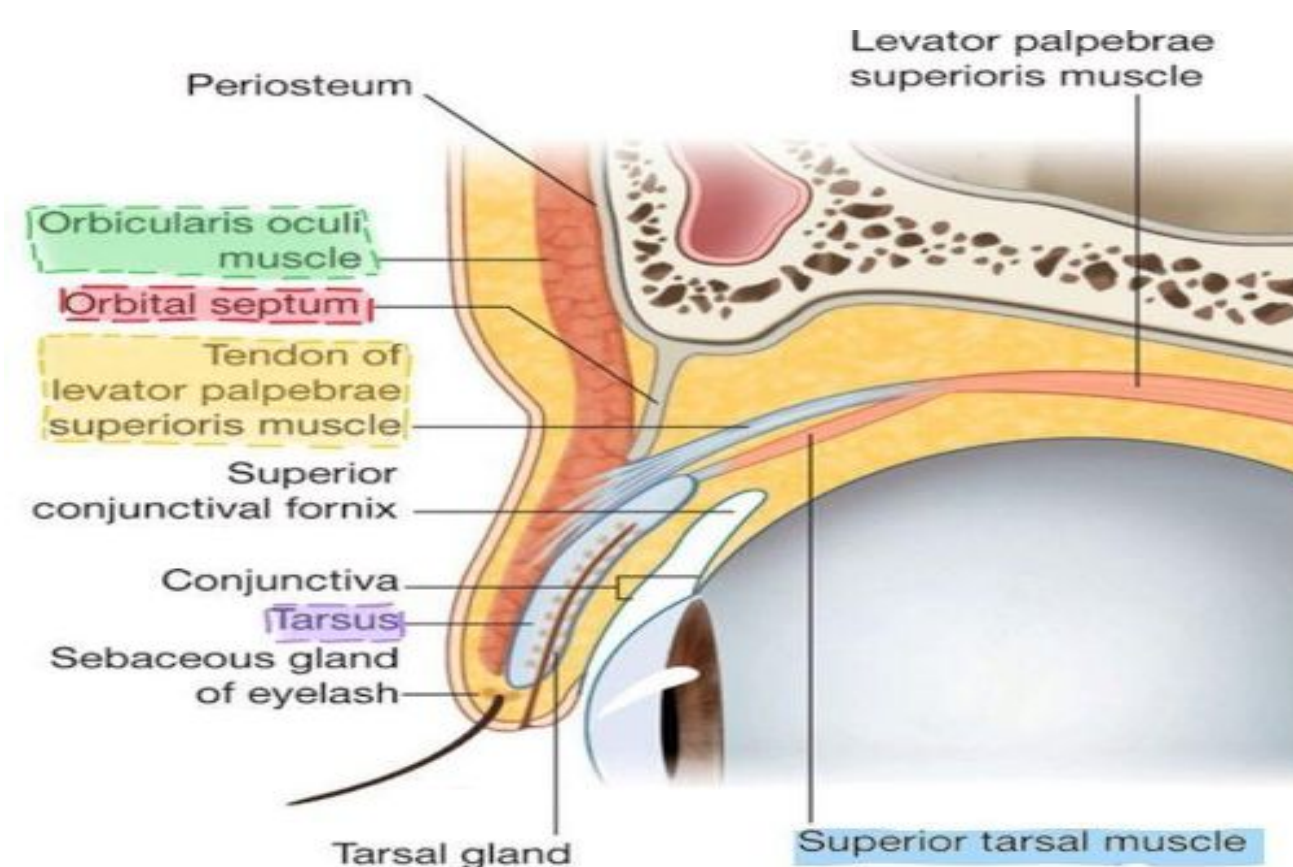


In children, probing is done. A metallic probe is introduced through the punctum, and then through the canaliculus, and then all the way down to the nose so it can perforate the membrane. Sometimes, a stent made of silicone will be placed to prevent the membrane from reforming and it will be removed after a few months.



The Eyelids

- ❖ Anatomy
- ❖ Trauma
- ❖ Lid lesions.
- ❖ Lid malpositions.



Eyelid trauma

Types:

Blunt, sharp/penetrating

- ◇ If one or all of the following involved in an eyelid trauma call ophthalmology (lid margin, canthal, canaliculi).

Classification:

- ◇ The lid margin is spared (not involved): examine eyelid
 - Skin and orbicularis only injured → skin sutures. You don't need to suture the orbicularis muscle; you only need to suture the skin.
 - FAT protrusion = septum violated, DO NOT suture the orbital septum. You need to do a thorough evaluation of the eye to rule out eyeball (cornea and globe) laceration.
- ◇ The Lid margin involved:
 - You need to suture the lid margin properly and meticulously because if the suturing wasn't properly done, the cornea will be irritated with every blink and Causes corneal ulceration.
- ◇ The canthals involve:- call ophthalmology
 - You need to call ophthalmology because the medial and lateral canthal ligaments are what stabilize the eyelid. If the canthal ligaments are injured, they need to be sutured to their proper positions to avoid any eyelid abnormalities.
- ◇ The canalicula involve: duct from the eye to the lacrimal sac
 - You need to call ophthalmology immediately because you need to treat the patient with suturing the canaliculus and putting a stent or a silicone tube through it to avoid permanent closure of the duct, This needs to be done acutely.
 - you will remove the stent after a few months.



Lid laceration medially with canalicular involvement. A metallic probe (called Bowman probe) is introduced through the punctum.+ silicone stent



Blepharitis

- ❖ Blepharitis is a **chronic** inflammation that involves the **roots of the eyelashes**, and it can also involve the meibomian glands and the eyelids as well. Usually by bacterial infection.
- ❖ Usually patients with blepharitis present with redness, irritation, and tearing due to the toxins present in the lid margin. Patient might also develop scales and dryness.
- ❖ They are treated with topical antibiotics and lid hygiene.
- ❖ Most common causative organism is Staph aureus.
- ❖ The main goal of treatment is not to eradicate the disease, but it is to control the symptoms.



