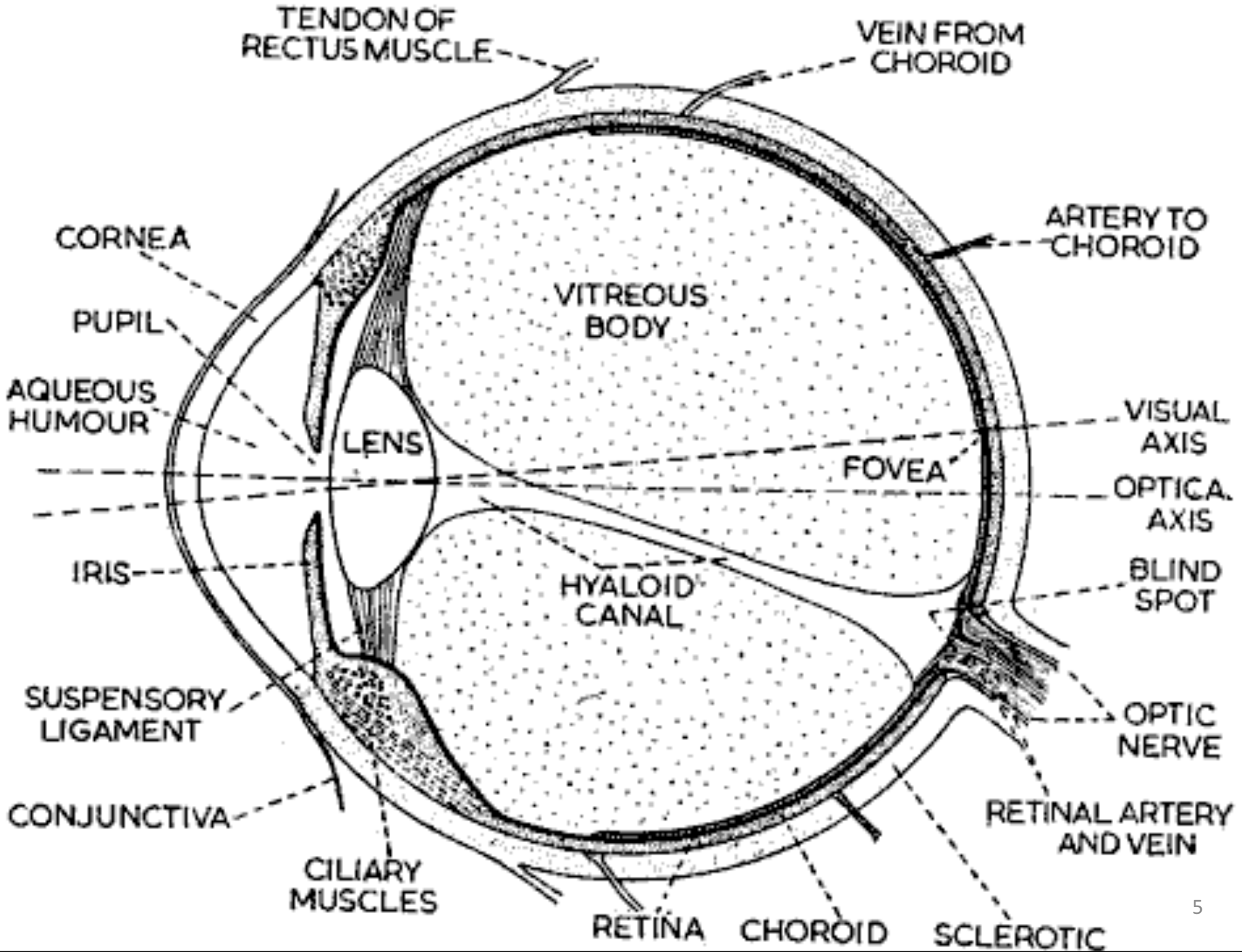
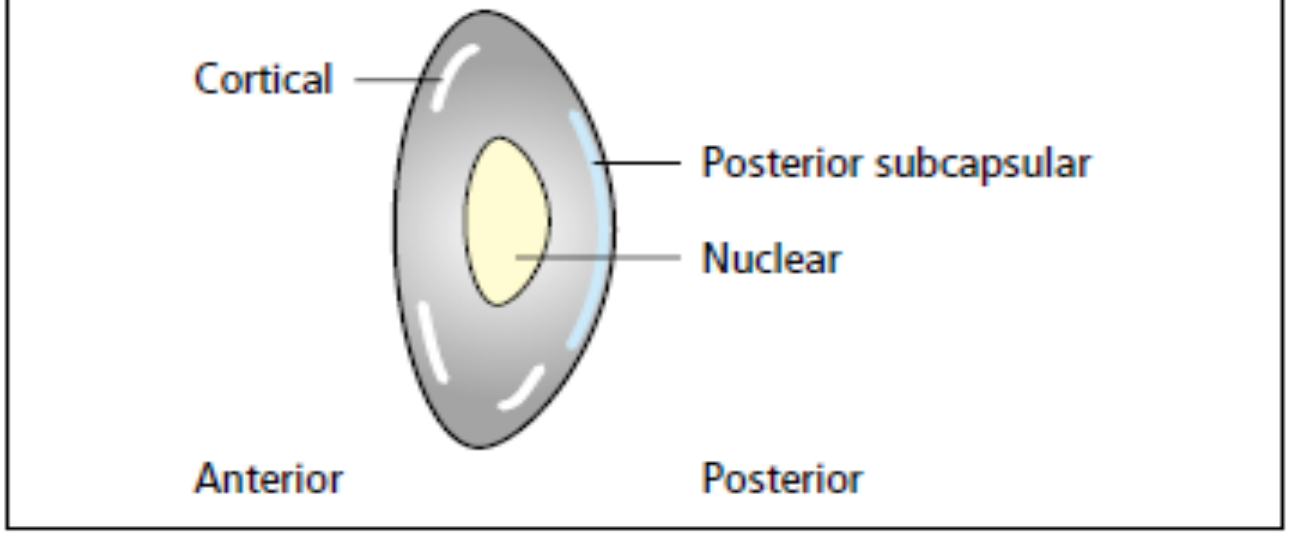

TENDON OF RECTUS MUSCLE
VEIN FROM CHOROID
CORNEA
ARTERY TO CHOROID
PUPIL
VITREOUS BODY
AQUEOUS HUMOUR
LENS
VISUAL AXIS
FOVEA
OPTICAL AXIS
IRIS
HYALOID CANAL
BLIND SPOT
SUSPENSORY LIGAMENT
OPTIC NERVE
CONJUNCTIVA
RETINAL ARTERY AND VEIN
CILIARY MUSCLES
RETINA
CHOROID
SCLEROTIC

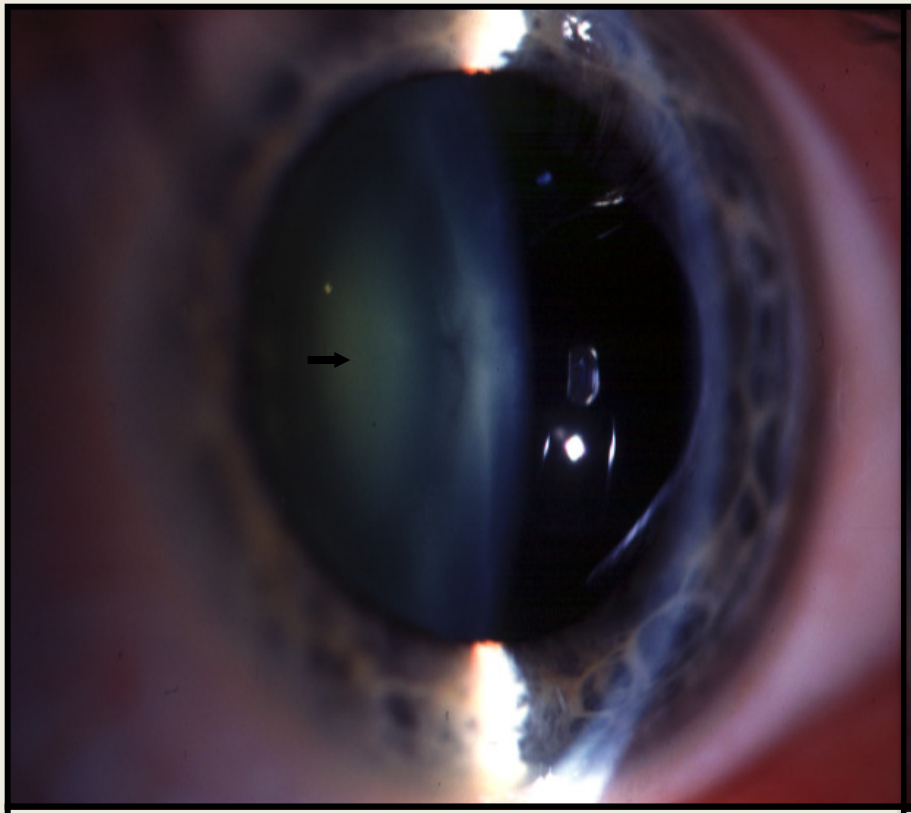
Cataract (Definition)

- Opacification of the lens of the eye
- It is the most common cause of treatable blindness in the world

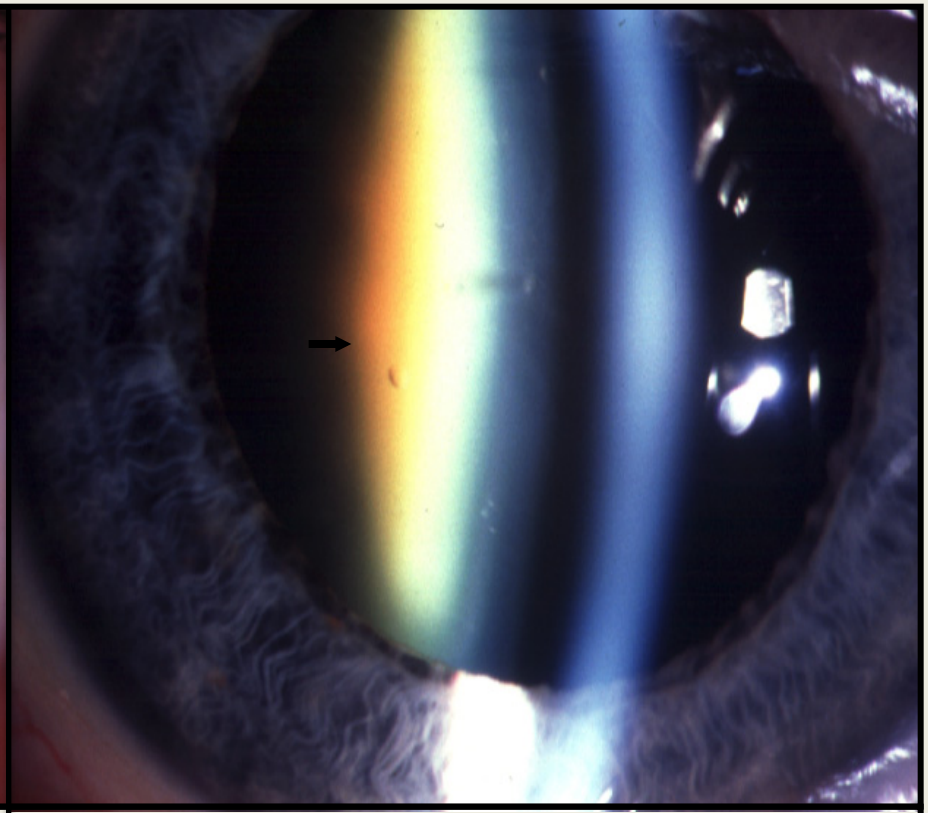
Age Related Cataract

- **The main types** of age-related cataracts are :
  1. Nuclear sclerosis
  2. Cortical
  3. Posterior subcapsular.

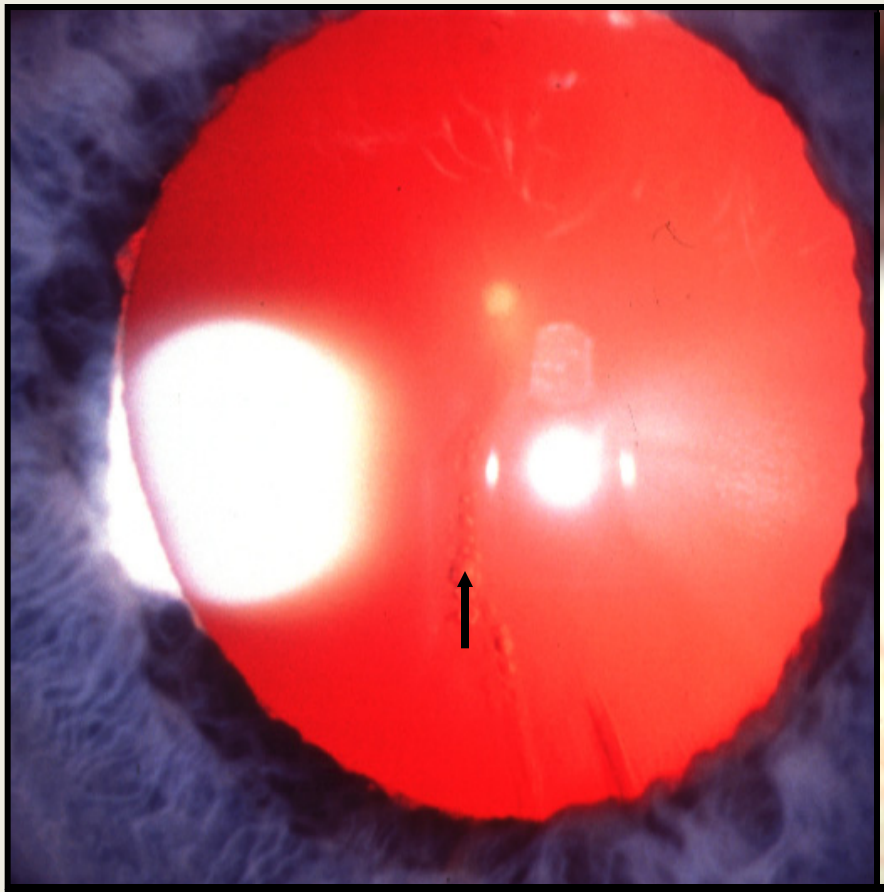




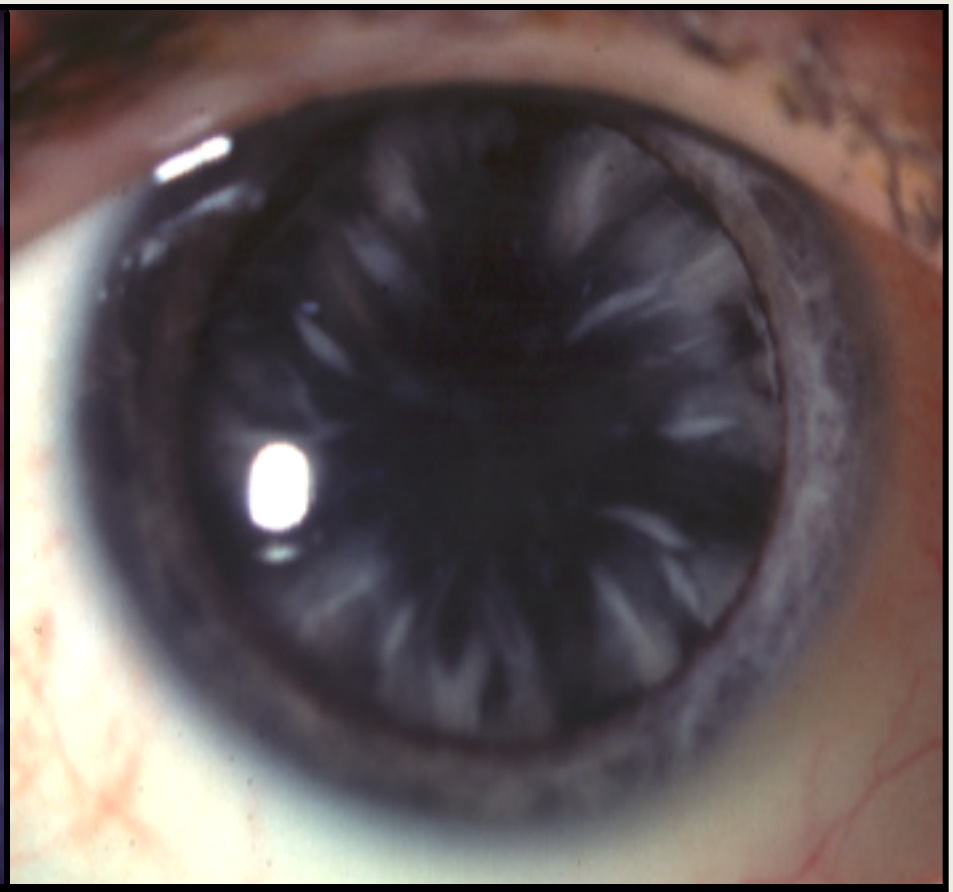
- Exaggeration of normal nuclear ageing change
- Causes increasing myopia