Herpes Zoster Ophthalmicus

- ❖ It involves the ophthalmic division of the upper division of trigeminal nerve.
- ❖ It occurs in the elderly without any comorbidities, however, if it occurs in young individuals you need to think about predisposing factors such as immunodeficiency.
- ❖ Treatment: systemic antiviral and specific tests to rule out immunocompromisation

Eyelids lesions

Sty

- ❖ Sty is a **localized acute** infection and inflammation around the root of the eyelashes. develops rapidly, producing an elevated, painful, red, swollen area on the eyelid.
- ❖ Patients will present with redness, swelling of the eyelid, and sometimes pus can be seen.
- ❖ They are treated with topical antibiotics and applying a warm compress.
- ❖ How is Sty different from blepharitis?
 - ◇ Blepharitis is a chronic infection along the route of the eyelashes, involving the whole eyelid.
 - ◇ Sty is an acute & localized infection



Chalazion (very common)

- ❖ Chalazion is an inflammation of the meibomian glands.
- ❖ The meibomian orifices are blocked and as a result there will be accumulation of the meibomian gland secretions in the meibomian gland itself which is why the patients will present with swelling.
- ❖ In some cases, it presents with a co-infection and the patient presents with redness and pain along with the swelling. They are treated with topical antibiotics and a warm compress. If there's no improvement, we need to do surgery to evacuate the sebum.



Xanthelasma

- ❖ Lipid deposits in the eyelid. We treat the hyperlipidemia along with treating the eyelid lesions. Investigating the lipid profile is very important because 50% will have lipid profile abnormality.



Eyelids Malposition

1. Ectropion

- ❖ Outward turning of lid margin (the eyelid is becoming so lax that it is turning away from the eye).
- ❖ Types:
 - ◇ Congenital.
 - ◇ Involutional (aging). Laxity of eyelid tendon and eyelid.
 - ◇ Paralytic (facial nerve palsy → orbicularis muscle paralysis).
 - ◇ Cicatricial. Scarring of the eyelid
 - ◇ Mechanical



2. Entropion

- ❖ Inversion of the lid margin (the eyelid is turning towards the eye) the lashes irritate the cornea and conjunctiva
 - ❖ Types:
 - ◇ Involutional (aging).
- Because of eyelid laxity some patient may have tendency for lid margin to turn toward the eye and rub against the cornea and ocular surface
- ◇ Congenital.
 - ◇ Acute-spastic.



Left: upper eyelid entropion
Right: lower eyelid entropion

Cicatricial
Entropion
Trachoma

◇ Cicatricial:

- Most common type of entropion.
- Happens as a sequela of **trachoma** which used to be a common infection in our area years ago.
- Typically start with eye redness and discharge, if it's not treated it will lead to scarring in the conjunctiva and this typically we see it when we evert the eyelid, the scarring of conjunctiva will cause shortening of the eyelid from posterior part and this will lead to lid margin to turn toward the eye and the lashes will rub against the cornea, if not treated will lead to corneal laceration and corneal opacification this will compromise the vision.
- Usually patient develop entropion many years later (Ex. patient had the infection 40 years ago).
- They usually present with entropion, corneal scarring, or dryness
- Trachoma caused by chlamydia trachomatis which is an intracellular bacterium that cannot be stained with a gram stain because it doesn't have a cell wall, and It is treated with tetracycline, azithromycin, or clarithromycin. However the sequelae of trachoma like entropion, corneal scarring need to be treated with Surgical intervention.

3. Trichiasis

eyelashes incorrectly grow toward the cornea. Just eyelashes for eg 1 or 2. Unlike entropion is the eyelid

isolated eyelashes that are misdirected towards the cornea


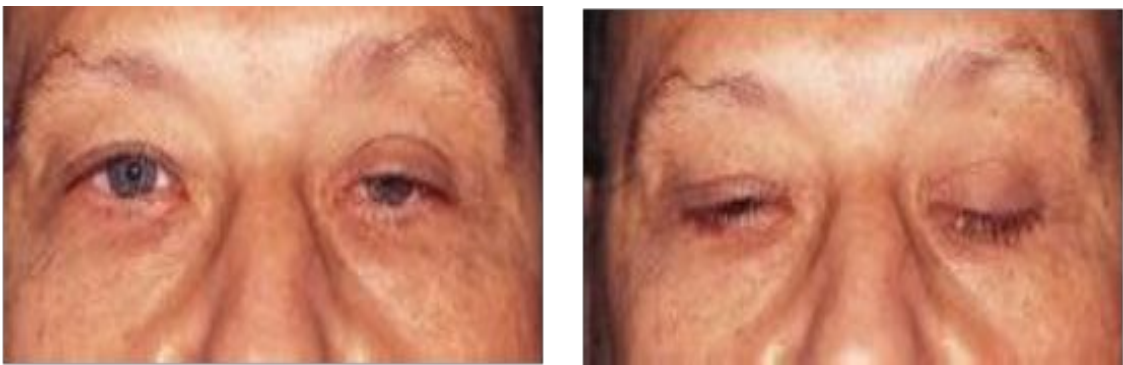



4. Blepharoptosis:

❖ Blepharoptosis is drooping or inferior displacement of the upper lid. This can either happen in the upper eyelid where the eyelid is drooping and covering the cornea from superior or from lower eyelid where the eyelid is pushed up and cover the cornea from inferior

❖ Classification:

- ◇ Congenital vs acquired:
- ◇ Myogenic → a problem with the levator muscle.
- ◇ Aponeurotic → a problem with the levator aponeurosis.
- ◇ Neurogenic → a problem with the innervation of the levator muscle (3rd nerve palsy) or the muller muscle (Horner's syndrome).
- ◇ Mechanical → a mass or swelling in the eyelid that's causing ptosis.
- ◇ Traumatic → trauma affecting the nerve, muscle, or aponeurosis.

Myogenic	<ul style="list-style-type: none"> ❖ Congenital (most common cause of myogenic ptosis). <ul style="list-style-type: none"> ◇ Dysgenesis of levator (malformation of the levator muscle). ❖ Acquired <ul style="list-style-type: none"> ◇ Localized or diffuse disease. ◇ Muscular dystrophy. ◇ CPEO (chronic progressive external ophthalmoplegia). ◇ MG (myasthenia gravis). ◇ Oculopharyngeal dystrophy. <p>For Acquired during adulthood we need to do The surgery for improving the visual field However, the patient will not have amblyopia</p> 	 <p>This child has congenital dysgenesis of the levator muscle. The levator muscle of the right eye is underdeveloped. Some children lift their chin to be able to see properly, but some children don't do that which allows the eyelid to block the pupil and this results in amblyopia. If the pupil is blocked by the eyelid, we need to do surgery as soon as possible to prevent amblyopia.</p>
Aponeurotic	<ul style="list-style-type: none"> ❖ Most common form of ptosis. <ul style="list-style-type: none"> ◇ Most common cause is aging. ◇ It is commonly seen in contact lens wearers because they tend to stretch their eyelids strongly when applying the contact lens. ◇ High lid crease with normal levator function. 	
Neurogenic	<ul style="list-style-type: none"> ❖ Acquired and congenital forms. <ul style="list-style-type: none"> ◇ Acquired: <ul style="list-style-type: none"> ■ 3rd nerve palsy ■ Horner syndrome (partial ptosis, due to the blockage of the Sympathetic ganglion) ■ Myasthenia gravis 	

Evaluation: Levator Function

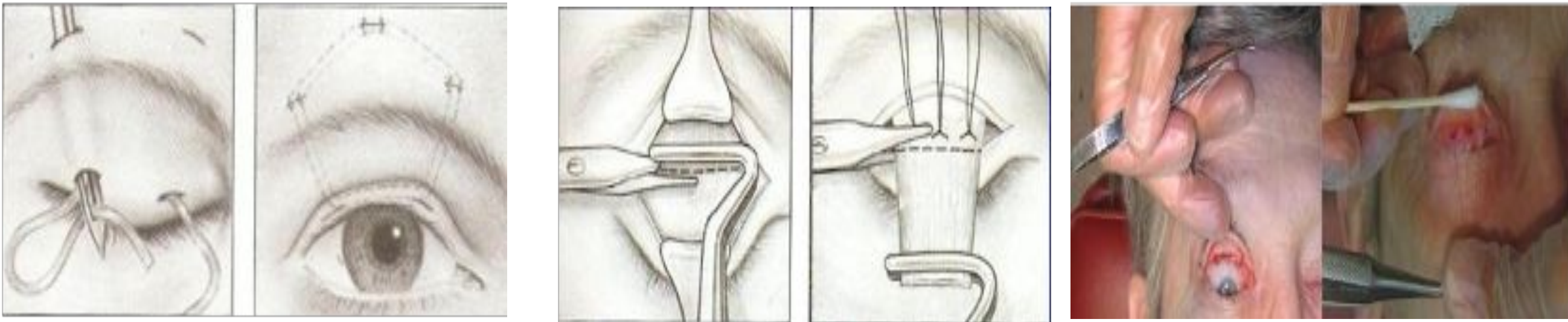
(this is the way we evaluate the muscle)

We ask the patient to look all the way down, and then we measure how much they go up. Normally it should be 15 cm and above, like in this picture.

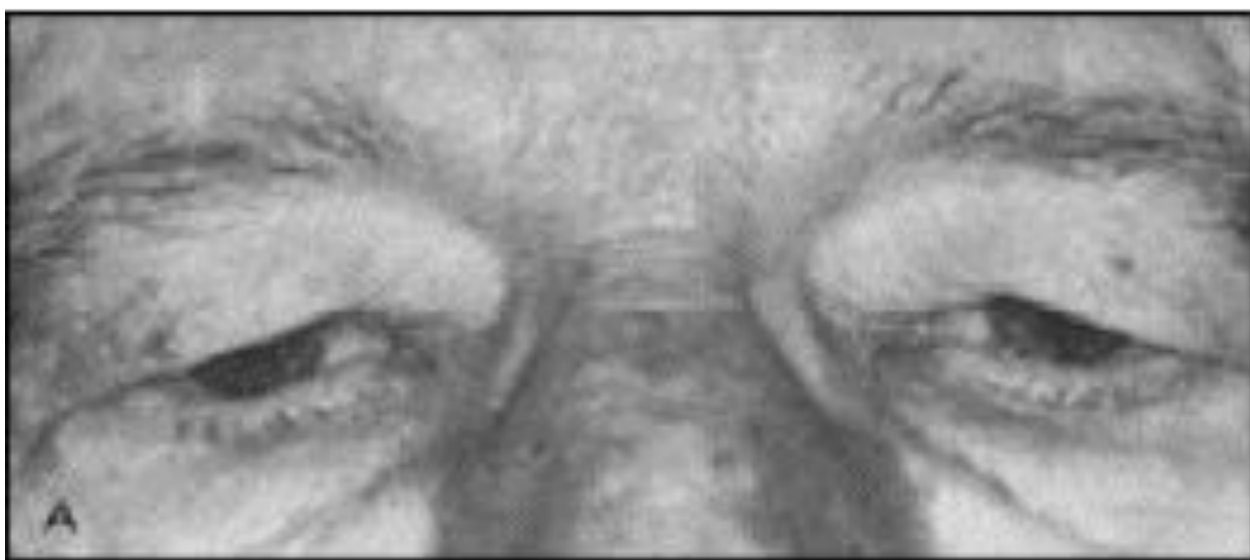


Treatment: (all surgical)

- ❖ Mild ptosis, good levator function: Mullerectomy.
- ❖ Any ptosis, reasonable levator function: Levator resection.
- ❖ Severe ptosis, poor levator function: Frontalis suspension.
- ❖ Children with ptosis covering the pupil need to be treated as soon as possible to prevent amblyopia.



Dermatochalasis (pseudo-ptosis)



There's excess skin hanging over the eyelid



Before and after **blepharoplasty** which is the most common cosmetic surgery done on the face.

<p>Before surgery →</p>	
<p>After surgery →</p>	
<p>Brow ptosis</p> <p>The eyelid opening is normal, but the brow is drooping.</p>	<p>Unilateral Brow ptosis</p> <p>The most common cause for unilateral brow ptosis is facial nerve palsy. The frontalis muscle of the eyebrow is supplied by the facial nerve.</p>

Abnormal eyelid movements

- ❖ Blepharospasm.
- ❖ Hemifacial spasm.
- ❖ Facial (7th) nerve palsy.

This patient has spasmodic contraction of the orbicularis and he has no control over it.



Blepharospasm (both eyes are affected).

- ❖ Involuntary tonic, spasmodic contraction of orbicularis. All of a sudden can not open
- ❖ Dermatochalasis.
- ❖ Rubbing.
- ❖ Brow ptosis.
- ❖ Frontalis spasm.
- ❖ Blepharoptosis.
- ❖ Levator dehiscence.
- ❖ Ectropion/entropion.
- ❖ Dry eye (we need to rule out local causes of irritation such as; dry eyes, foreign body, or eyelid malposition).
- ❖ Idiopathic cause, treatment is yet to be recognised.