- Increasing nuclear opacification
- Initially yellow then brown



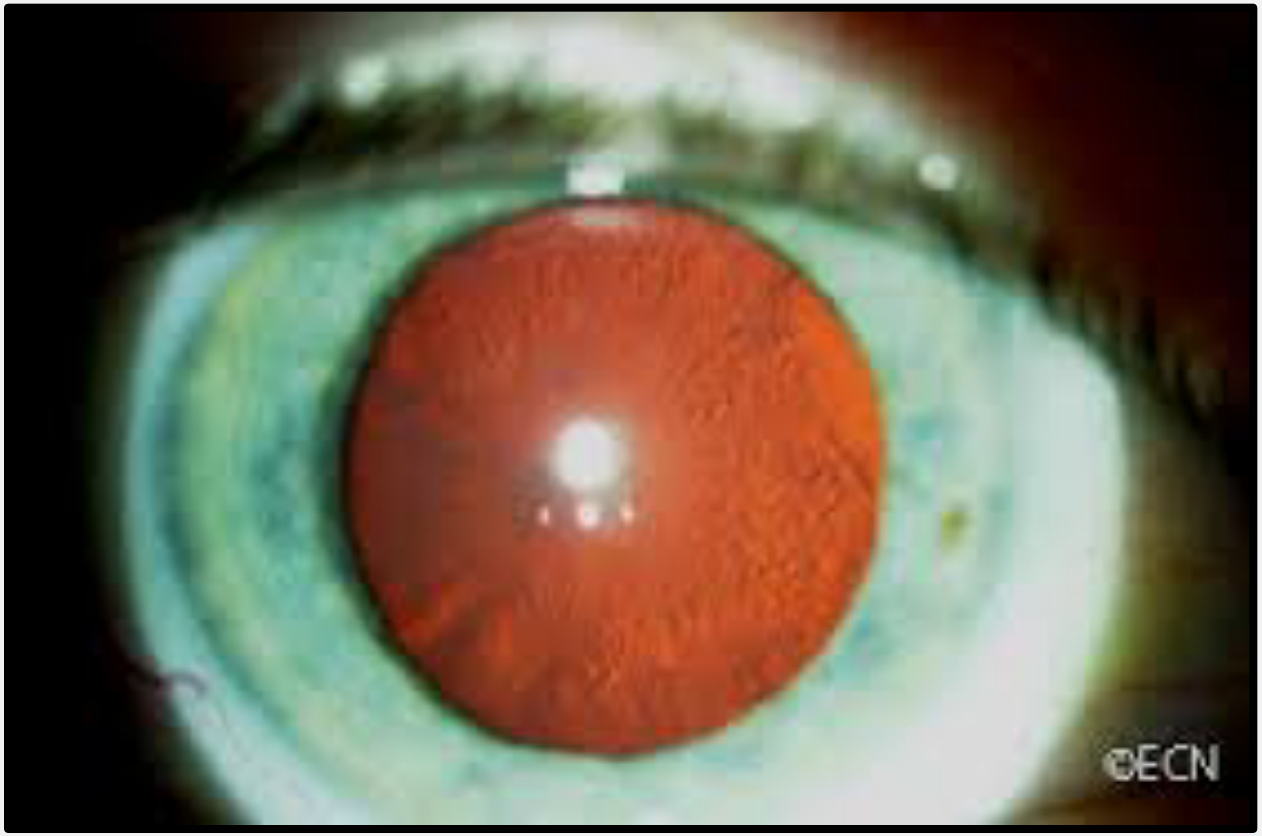
Initially vacuoles and clefts



Progressive radial spoke-like opacities

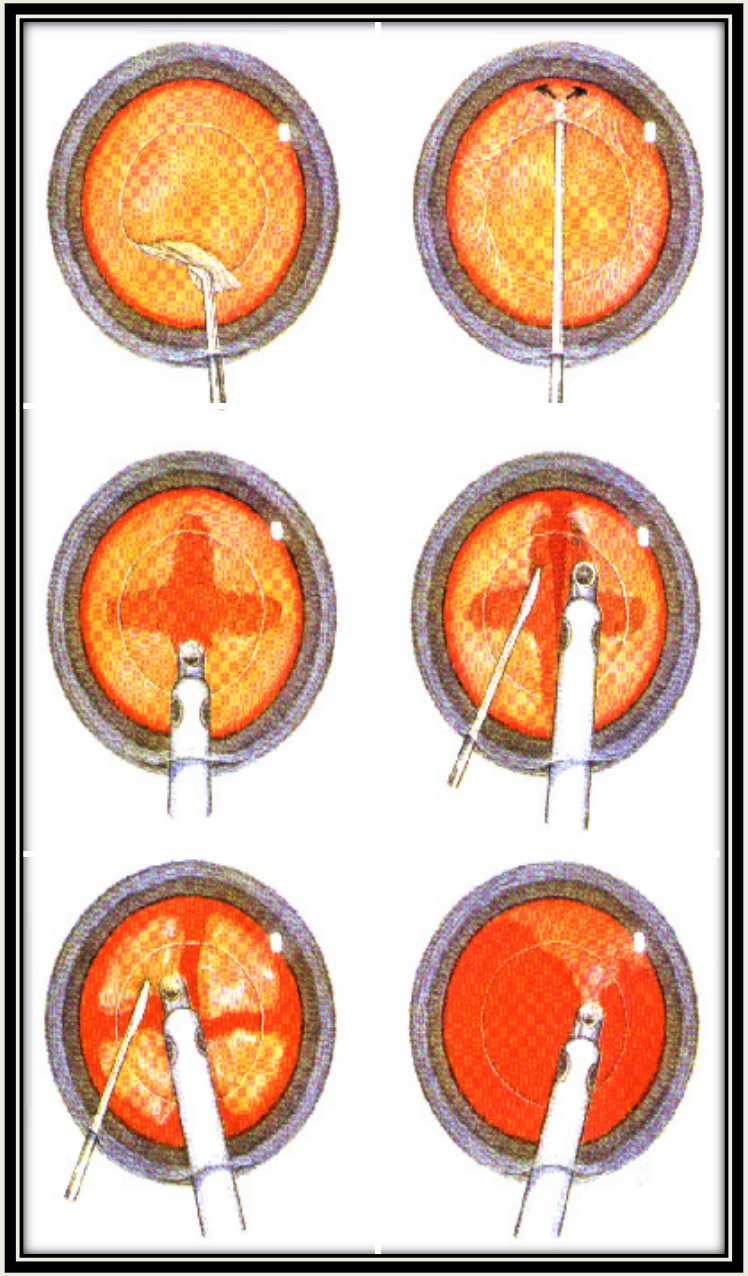
3) Posterior subcapsular

- Forms on the back of the lens, on the inner surface of the posterior capsule bag.
- These cataracts tend to occur in patients on steroids, with diabetes, and those with history of ocular inflammation.
- The opacity looks like breadcrumbs or sand sprinkled onto the back of the lens. This posterior location creates significant vision difficulty despite appearing innocuous on slit-lamp exam.


©ECN

Phacoemulsification

1. Capsulorhexis



2. Hydrodissection

3. Sculpting of nucleus

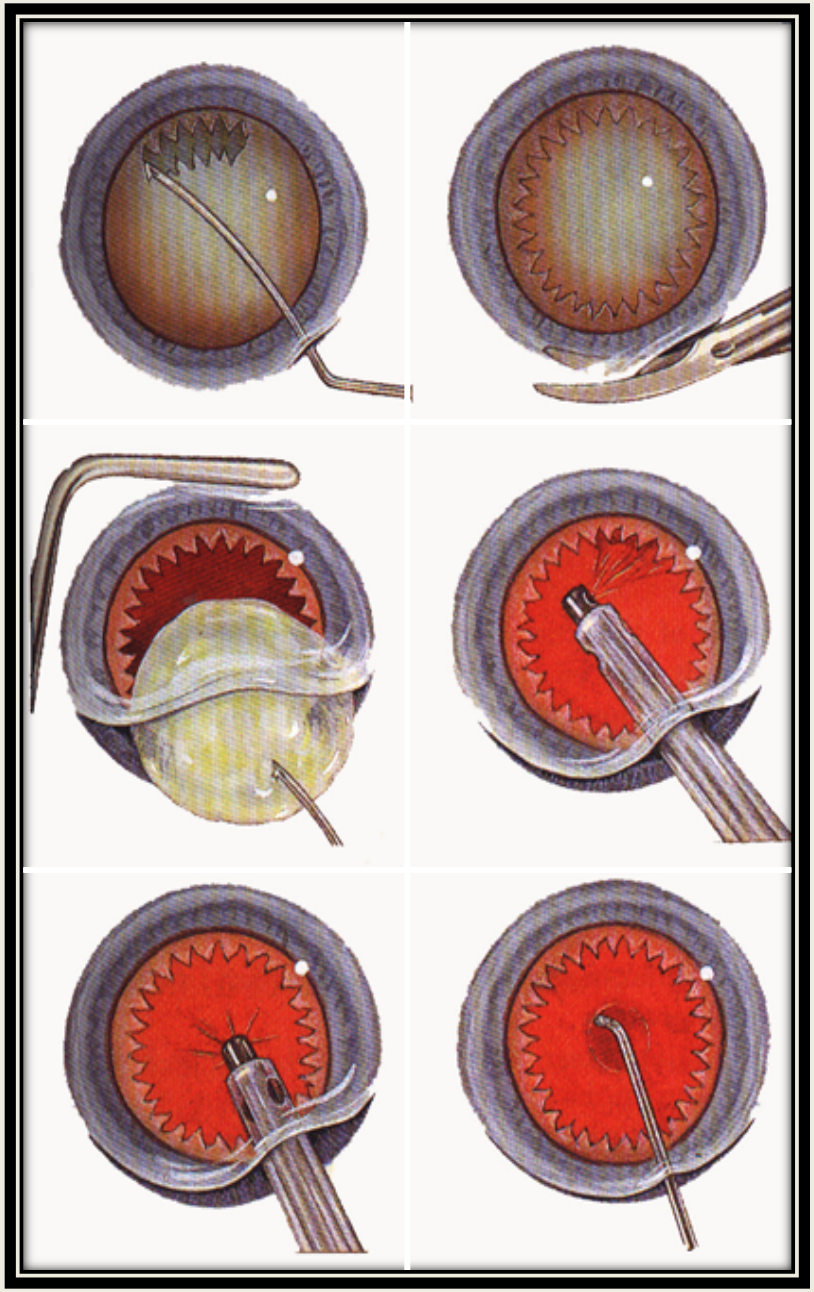
4. Cracking of nucleus

5. Emulsification of each quadrant

6. Cortical cleanup and insertion of IOL

Extracapsular cataract extraction

1. Anterior capsulotomy



2. Completion of incision

3. Expression of nucleus

4. Cortical cleanup

5. Care not to aspirate posterior capsule accidentally

6. Polishing of posterior capsule, if appropriate

Extracapsular cataract extraction (cont.)

7. Injection of viscoelastic substance

8. Grasping of IOL and coating with viscoelastic substance

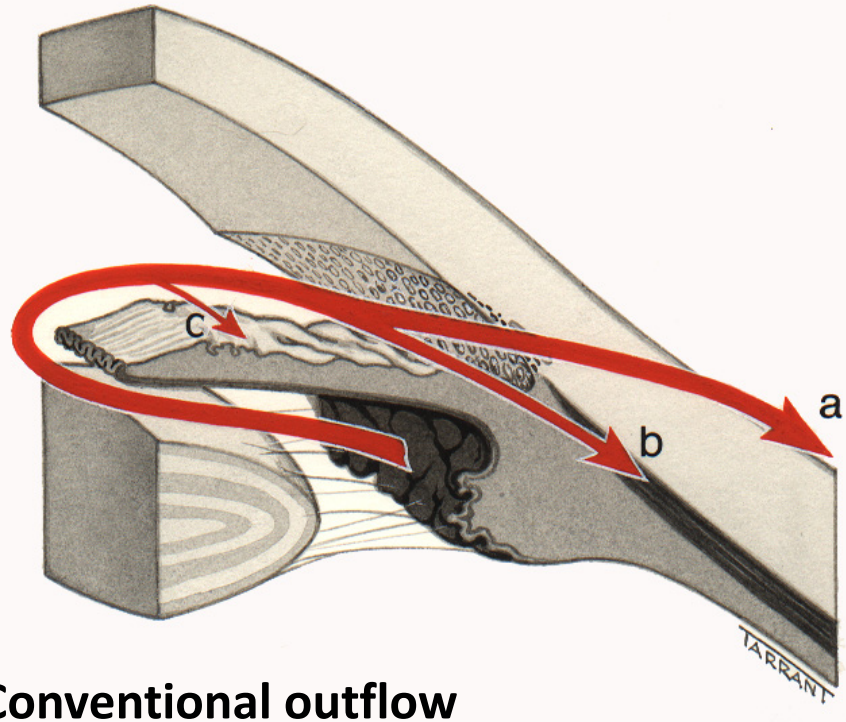
9. Insertion of inferior haptic and optic

10. Insertion of superior haptic

11. Placement of haptics into capsular bag and not into ciliary sulcus

12. Dialing of IOL into horizontal position

Aqueous outflow

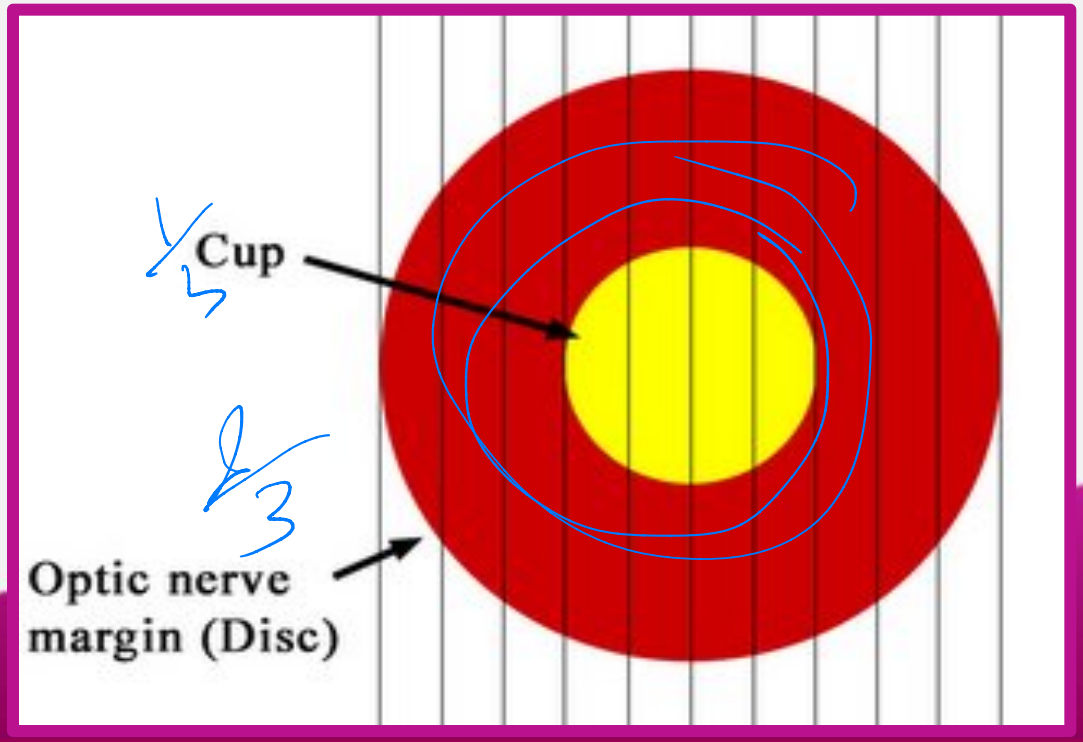


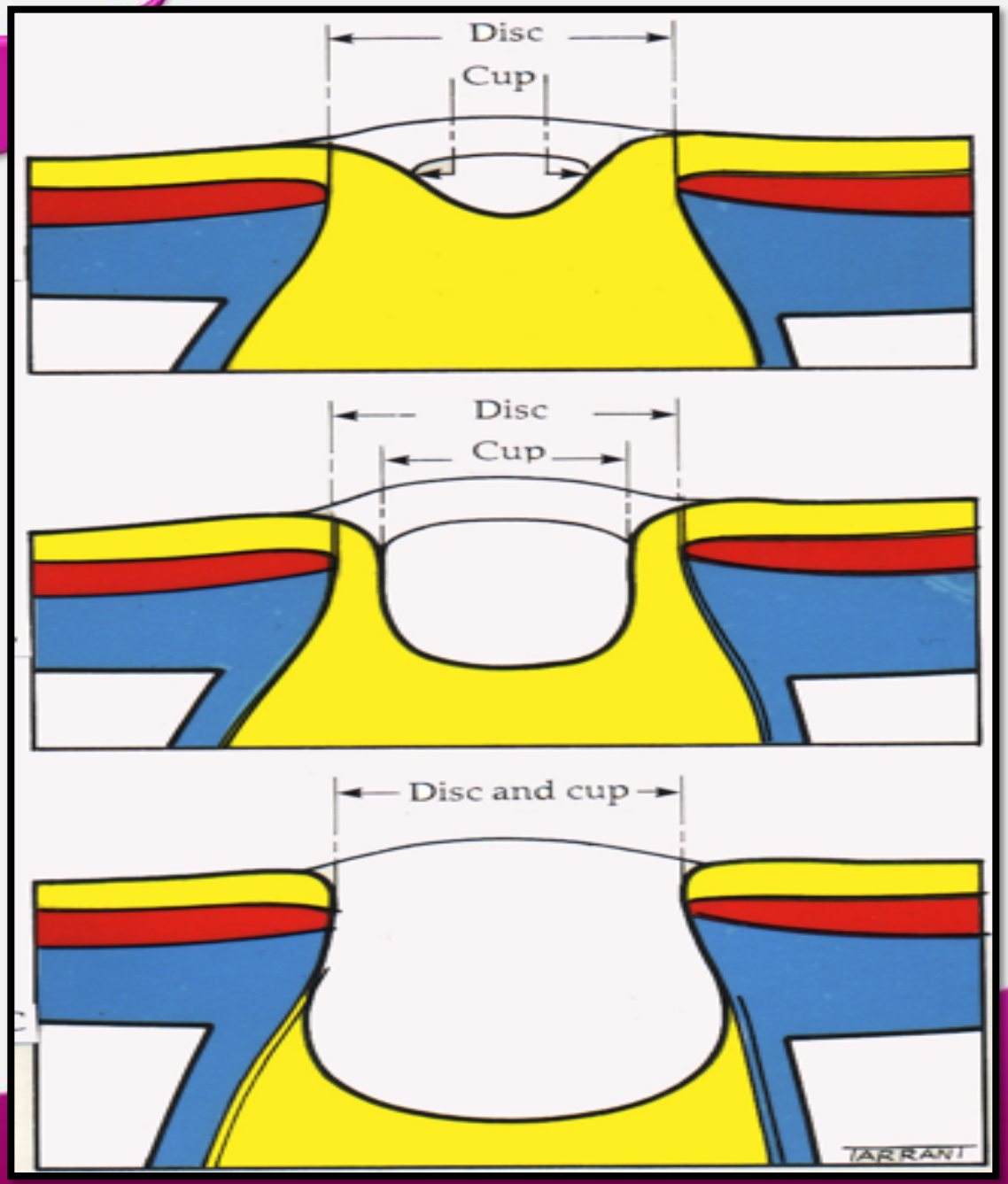
a - Conventional outflow
b - Uveoscleral outflow

With the loss of nerve fibers from glaucoma, the cup becomes progressively larger because there is less space occupied by the remaining nerve fibers

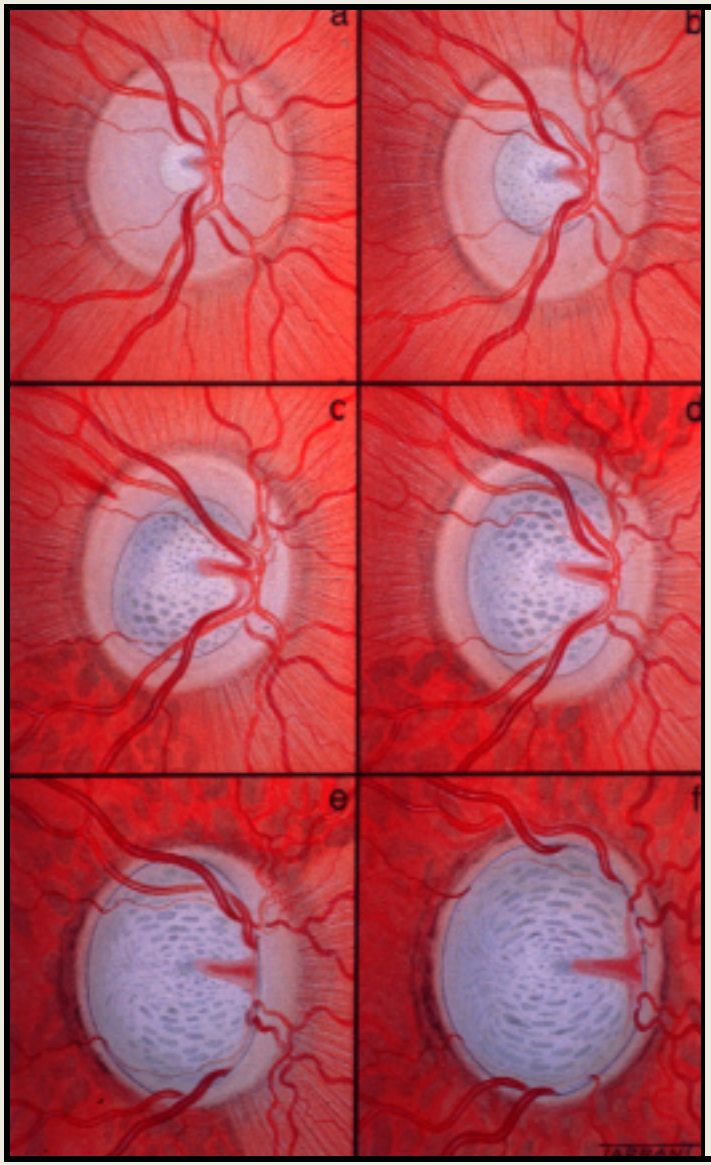
The *optic nerve is divided into tenths* and the cup is compared to the entire optic nerve (optic disc) to obtain the cup-to-disc ratio.

The normal c/d ratio is 0.3(The C/D ratio here is 0.4)




Disc
Cup
Disc
Cup
Disc and cup
TARRANT

Progression of glaucomatous cupping



a. Normal (c:d ratio 0.2)

b. Concentric enlargement (c:d ratio 0.5)

c. Inferior expansion with retinal nerve fibre loss

d. Superior expansion with retinal nerve fibre loss

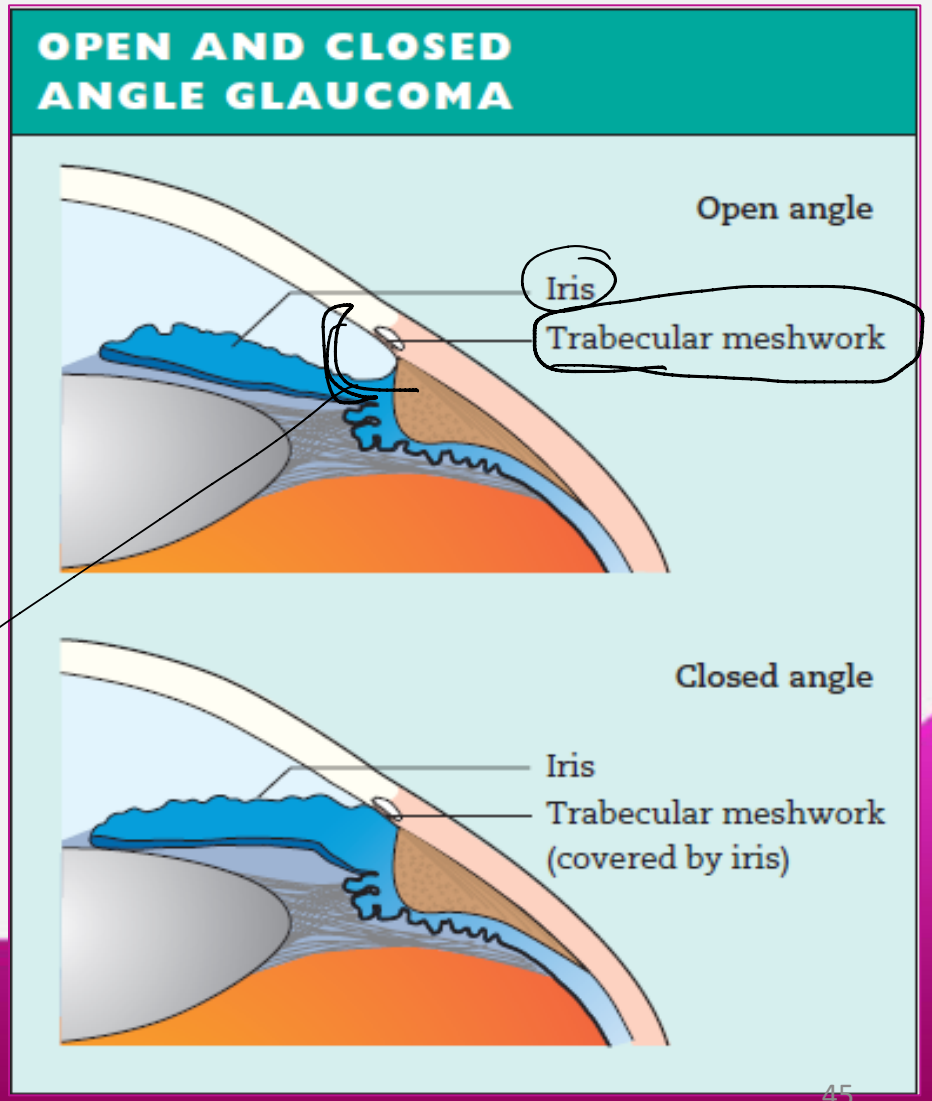
e. Advanced cupping with nasal displacement of vessels

f. Total cupping with loss of all retinal nerve fibres

Primary Glaucoma

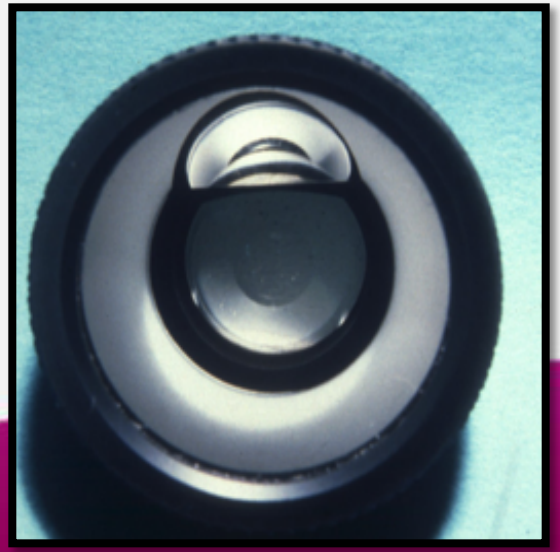
- Classification of the primary glaucomas is based on whether or not the iris is:
  - Clear of the trabecular meshwork (open angle)→ (**POAG**)
  - Covering the meshwork (closed angle)→ (**PACG**)

ANGLE: the iridocorneal angle

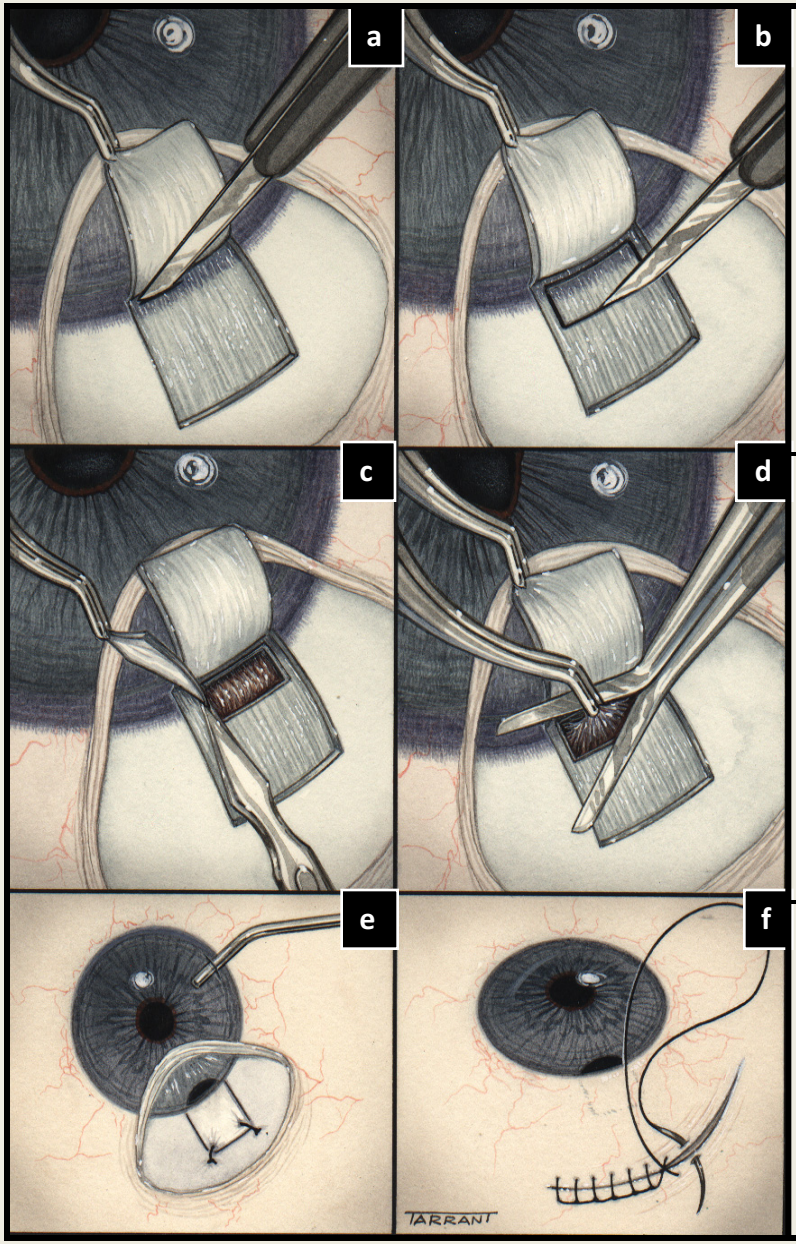


How to examine the ANGLE

- Using special lenses which allows visualization of the angle structure to determine whether the angle configuration is closed or open [***Goniolenses***] .



Technique



a. Cutting of deep block - anterior incision

b. Posterior incision

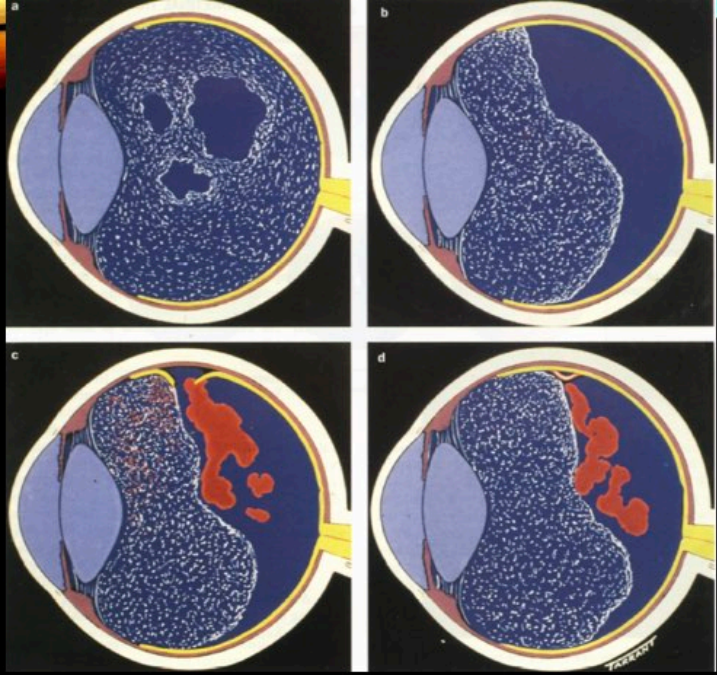
c. Excision of deep block

d. Peripheral iridectomy

e. Suturing of flap and reconstitution of anterior chamber

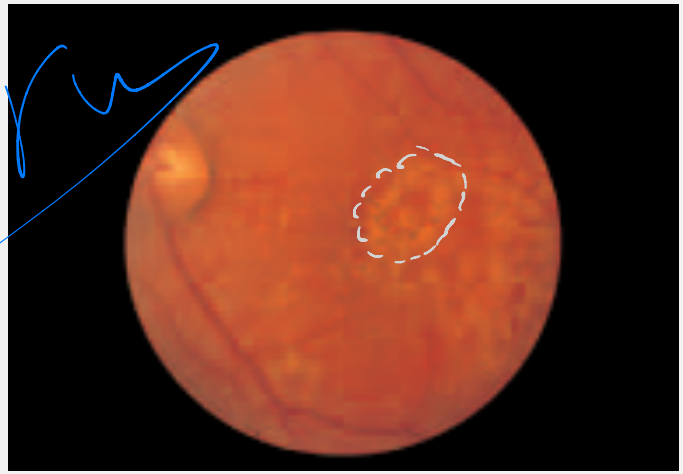
f. Suturing of conjunctiva

The appearance of a trabeculectomy bleb.

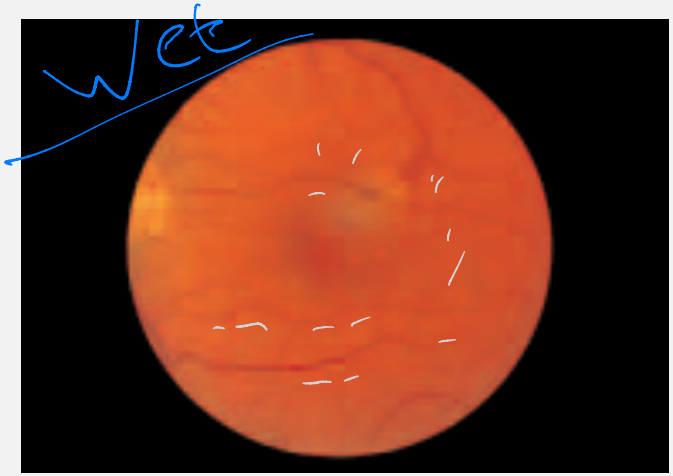


ACUTE POSTERIOR VITREOUS DETACHMENT: (A) SYNCHISIS; (B) UNCOMPLICATED POSTERIOR VITREOUS DETACHMENT; (C) RETINAL TEAR FORMATION AND VITREOUS HAEMORRHAGE; (D) AVULSION OF A RETINAL BLOOD VESSEL AND VITREOUS HAEMORRHAGE

- A doctor can usually diagnose macular degeneration by examining the eyes with an ophthalmoscope or slit lamp. Sometimes fluorescein angiography is used to determine the diagnosis



dry AMD, note the discrete scattered yellowish sub-retinal drusen

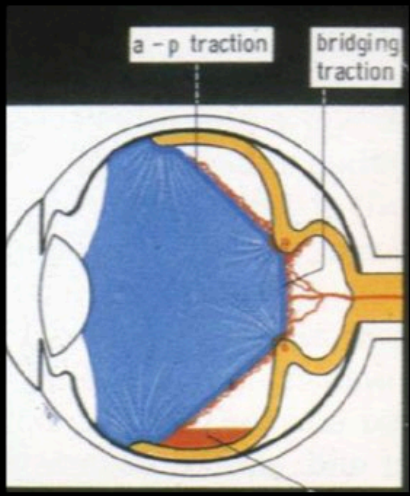


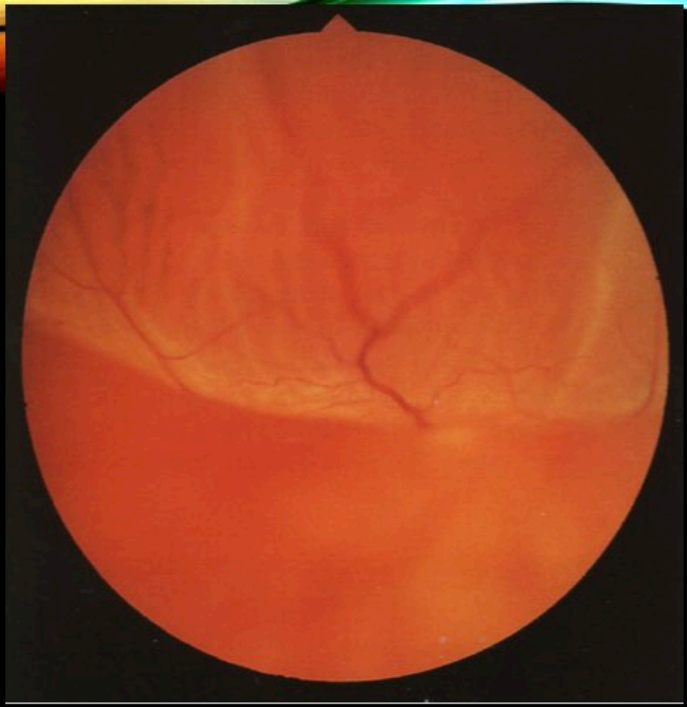
wet AMD, note the small haemorrhage associated with the sub-retinal membrane

Static traction:

- It plays an important role in the pathogenesis of tractional RD and proliferative vitreoretinopathy.

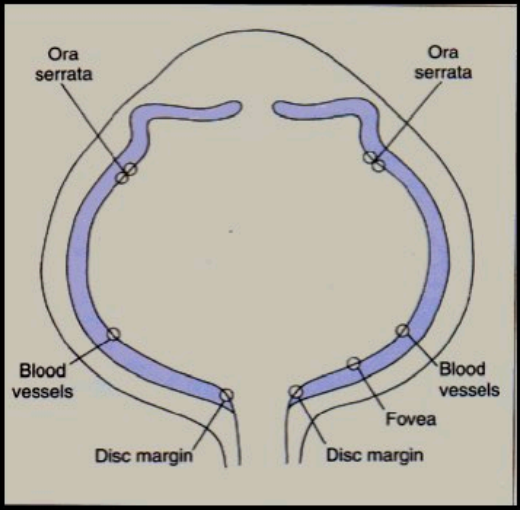
  - It can be: Tangential, Anteroposterior and Bridging traction.