Hemifacial Spasm (one eye is affected)

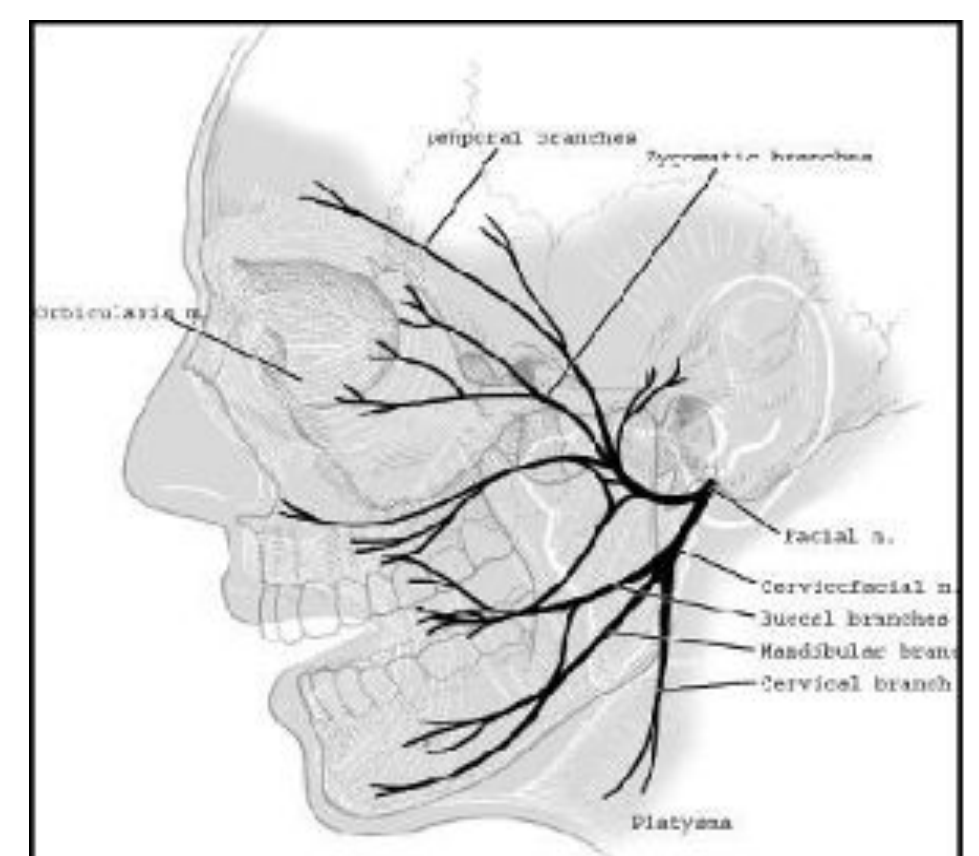
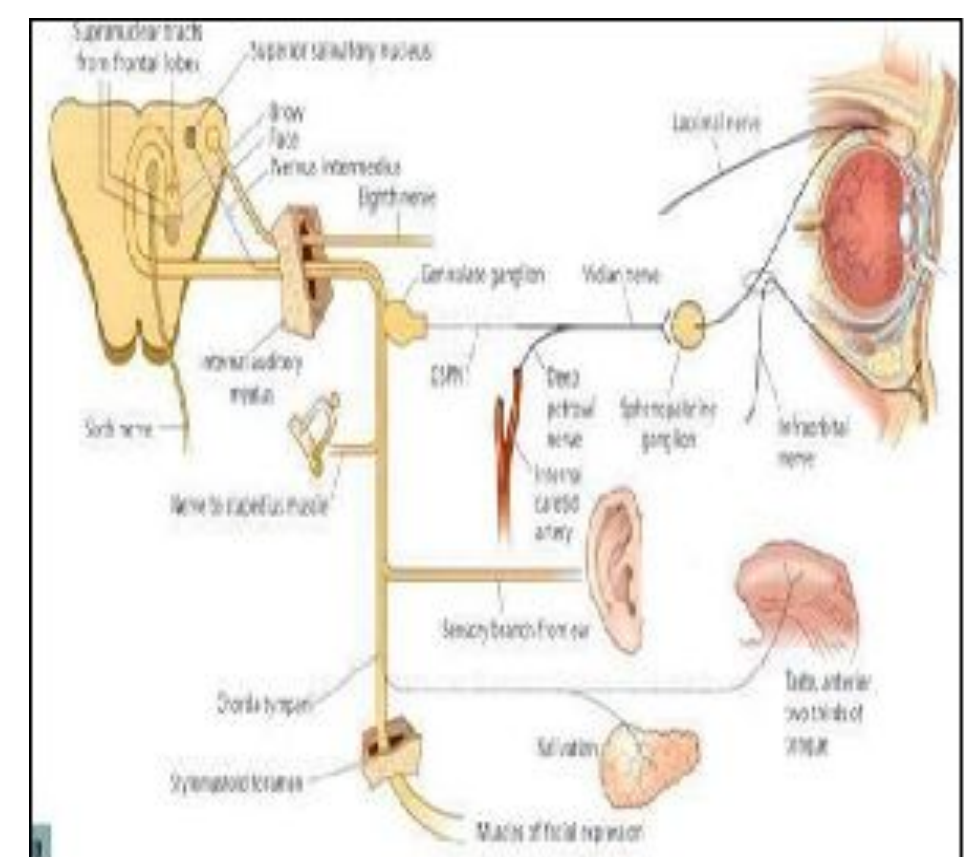
- ❖ Intermittent and involuntary contractions of the entire unilateral side of face. (twitching of both eyelids of that eye + face)
- ❖ Present during sleep.
- ❖ Compression of 7th nerve at the level of the brain stem. (if both eyes are affected → idiopathic).
- ❖ Spasm in the face can be a sequelae of a healing facial nerve palsy.
- ❖ MRI evaluation.

7th nerve palsy

- ❖ Lower motor neuron lesion.
- ❖ The most common cause for facial nerve palsy is Bell's palsy.
- ❖ Manifestations:
 - ◇ Lagophthalmos (cannot close eyes (loss of orbicularis muscle) → exposure keratopathy and corneal ulceration.
 - ◇ Tearing. Failure of pumping the tear from eye to the lacrimal drainage because of compromised orbicularis muscle .
 - ◇ Eyelid Ectropion.
 - ◇ Brow ptosis.
- ❖ Location of lesion:
 - ◇ Supranuclear, brain stem, peripheral.
- ❖ Cause of paralysis:
 - ◇ Bell's, infection, infarct, demyelination, neoplasm, trauma or miscellaneous.