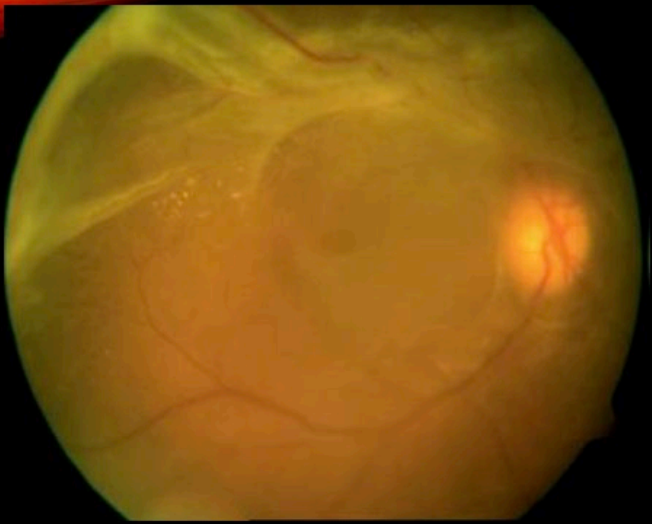


FRESH BULLOUS SUPERIOR RETINAL DETACHMENT

DYNAMIC VITREORETINAL TRACTIONS:



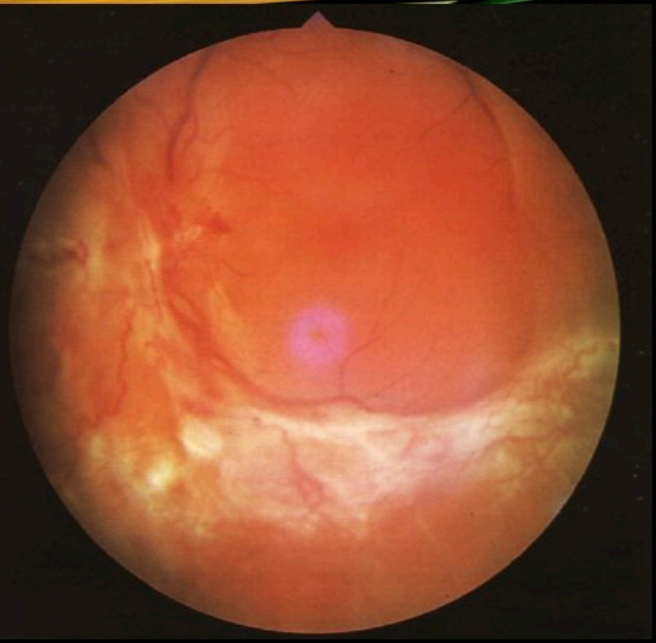
Normal Vitreoretinal adhesions



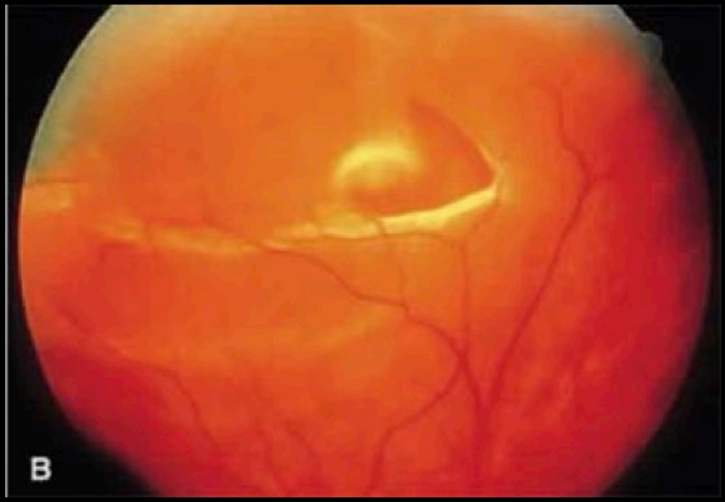
TRACTIONAL RD IN PROLIFERATIVE DIABETIC RETINOPATHY

COMBINED TRACTIONAL AND RHEGMATOGENOUS RD

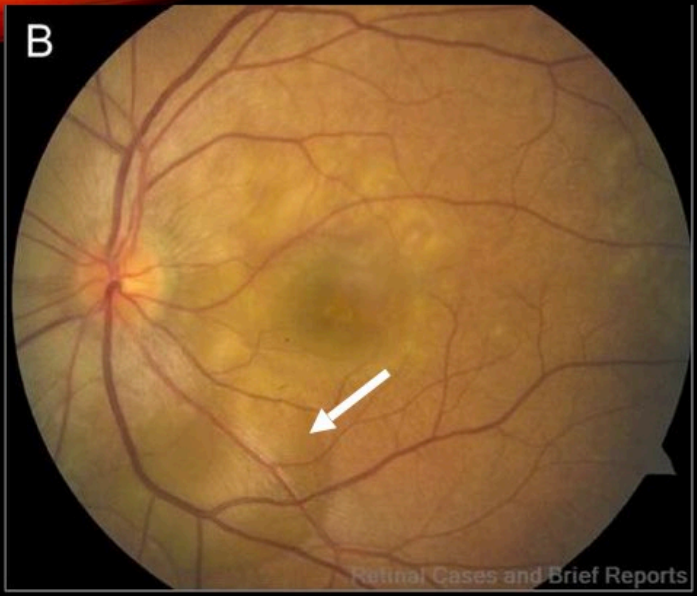
Tractional RD in proliferative diabetic retinopathy



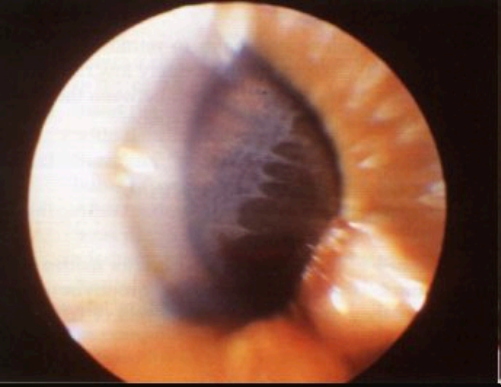
INFERIOR TRACTIONAL RETINAL DETACHMENT

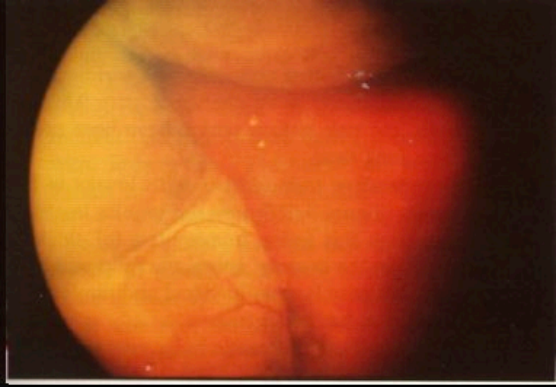


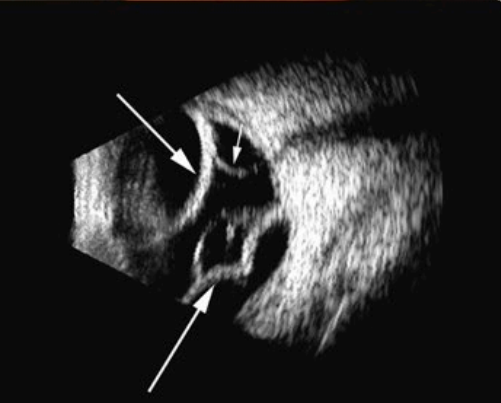
RETINAL TEAR WITH RETINAL DETACHMENT



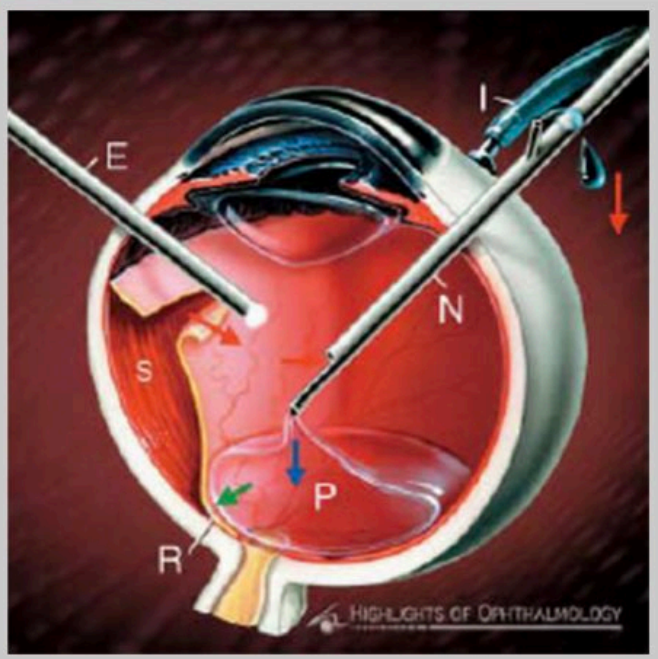
EXUDATIVE RETINAL DETACHMENT IN VKH

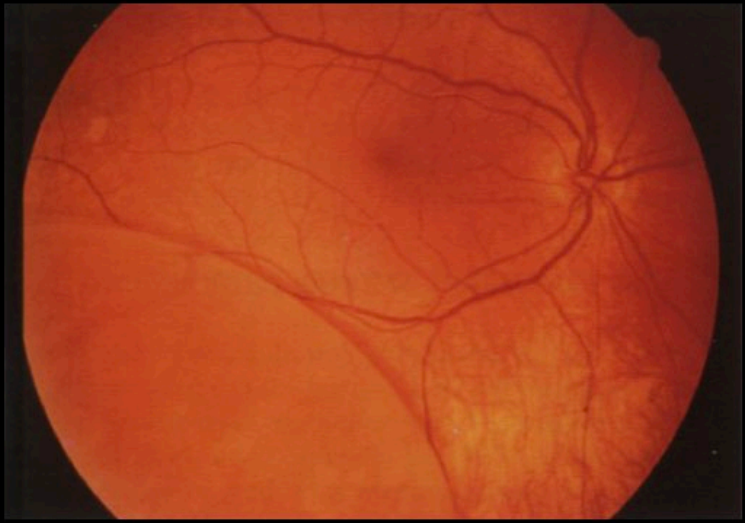




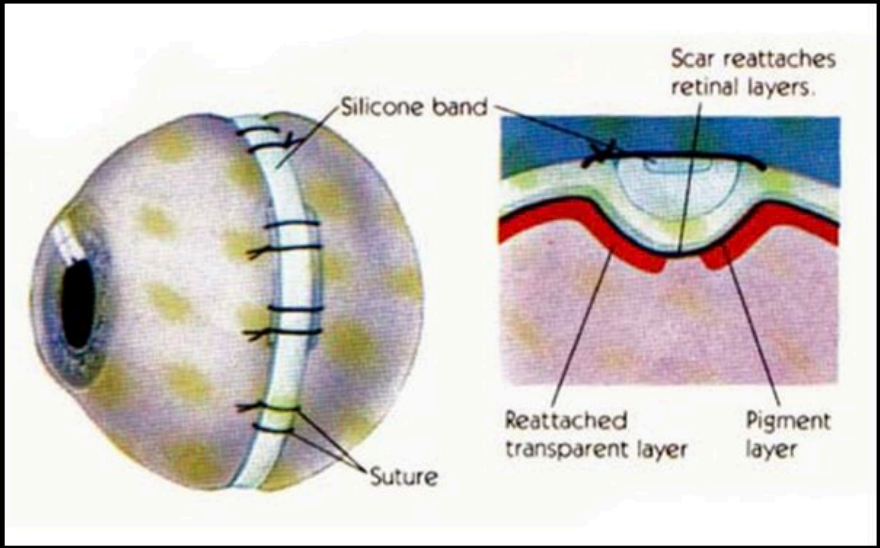


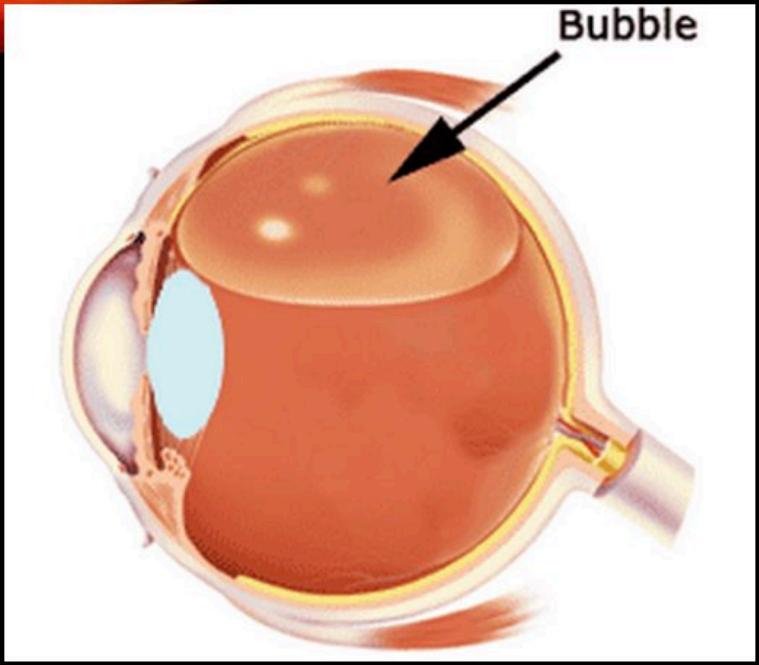
CHOROIDAL DETACHMENT


E
I
N
S
P
R
HIGHLIGHTS OF OPHTHALMOLOGY

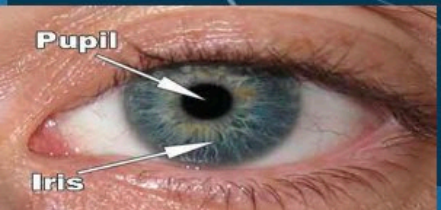


RETINOSCHISIS


Silicone band
Suture
Scar reattaches retinal layers.
Reattached transparent layer
Pigment layer

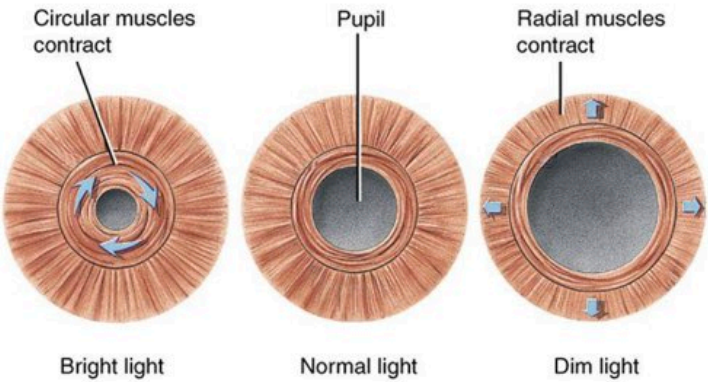

Bubble

Pupil

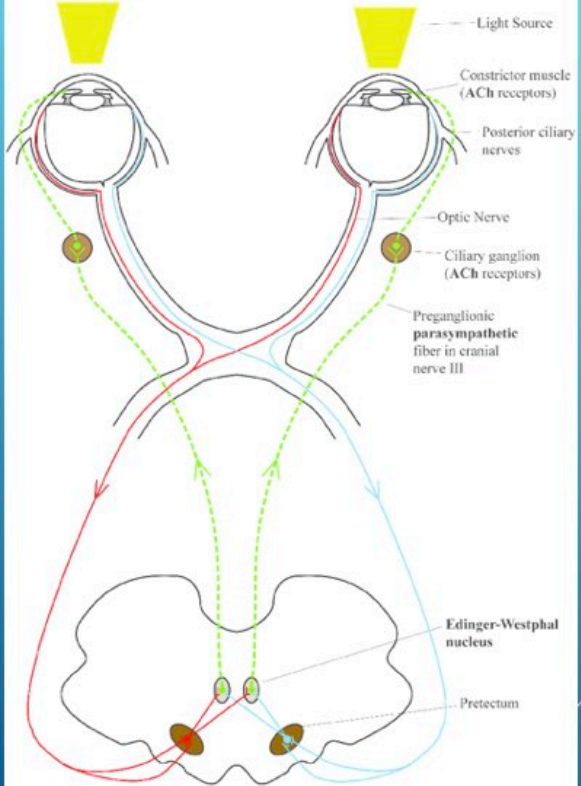


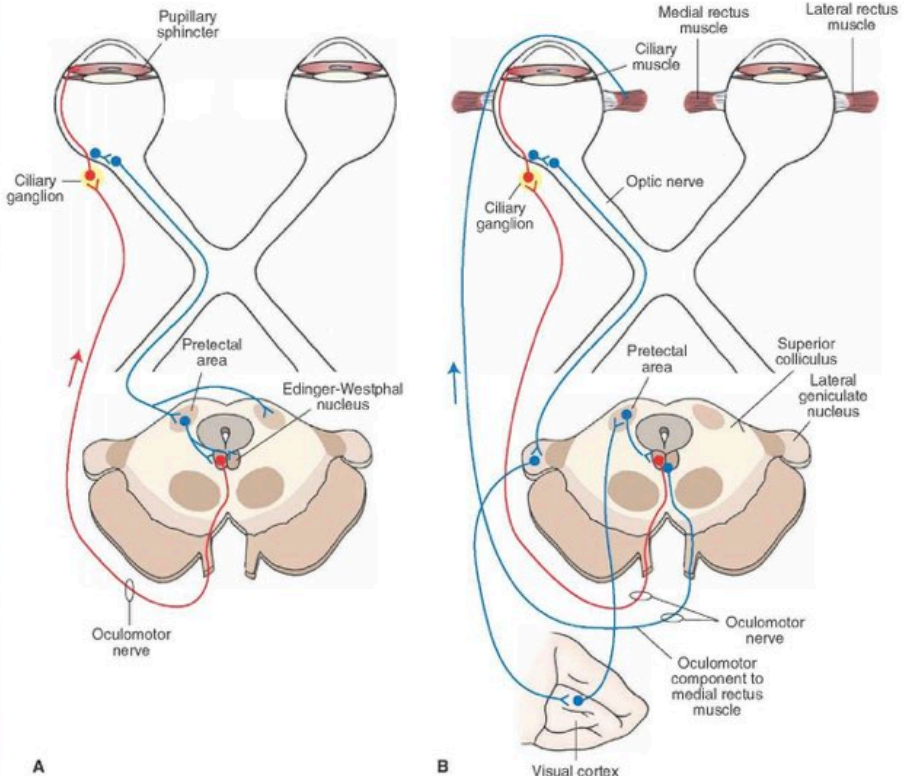
lens
iris
pupil
anterior chamber
cornea

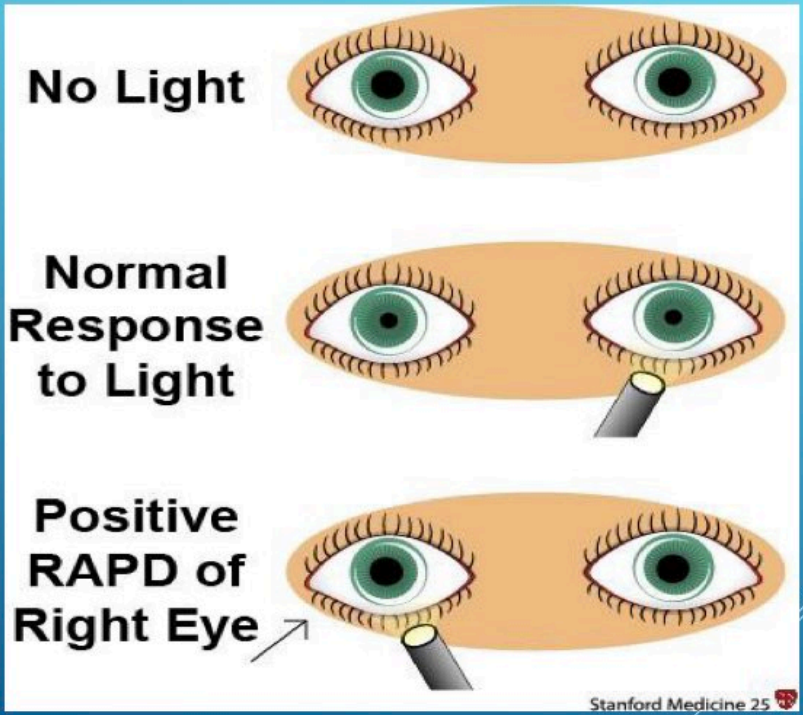
Vascular Tunic -- Muscles of the Iris

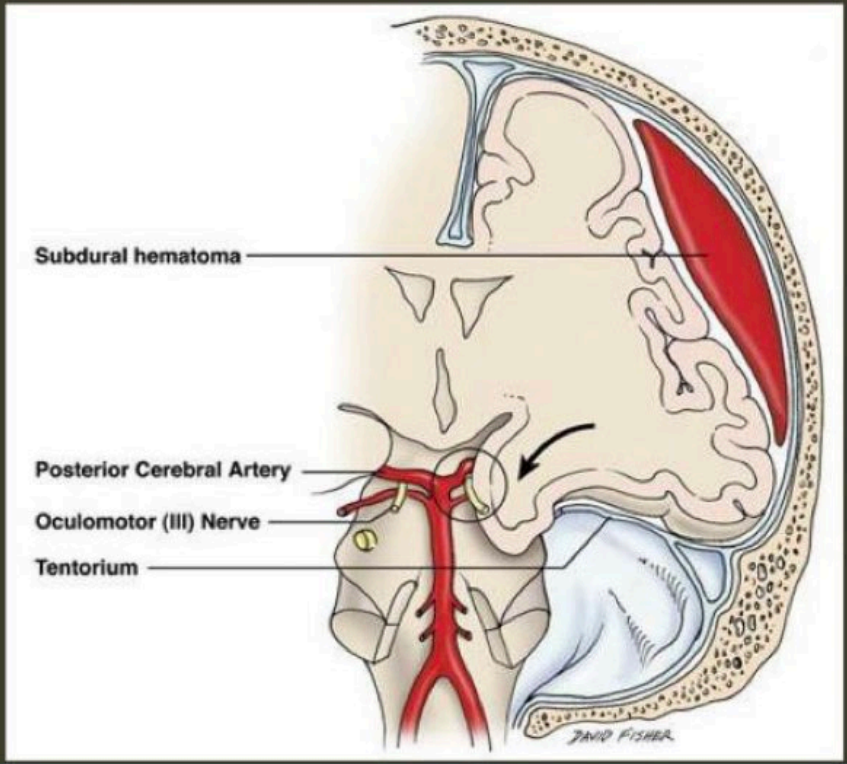


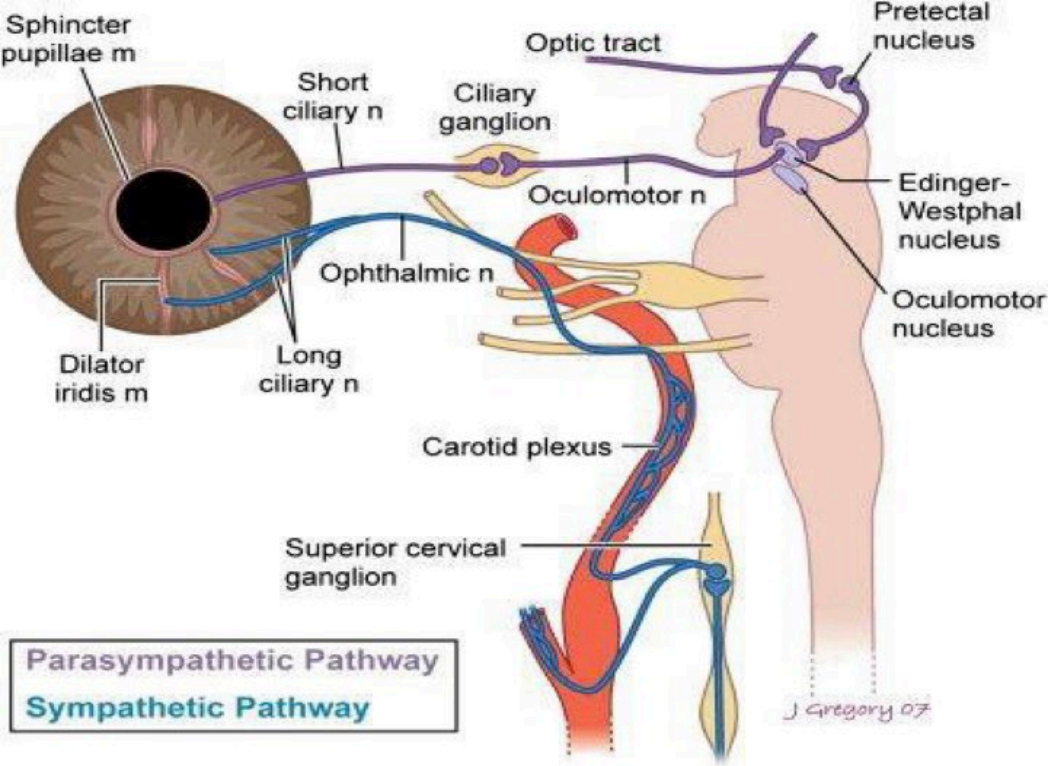
- Constrictor pupillae (circular) are innervated by parasympathetic fibers while Dilator pupillae (radial) are innervated by sympathetic fibers.
- Response varies with different levels of light


Light Source
Constrictor muscle
(ACh receptors)
Posterior ciliary
nerves
Optic Nerve
Ciliary ganglion
(ACh receptors)
Preganglionic
parasympathetic
fiber in cranial
nerve III
Edinger-Westphal
nucleus
Pretectum

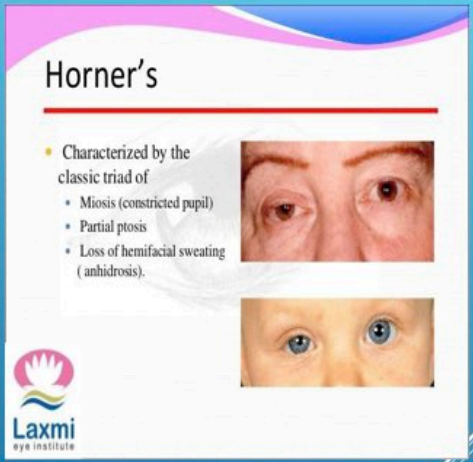

Pupillary sphincter
Ciliary ganglion
Pretectal area
Edinger-Westphal nucleus
Oculomotor nerve
A
Medial rectus muscle
Lateral rectus muscle
Ciliary muscle
Optic nerve
Ciliary ganglion
Pretectal area
Superior colliculus
Lateral geniculate nucleus
Oculomotor nerve
Oculomotor component to medial rectus muscle
Visual cortex
B


No Light
Normal Response to Light
Positive RAPD of Right Eye
Stanford Medicine 25

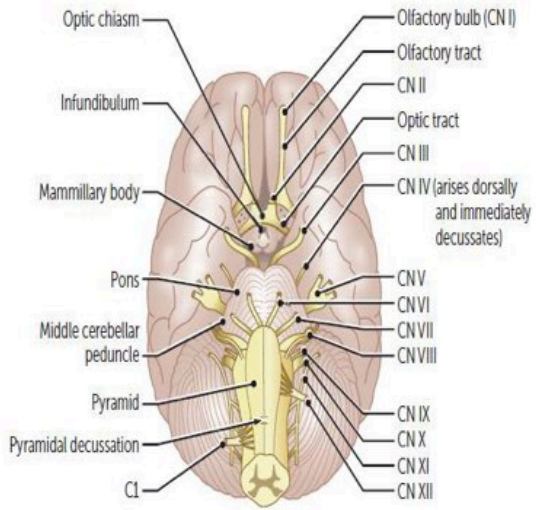

Subdural hematoma
Posterior Cerebral Artery
Oculomotor (III) Nerve
Tentorium
DAVID FISHER


Sphincter pupillae m
Short ciliary n
Ciliary ganglion
Optic tract
Pretectal nucleus
Oculomotor n
Edinger-Westphal nucleus
Ophthalmic n
Oculomotor nucleus
Dilator iridis m
Long ciliary n
Carotid plexus
Superior cervical ganglion
Parasympathetic Pathway
Sympathetic Pathway
J Gregory 07

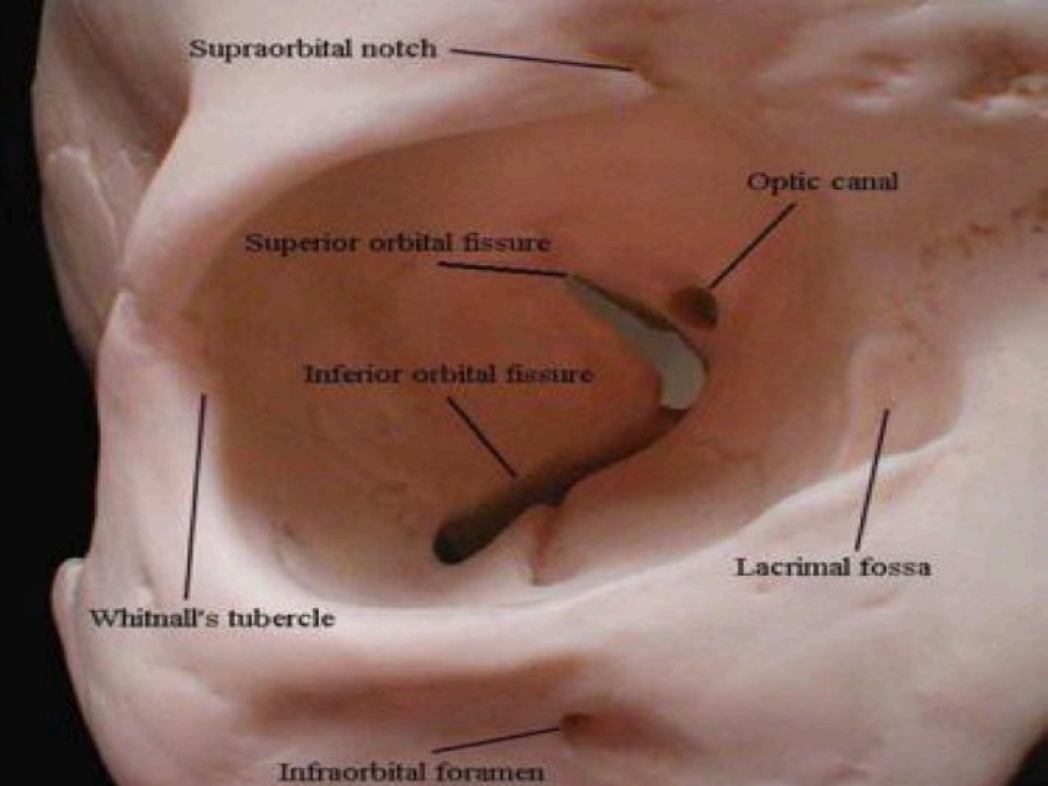
Miosis
Ptosis
Apparent enophthalmos

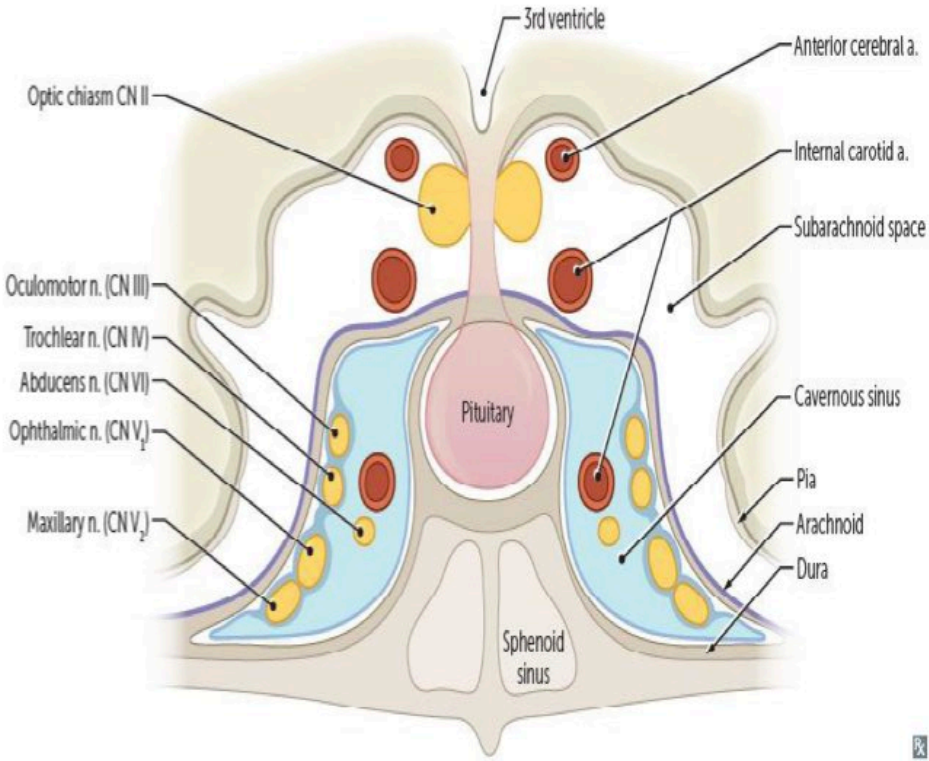


Brain stem—ventral view

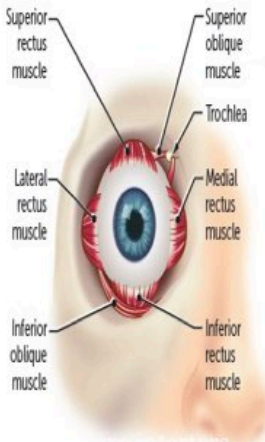


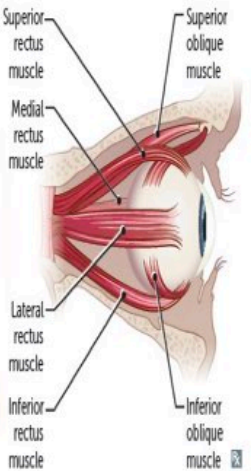
- CN are in above pons (I, II, III, IV).
- CN are in pons (V, VI, VII, VIII).
- CN are in medulla (IX, X, XI, XII).
- CN nuclei are medial (III, IV, VI, XII). "Factors of 12, except 1 and 2."


Supraorbital notch
Optic canal
Superior orbital fissure
Inferior orbital fissure
Lacrimal fossa
Whitnall's tubercle
Infraorbital foramen

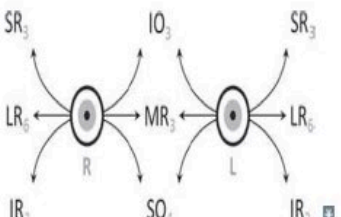

3rd ventricle
Anterior cerebral a.
Optic chiasm CN II
Internal carotid a.
Subarachnoid space
Oculomotor n. (CN III)
Trochlear n. (CN IV)
Abducens n. (CN VI)
Pituitary
Cavernous sinus
Ophthalmic n. (CN V1)
Pia
Maxillary n. (CN V2)
Arachnoid
Dura
Sphenoid sinus

Ocular motility





CN VI innervates the Lateral Rectus.
CN IV innervates the Superior Oblique.
CN III innervates the Rest.
The "chemical formula" $LR_6SO_4R_3$.
The superior oblique abducts, intorts, and depresses while adducted.

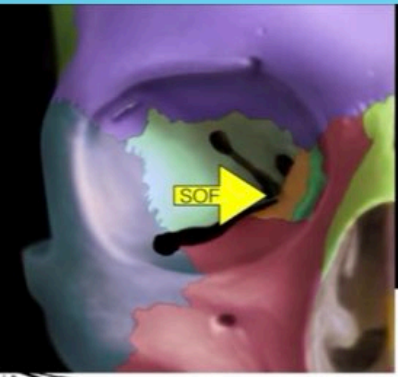


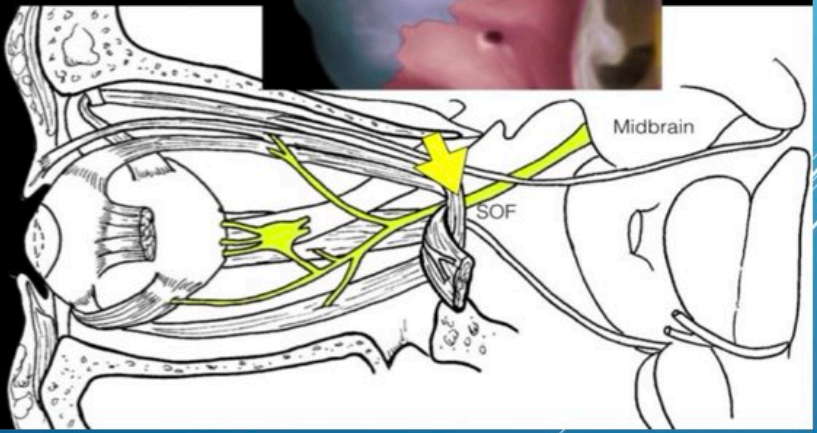
To test each muscle, ask patient to move his/her eye in the path diagrammed below, from neutral position toward the muscle being tested.

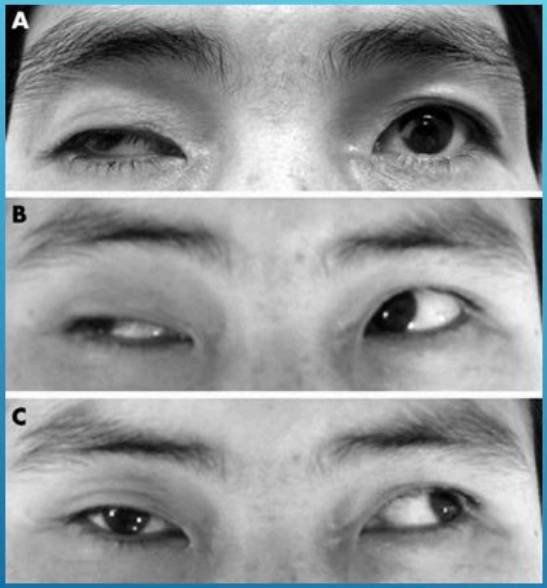
Obliques go Opposite (left SO and IO tested with patient looking right).
IOU: IO tested looking Up.