Lagophthalmos


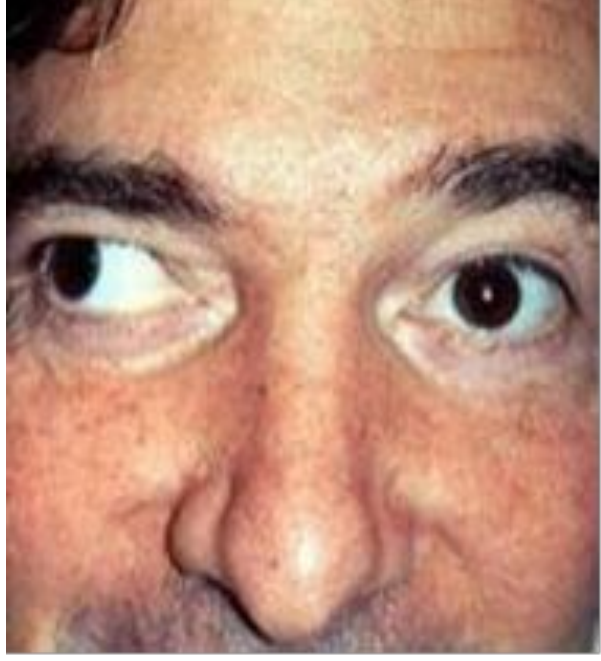




- ❖ Treat with lubricating drops or ointment and ask the patient tape their eyes when they go to sleep. Though, these are only temporary measures.

Botox in Ophthalmology

Botulinum toxin:

- ❖ Clostridium botulinum **anaerobic bacteria**
- ❖ Neurotoxin types A,B,C1,D,E,F,G
- ❖ Botox = Botulinum Toxin A
- ❖ Blocks the cholinergic **nerve terminals, thereby decreasing** release of acetylcholine at neuromuscular junction
- ❖ Onset 3 days
- ❖ Peak effect 1-2 weeks, Duration 6-12 weeks

Uses			
1) Blepharospasm	2) Strabismus	3) Glabella Botox	4) Botox for Crow's-Feet
 <p>Inject the orbicularis</p>	 <p>Inject the 4 extraocular muscles</p>	<p>Cosmetic use</p> 	 <p>Cosmetic use</p>