CN III. Oculomotor nerve

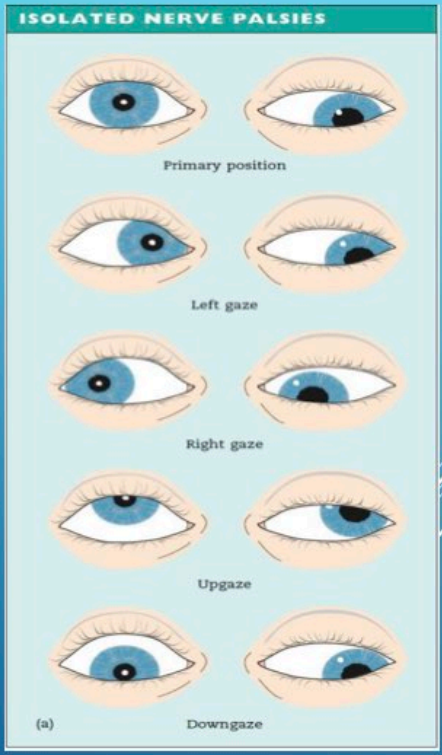
Origin/Course





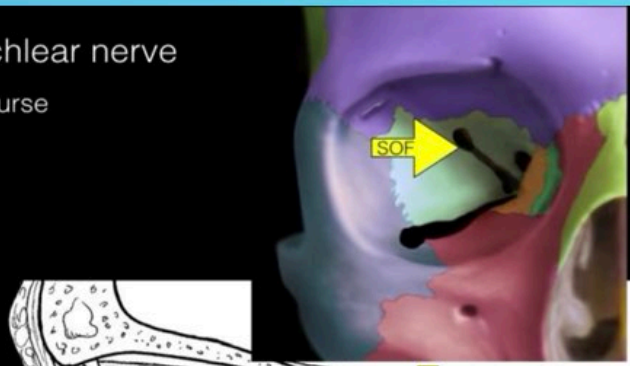


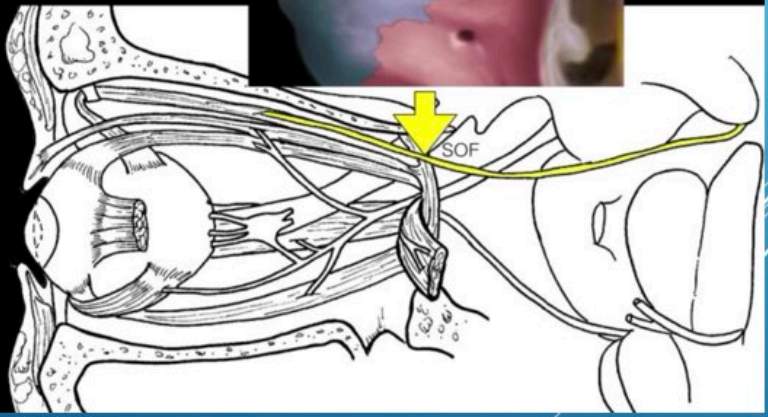
Photograph of the patient's extraocular movements on forward gaze (A), right gaze (B), and left gaze (C)



CN IV. Trochlear nerve

Origin/Course

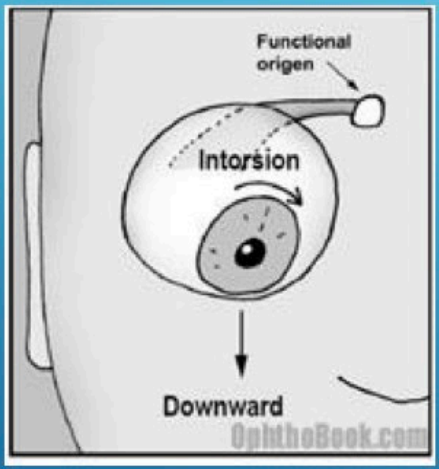




FOURTH CRANIAL NERVE PALSIES

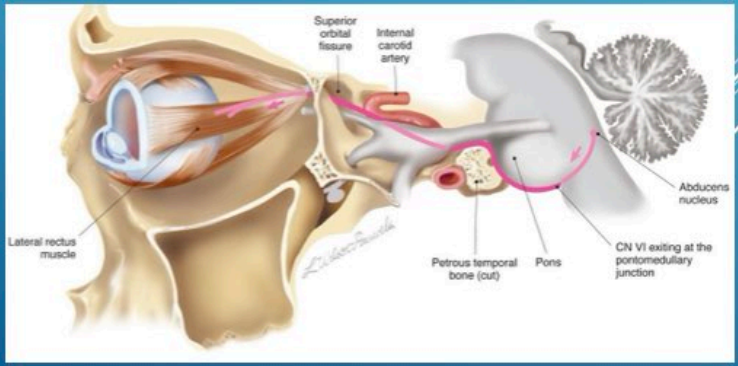
Weakness of the muscle innervated by the 4th (trochlear) nerve **(superior oblique muscle)**.

- These palsies are often difficult to detect because they produce the least eye movement abnormality.
- They affect vertical eye position predominantly when the eye is turned inward (Intorsion).

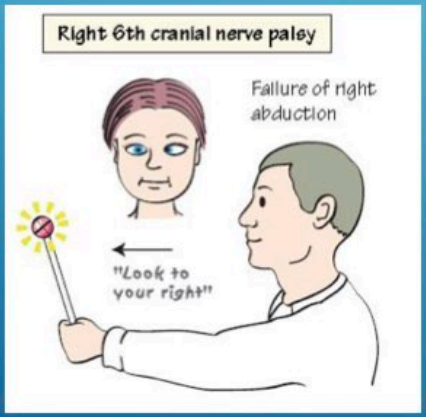

Functional origen
Intorsion
Downward
OphthoBook.com


My neck hurts for some reason.
OphthoBook.com

- Originates in the Abducens Nucleus → "PontoMedullary Junction"
- Continues anteriorly through the Cavernous sinus
- Then continues to the lateral portion of the "Superior Orbital Fissure"
- **-Longest course**
- **-Most common palsy**



- Bilateral 6th nerve palsy :



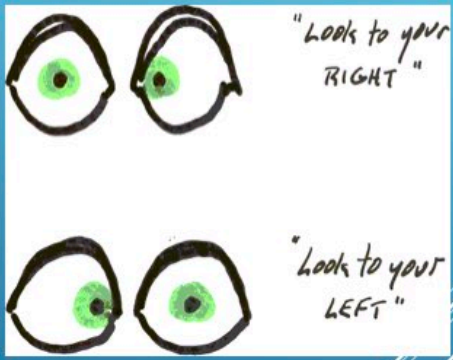
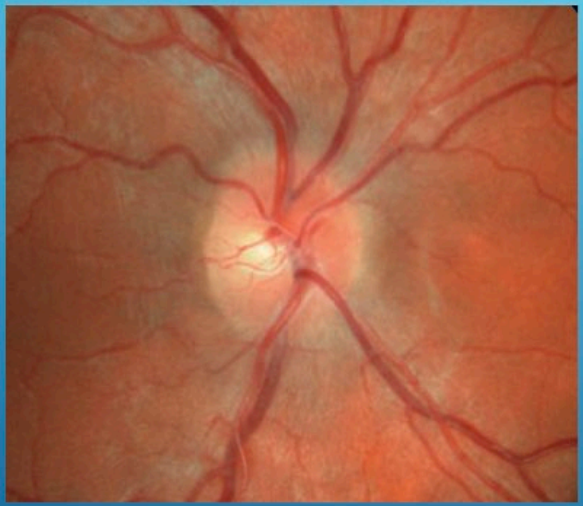
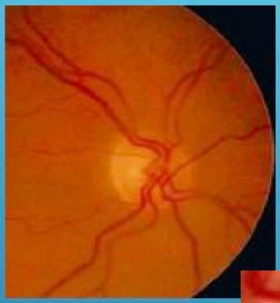


Fig. 19.71 *Acute left sixth nerve palsy in a child.* **(A)** *Left esotropia in the primary position;* **(B)** *marked limitation of left abduction*



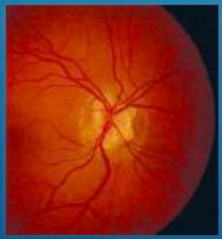
The normal optic nerve head has distinct margins , a pinkish rim and usually a white central cup “CDR=0.3”

Optic Disc Swelling



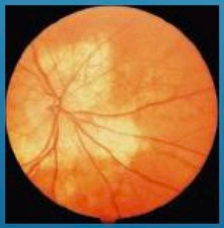
a) A normal disc

(B) A SWOLLEN DISC SECONDARY TO RAISED INTRACRANIAL PRESSURE. NOTE THE LACK OF A SHARP OUTLINE TO THE DISC AND THE DILATED CAPILLARIES ON THE DISC.

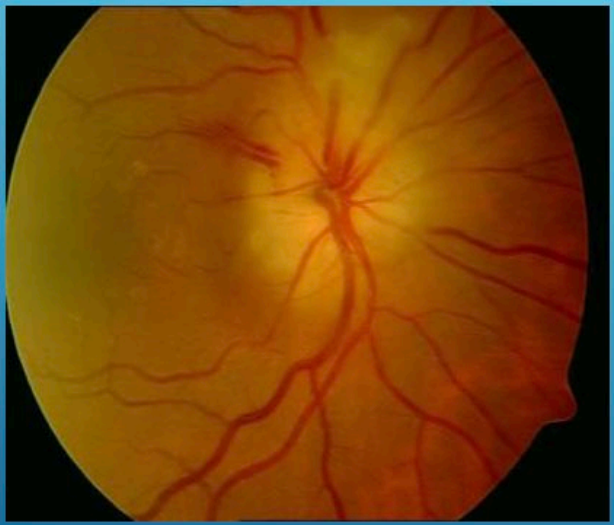


(c) The appearance of optic disc drüsen; note how the solid yellow lesions cause irregularity of the disc margin

(d) Myelination of the nerve fibers around the nerve head may be mistaken for a swollen optic disc

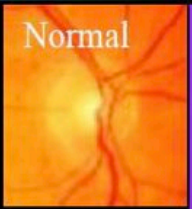


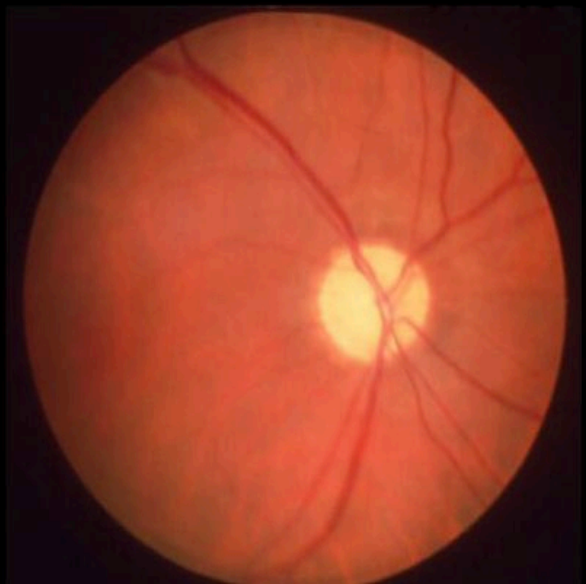
(e) A myopic optic disc. Note the extensive peripapillary atrophy.



Pale with swollen disk:

suggested GCA particularly if associated with visual loss



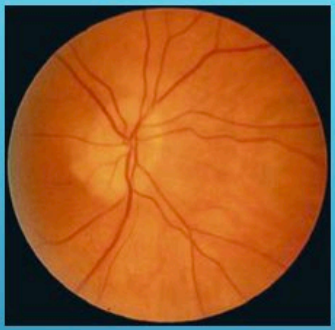


Pale, featureless disc

= optic atrophy

(ischaemia, MS etc)

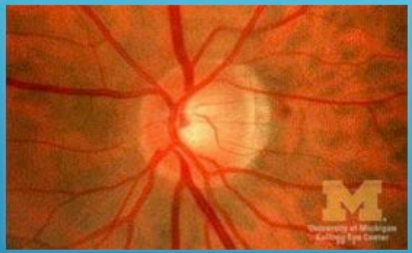
(a)



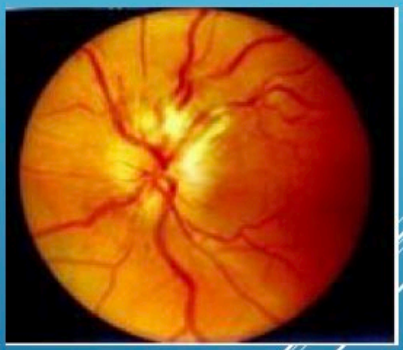
(b)

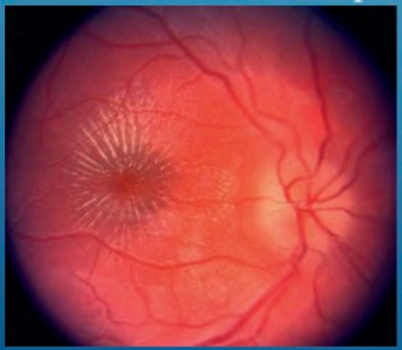
(a) A pale optic disc compared to (b) a normal optic disc.

- Normal Optic Disc



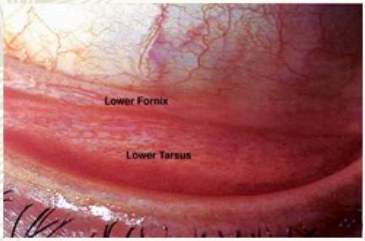
- Optic Neuritis

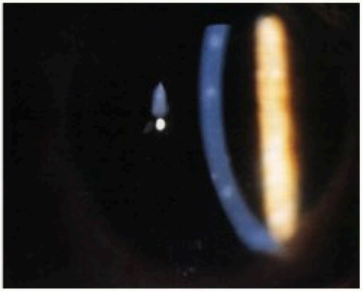




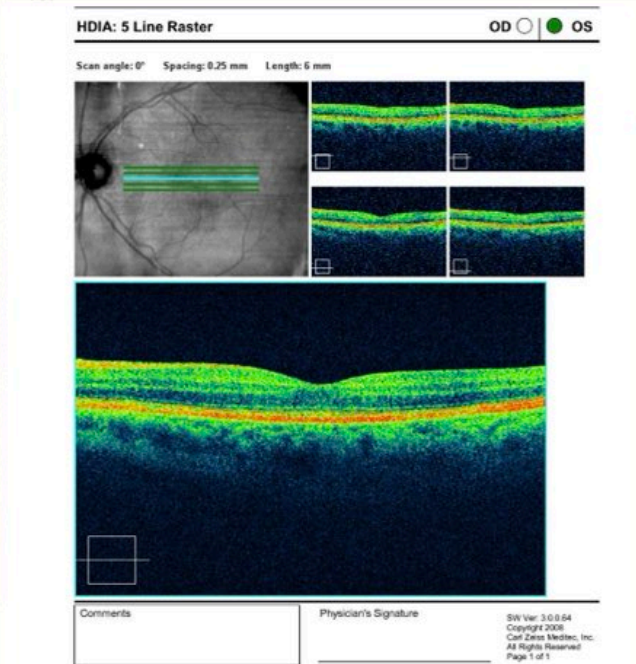
- Neuroretinitis

Advanced techniques
Slit Lamp


Lower Fornix
Lower Tarsus



Optical Coherence Tomography: OCT



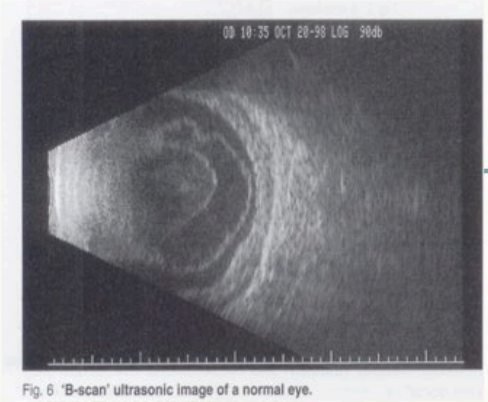
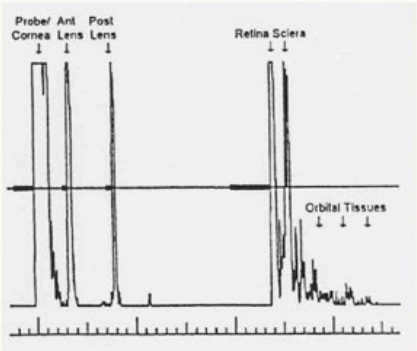


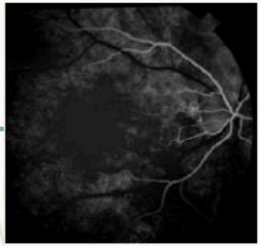
Fig. 6 'B-scan' ultrasonic image of a normal eye.

Ultrasound: B-scan

Ultrasound: A-scan

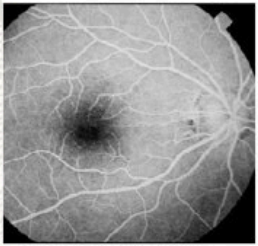


Fluorescein Angiography

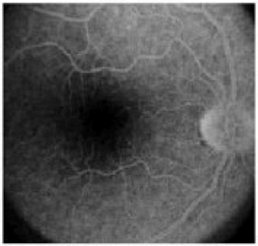


Arterial phase

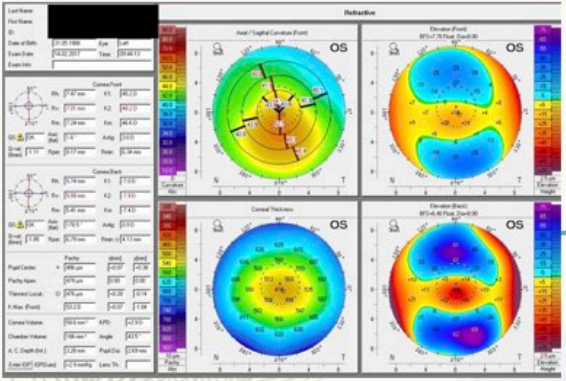
Early venous phase



Venous phase



Late phase



Corneal Curvature and surface evaluation

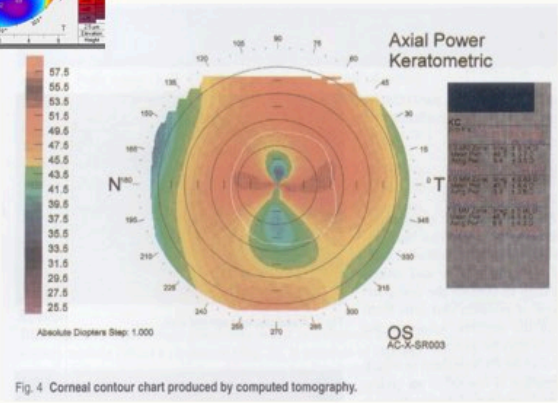


Fig. 4 Corneal contour chart produced by computed tomography.

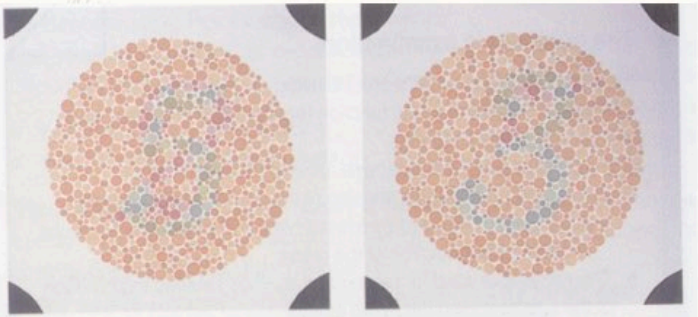
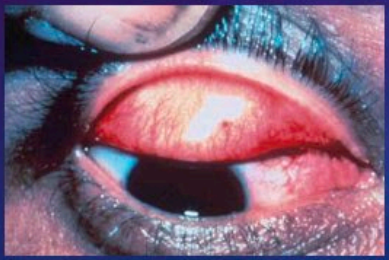
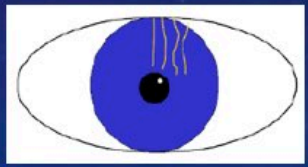


Fig. 2 **An Ishihara pseudoisochromatic plate.**

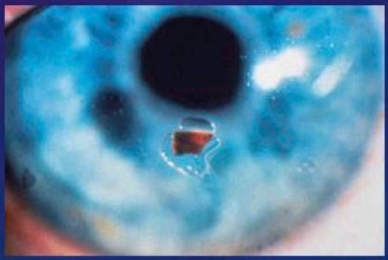
MINOR TRAUMA:

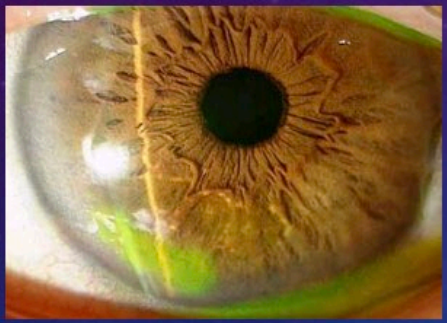
- **Conjunctival FB:**
  - SUBTARSAL FOREIGN BODY: No ocular examination is complete until the upper eyelid is everted and closely inspected.
  - Linear epithelial defects is suggestive of a foreign body under the eye lid

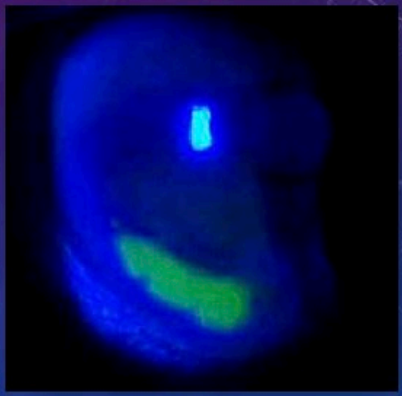


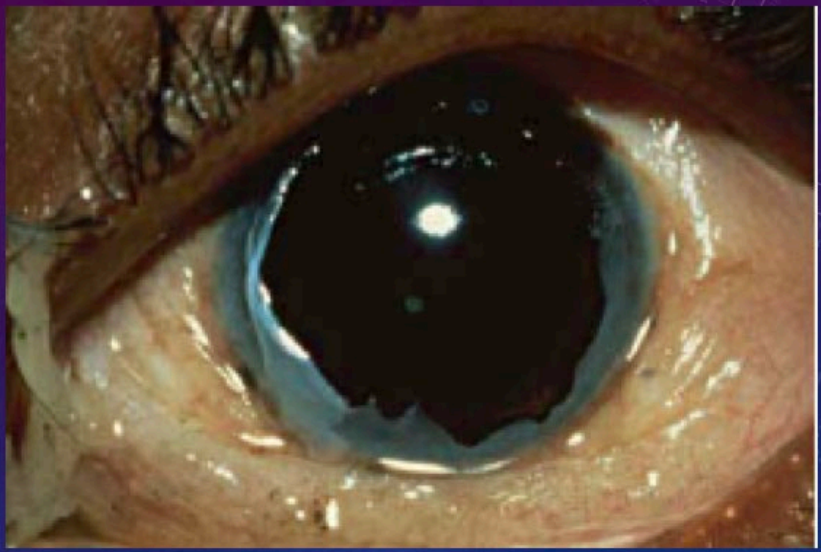


- ***Corneal FB:***
  - Corneal foreign bodies and rust rings are best removed with a sterile disposable needle (19 to 23 G).
  - Do not attempt central or deep foreign bodies as a slit lamp is required to avoid excessive trauma.
  - Instil antibiotic ointment and pad for 24 hours.
  - Review daily until healed, or referred to ophthalmologist.