Conclusion

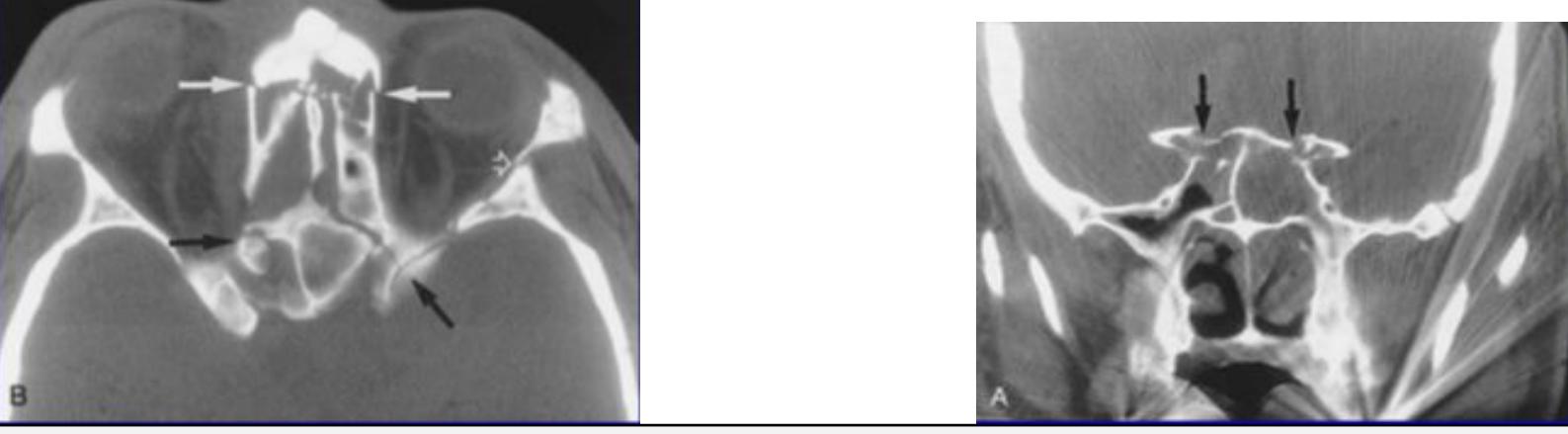
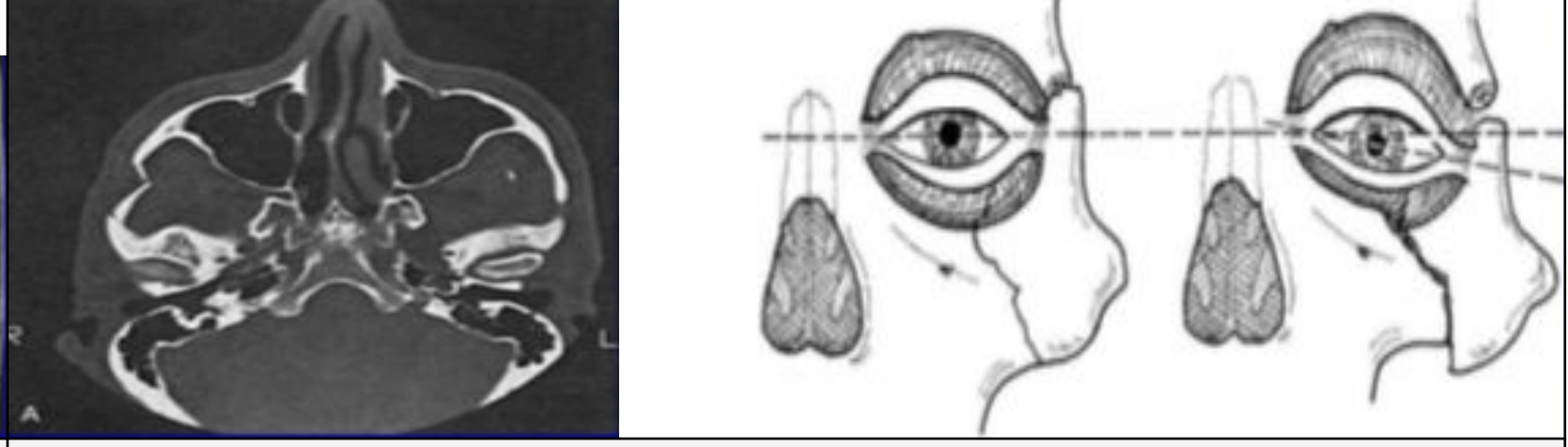
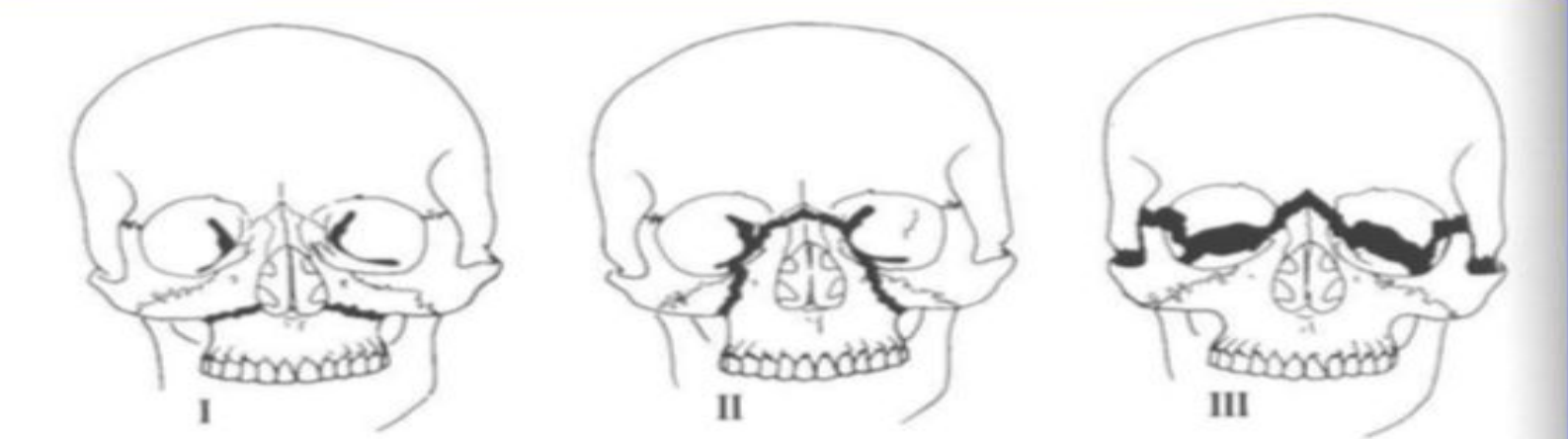
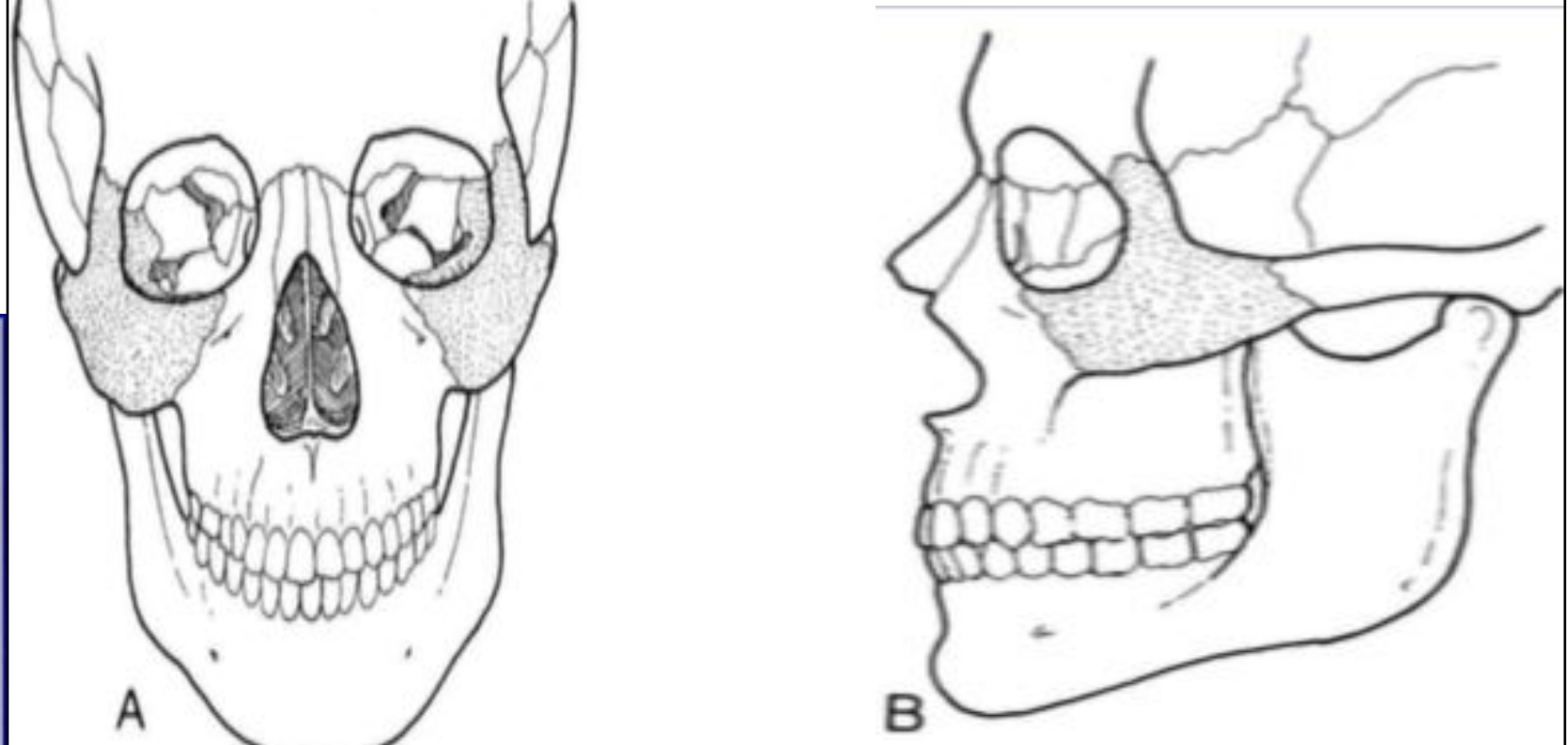
- ❖ Knowing the anatomy helps to understand different pathological process, this is true for any medical specialty.
- ❖ Early diagnosis and proper management of orbital cellulitis save patients vision and lives.so early diagnosis of orbital cellulitis is really vital.
- ❖ Aponeurotic ptosis is the most common cause of ptosis.
- ❖ Thyroid eye disease is an autoimmune disease and it's considered the most common cause of proptosis either unilateral or bilateral.
- ❖ **Unilateral recent proptosis in a child should be taken seriously.**
- ❖ Congenital nasolacrimal duct obstruction commonly caused by membranous obstruction and typically present with tearing and discharge since birth.
- ❖ Chalazion is a common condition results from blockage of meibomian gland and present as discrete swelling in the eyelid.
- ❖ Severe congenital ptosis needs to be corrected as early as possible to prevent amblyopia especially when the ptosis blocks the pupil if not it consider cosmetic and corrected by elective procedure any time.
- ❖ **Proper treatment of exposure keratopathy in pt with facial nerve palsy is critical to prevent corneal ulceration and scarring.**

Information skipped by doctor

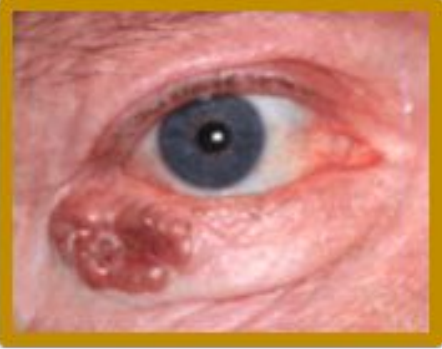

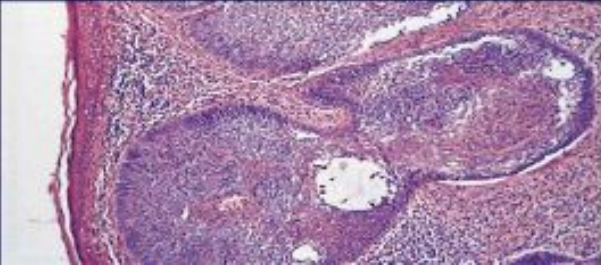
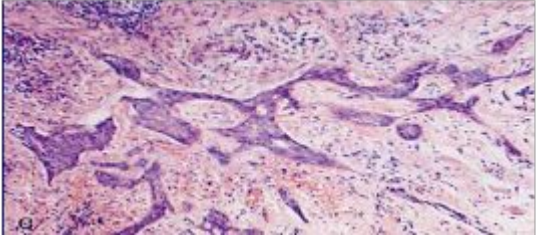



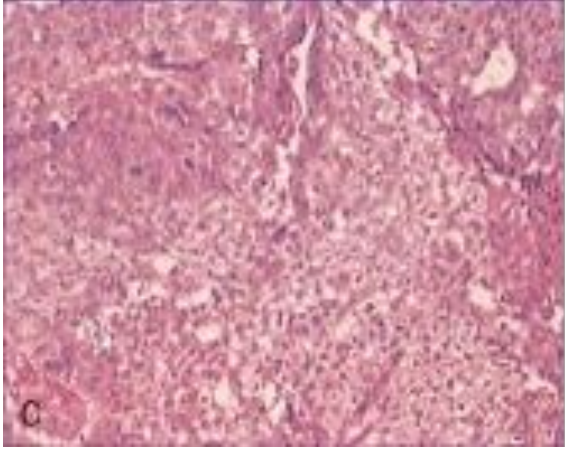
Lacrimal gland fossa lesions

Disease	Duration	Presence of pain	Ultrasound reflectivity	CT	Management
Orbital pseudotumor	Days to chronic	Yes	Low	Localized or diffuse, molds to bone and globe	Management: systemic steroids, XRT
Lymphoma	Months	No	Low	Homogenous, oblong, molds to globe/bone	XRT, CTX (systemic disease)
Pleomorphic adenoma (benign mixed tumor)	Often > 1 year	No	Medium to high, regular internal structure	Well circumscribed, globular, possible bony expansion or excavation.	complete excision with capsule without biopsy
Adenoid cystic carcinoma, malignant epithelial tumors	< 1 year	Yes (perineural invasion)	Medium to high, irregular internal structure	Round to oval mass with bony erosion	incisional biopsy, await permanent sections; exenteration

Other Facial Fractures

Optic Canal Fracture:	Zygomaxillary Complex (ZMC) fracture
May be with or without displaced bony fragments	
	
LeForte fracture	Zygoma
Class 1: transverse maxillary Class 2: pyramid Class 3: craniofacial disjunction	
	