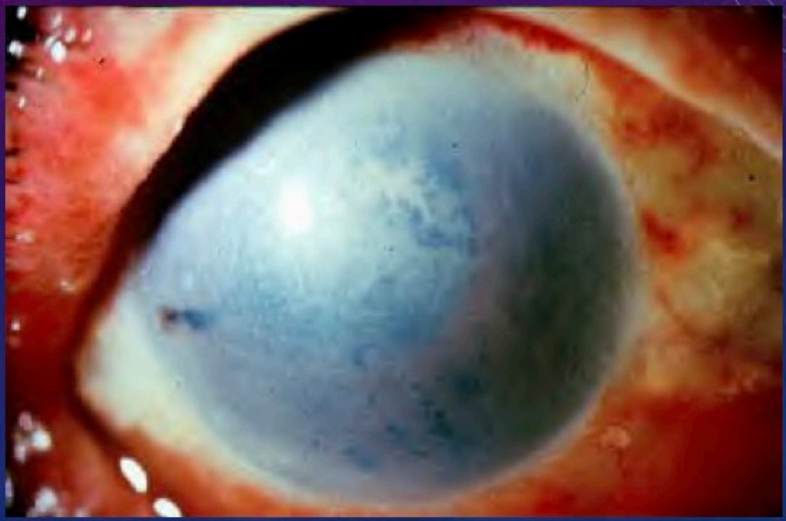


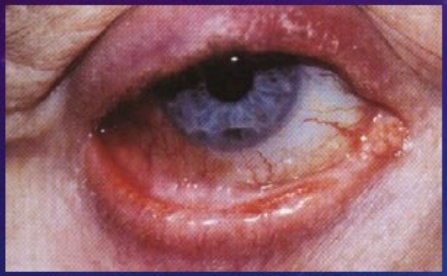


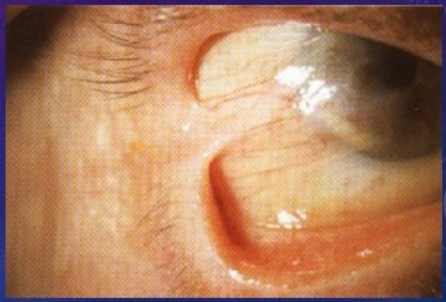


•Damage from alkali injuries is usually worse and carries a poor prognosis(Fig. 2).

ALKALI BURN UNTREATED

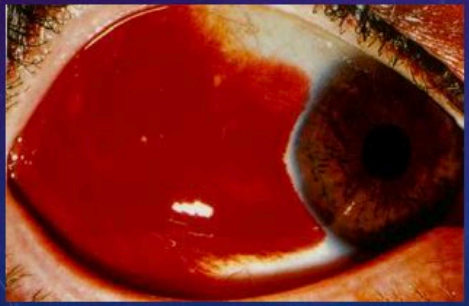




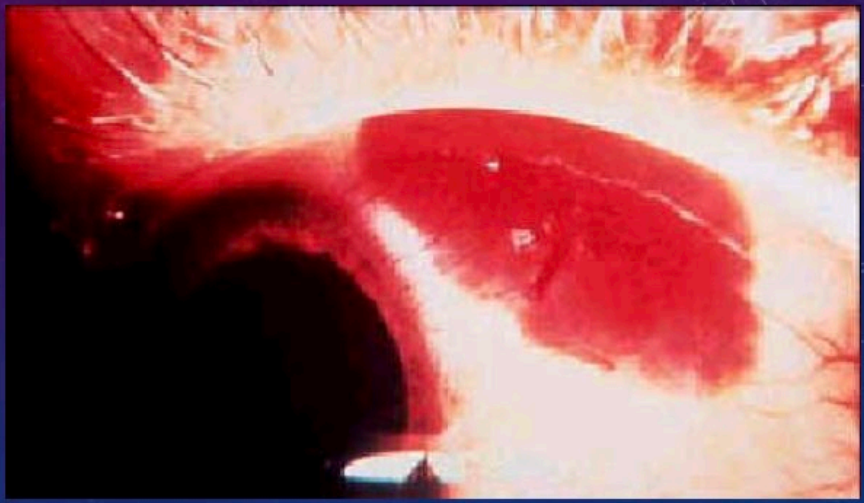


SUBCONJUNCTIVAL HEMORRHAGE

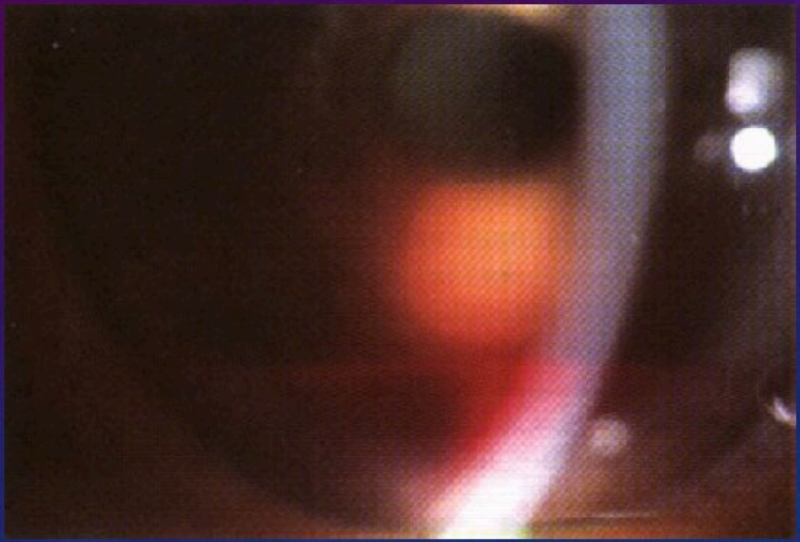
- Can occur secondary to blunt trauma or can be spontaneous
- Usually benign and self-limited.
- No treatment is required, Lubrication if foreign body sensation
- But be **aware of rupture globe**.



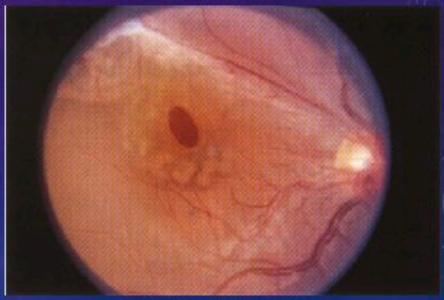
SUBCONJUNCTIVAL HEMORRHAGE

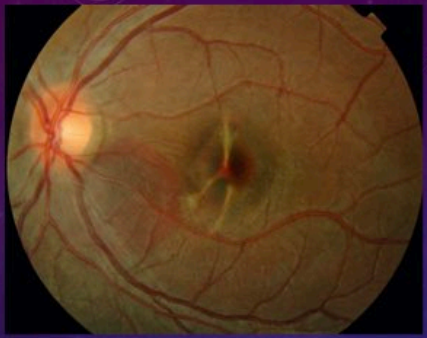


SUBCONJUNCTIVAL HEMORRHAGE

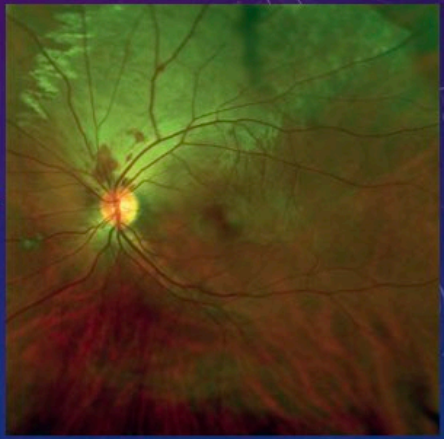


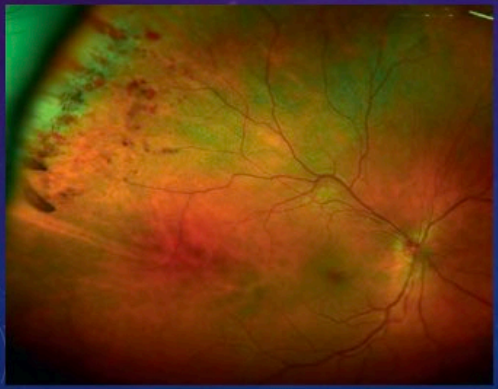
- RETINAL DETACHMENT.
  BEWARE OF FLOATERS, FLASHES AND FIELD DEFECTS.
  URGENT REFERRAL IS MANDATORY.





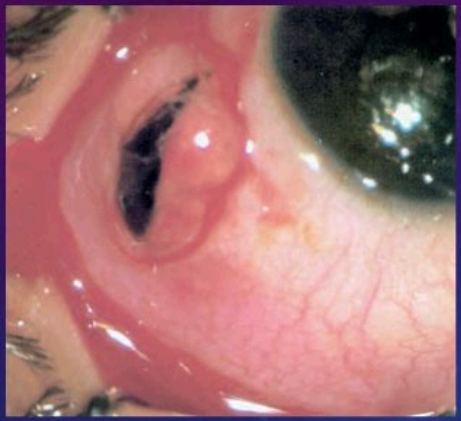
CHOROIDAL RUPTURE

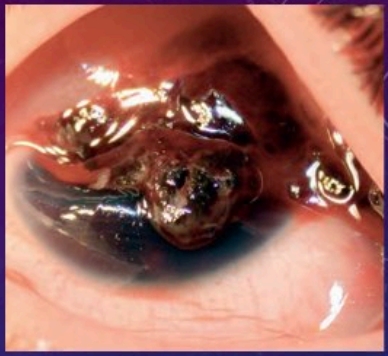


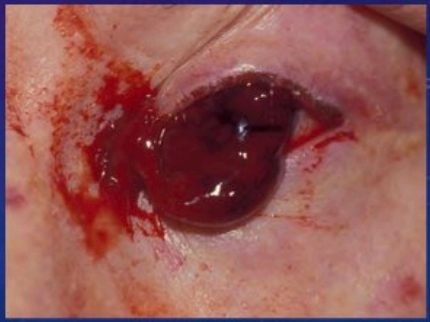


Commotio Retinae w/ retinal hgs

RUPTURE OF GLOBE

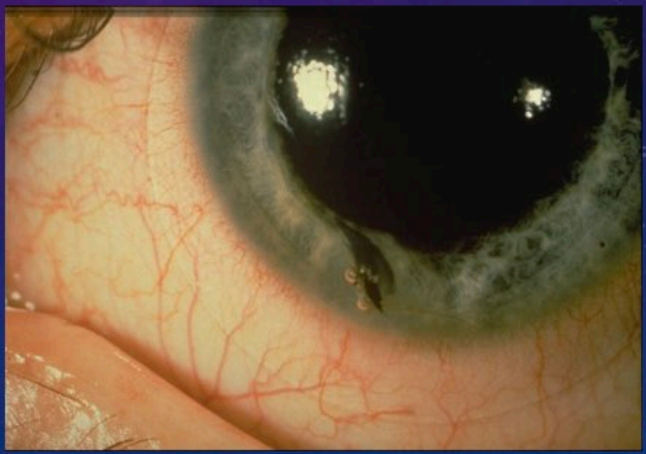






OPEN GLOBE

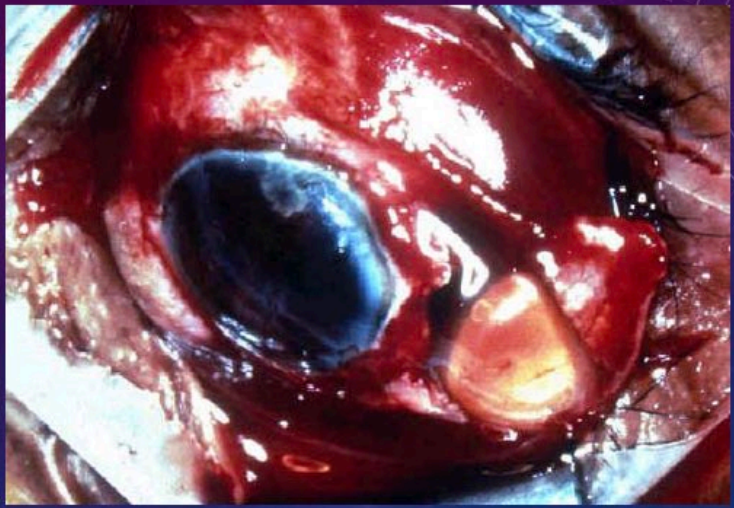
- Perforating corneal laceration



PENETRATING TRAUMA

- Do not remove penetrating foreign bodies
- Minimize additional damage (shield)
- NPO
- Tetanus
- Antibiotics
- REFER

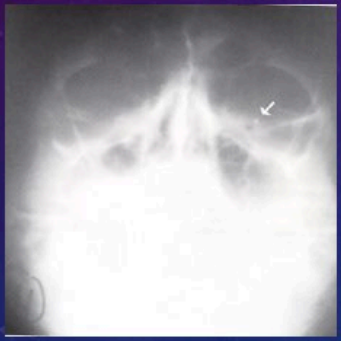
- Penetrating injury with nail gun

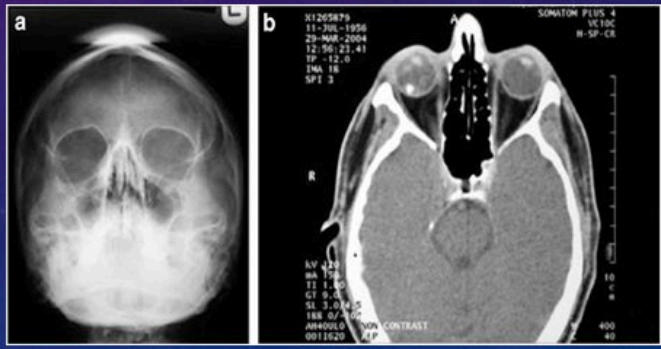


- Severe trauma that resulted in a scleral rupture with delivery of the lens

- Cataractous lens following penetrating trauma

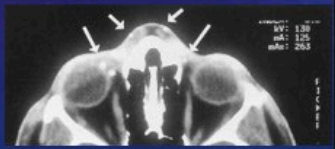
INTRAOCULAR FOREIGN BODY





INTRAOCULAR FOREIGN BODY

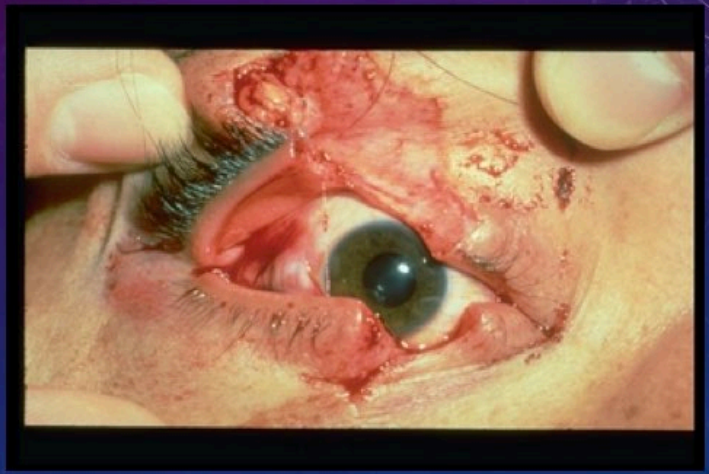
- CT localizes best
- Antibiotics (IV or PO)
- Refer



OPEN GLOBE-TREATMENT

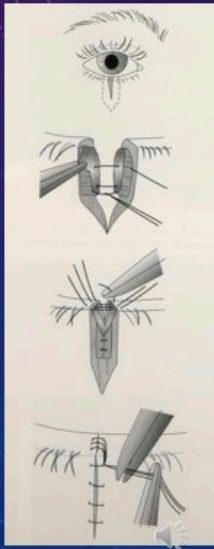
- When suspect an open globe, one shall protect the eye from further injury by covering the eye with a shield or any device that can protect the eye.
- **Minimize additional damage**
  - shield (not patch)
  - avoid valsalva
- Do not instill any medication to the eye.
- Do not attempt to remove anything from the wound, and consult the opthalmologist.
- "Prepare for repair"
  - NPO

LID LACERATIONS



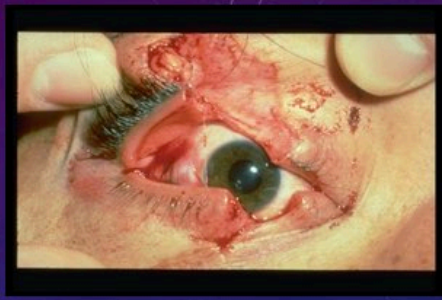
LID LACERATION

- REFER for location
  - medial
  - margin



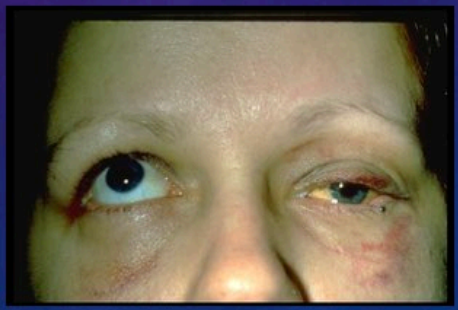
LID LACERATION

- REFER for
  - Depth
  - Extensive tissue loss



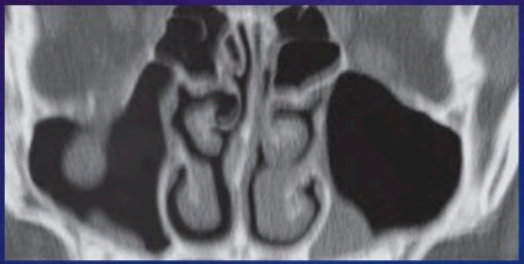
ORBITAL BLOW OUT FRACTURE

- Abnormal motility -> DOUBLE VISION
  - May need repair (if persistent)