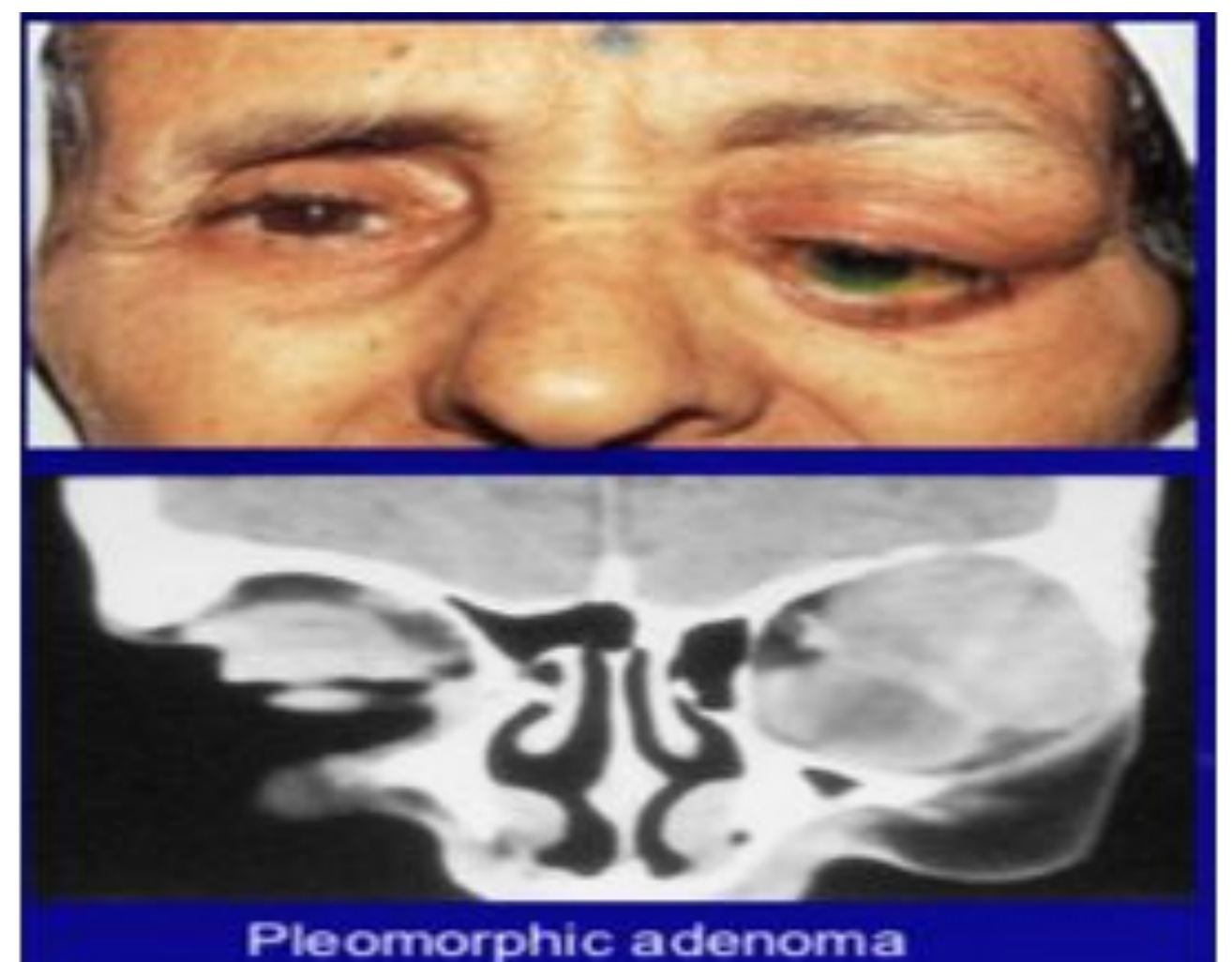
Eyelids Tumors

Basal Cell Carcinoma	Squamous cell	Sebaceous Adenocarcinoma
<ul style="list-style-type: none"> ▪ 90-95% of malignant eyelid. ▪ Tumors Lower lid and medial canthal areas. ▪ Nodular and morpheaform types. ▪ Medial canthal lesions can be problematic. ▪ 3% mortality <div style="display: flex; justify-content: space-around;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;">  </div> <p style="text-align: center; color: blue;">Nodular</p> <div style="display: flex; justify-content: space-around; margin-top: 10px;">  </div> <p style="text-align: center; color: blue;">Morpheaform</p>	<ul style="list-style-type: none"> ▪ 40 times less common than BCC. ▪ More aggressive, associated with > perineural invasion. ▪ Most arise from pre-existing lesions. ▪ Variable presentations. <div style="display: flex; justify-content: center; margin-top: 10px;">  </div> <div style="display: flex; justify-content: center; margin-top: 10px;">  </div>	<ul style="list-style-type: none"> ▪ Highly malignant. ▪ 2x more common in the upper lid. ▪ Multicentric. ▪ Separate upper and lower lid lesions in 6-8%. ▪ Pagetoid spread. <div style="display: flex; justify-content: center; margin-top: 10px;">  </div> <div style="display: flex; justify-content: center; margin-top: 10px;">  </div>

Lacrimal gland masses

- Inflammatory:
 - Sarcoidosis.
 - Orbital Pseudotumor.
 - Vasculitis.

- Non-inflammatory:
 - Lymphoproliferative.
 - Epithelial neoplasms.



Practice Questions

Q1) 35-year-old lady presented with mild fever, proptosis, swelling, tenderness on left medial lid margin, limited extra-ocular motility, reduced visual acuity. what is the appropriate investigation?

- a) CT
- b) Orbital ultrasound
- c) visual field
- d) Angiography

Q2) A 20 years old patient presented with painless upper lid swelling of 3 months duration. What is the most common cause?

- A) Basal cell carcinoma
- B) Chalazion
- C) Sebaceous cell carcinoma
- D) Dermoid cyst

Q3) Which orbital bone is most likely to fracture with blunt trauma to the eye?

- A) Zygomatic
- B) maxillary
- C) ethmoid
- D) Sphenoid

Q4) A 1 year old child presented with excessive tearing and sticky discharge of the left eye. On examination regurgitation test was positive. What is the most likely diagnosis?

- a) Nasolacrimal duct block
- b) Common canaliculus block
- c) Punctal atresia
- d) Buphthalmos

Q5) 39-year-old female with recurrent attack of diplopia, bilateral ptosis and she said the course of diplopia is changing over the day. What is the most common cause?

- A) Myasthenia gravis
- B) Bilateral III nerve palsy.
- C) Cavernous sinus thrombosis
- D) Graves' disease (hyperthyroidism)

Q6) A 5 year old female presented with a 2 day history of redness, pain, and discharge in the nasal aspect of the right lower eyelid. Slit lamp examination shows swelling, erythema, and tenderness of the right lower eyelid extending to the periorbital area. Yellowish discharge can be expressed from the punctual area. What is the most likely diagnosis?

- A) Dacryolith
- B) Mucocele
- C) Dacryocystitis
- D) Adenocystitis

Answers

1) A 2) B 3) C 4)A 5)A 6)C

Cases from 435

Case 1: an 9 y/o child brought to ER with history of recent unilateral proptosis, when the ER oncall asked the family about hx of trauma, they said we don't know we just noticed the eye bulging, however when the doctor asked the child he said yes i had trauma in my left eye.



CT: shows mass in the left eye

Dx: rhabdomyosarcoma

any recent unilateral proptosis in your index of suspicion a child is tumor until proven otherwise

Case 2: 11 y/o boy presented with pain and redness in the right eye for 3 days duration.



On examination: The right eye is deviated and pushed, some swelling

CT: subperiosteal abscess + ethmoidal sinusitis (normally the sinus is black but here the right one is opacified)

Dx: orbital cellulitis, it's not preseptal because there's ptosis

Rx: IV antibiotics admission, consult ENT and ID group. if no improvement with antibiotics → do surgical drainage