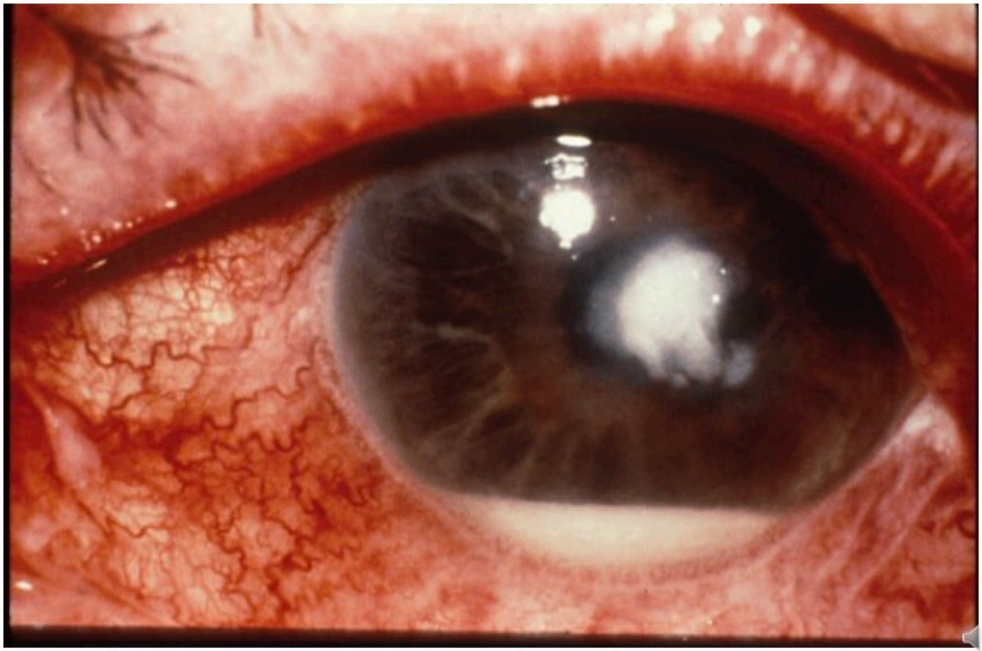


ORBITAL BLOW OUT FRACTURE

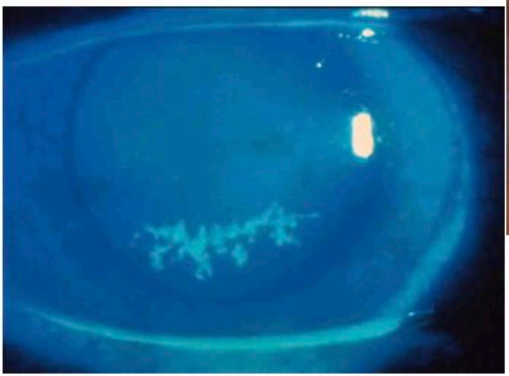
- Crepitus
- Paresthesia (cheek, gum)

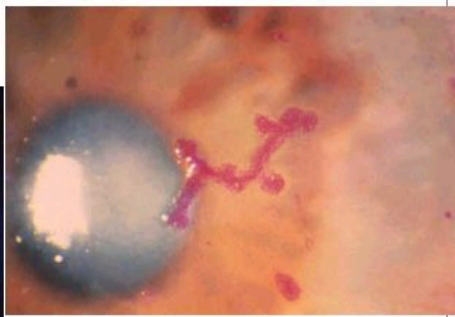


Bacterial keratitis



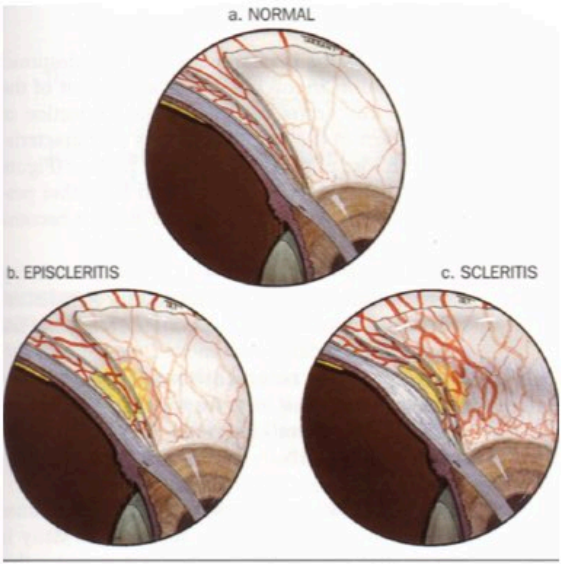
Herpes simplex keratitis



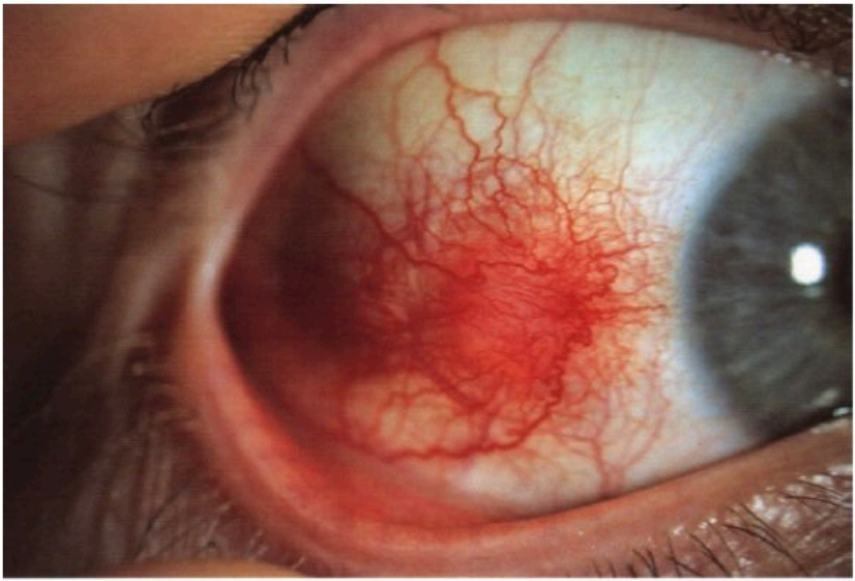


Herpes Zoster Keratitis

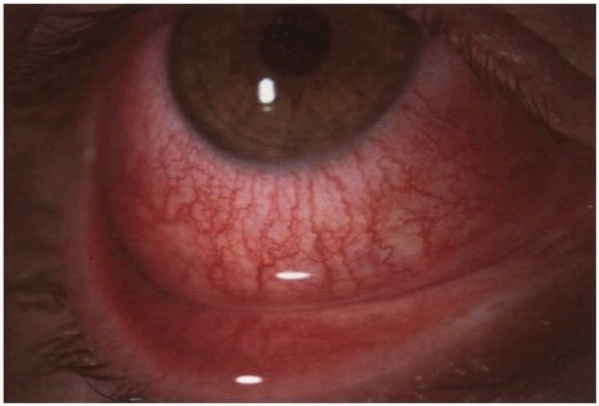
Late changes: severe dry eye with macrodendrites, post herpetic neuralgia
Treatment: oral Acyclovir of proven benefit to reduce complications, topical antivirals not indicated, lubrication, treat complications


a. NORMAL
b. EPISCLERITIS
c. SCLERITIS

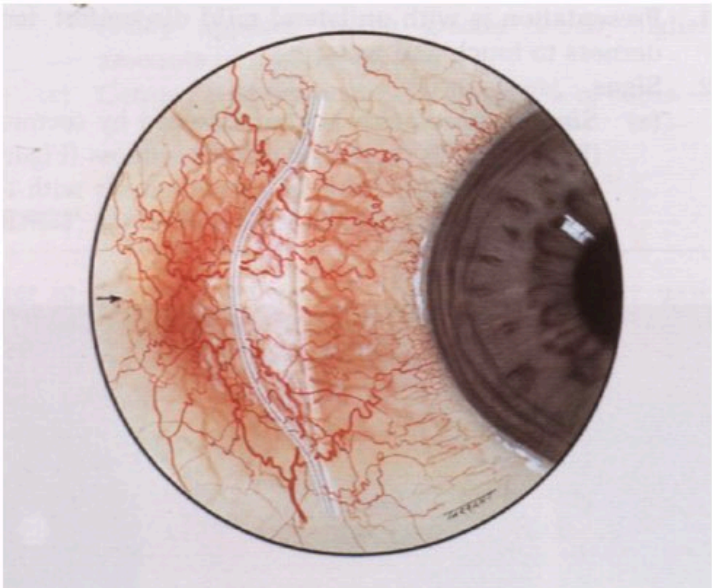
Episcleritis



Episcleritis



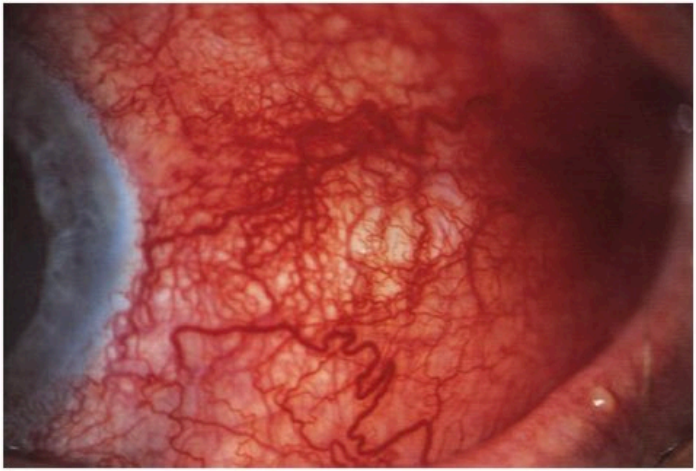
Episcleritis



- **Treatment**
  - ***Mild cases may need no specific therapy but if*** discomfort is annoying, topical steroids and/or topical non-steroidal anti-inflammatory drugs (NSAIDs) may be helpful.
  - ***Unresponsive recurrent cases, which are rare,*** require systemic flurbiprofen (100 mg three times daily), taken at the first symptom of recurrence in order to abort an attack

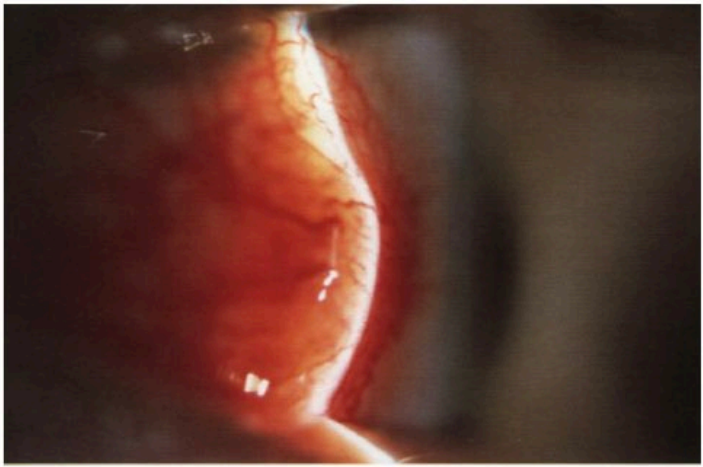
ANTERIOR NON-NECROTIZING SCLERITIS

- *Diffuse scleritis is characterized by widespread*
- *Nodular scleritis*



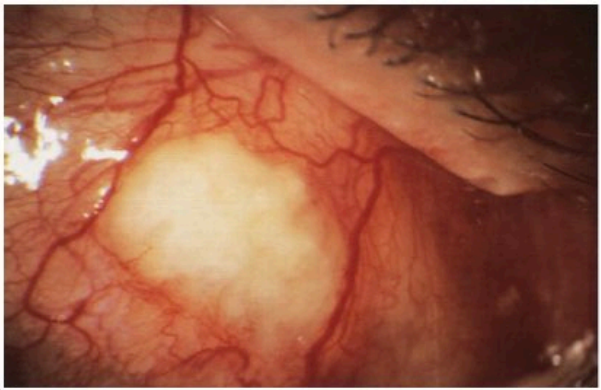
ANTERIOR NON-NECROTIZING SCLERITIS

- *Nodular scleritis*



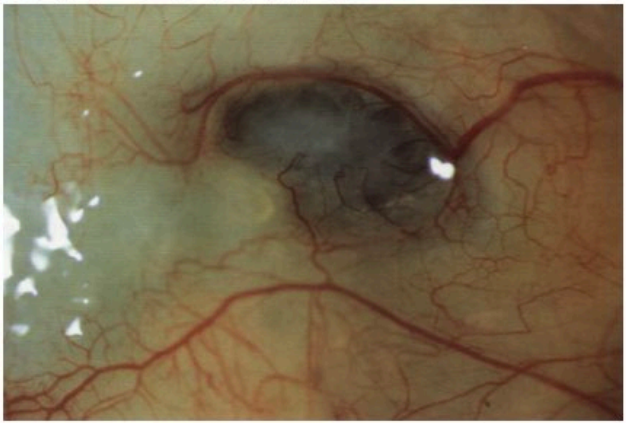
Anterior Necrotizing scleritis with inflammation

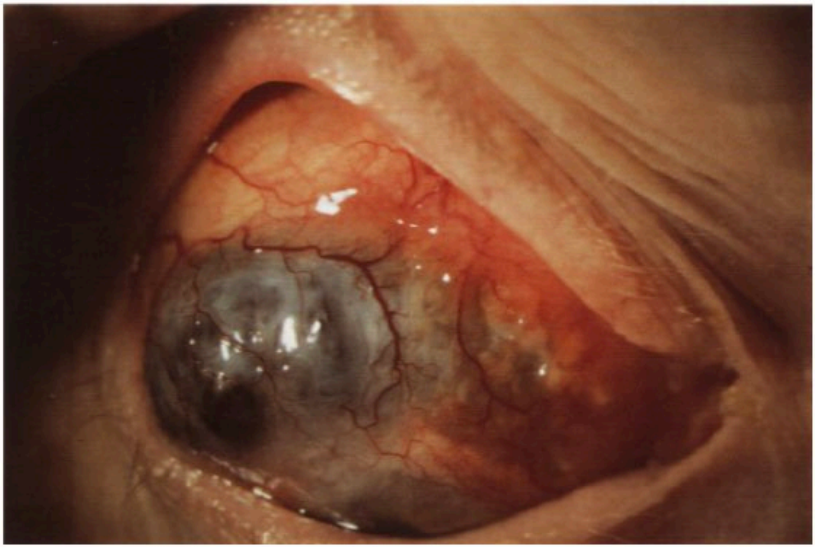
- Distortion or occlusion of blood vessels
  - Development of scleral necrosis



Anterior Necrotizing scleritis with inflammation

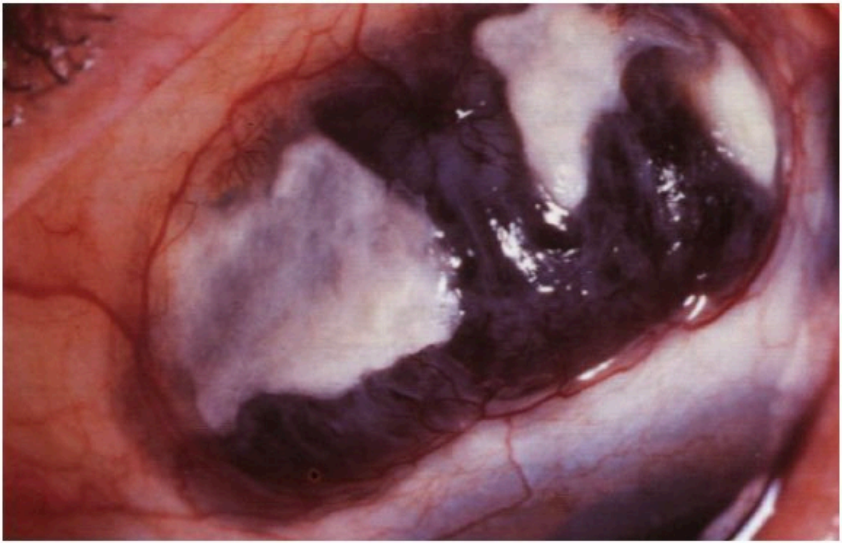
- Development of scleral necrosis
- Distortion or occlusion of blood vessels





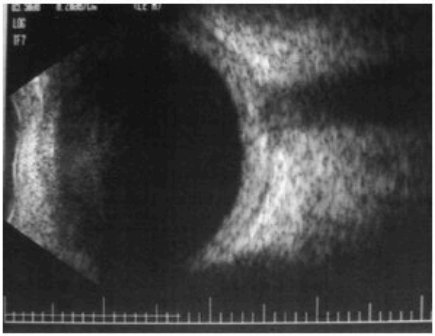
Anterior Necrotizing scleritis without inflammation

- **scleromalacia perforans**



POSTERIOR SCLERITIS

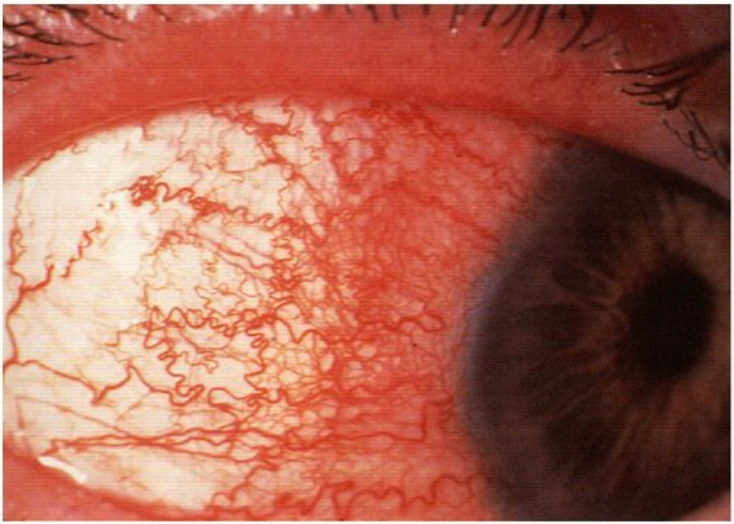
- **External signs may include eyelid oedema, proptosis** and ophthalmoplegia.
-



- **Ophthalmoscopy shows** Disc swelling, macular oedema and exudative retinal detachment .
- **Ultrasonography** shows thickening of the posterior sclera with fluid in Tenon space
- CT will also demonstrate posterior scleral thickening .
- **Treatment**
  - ***Elderly patients with associated systemic disease*** are treated in the same way as those with necrotizing anterior scleritis.
  - ***Young patients without associated systemic disease*** usually respond well to NSAIDs.

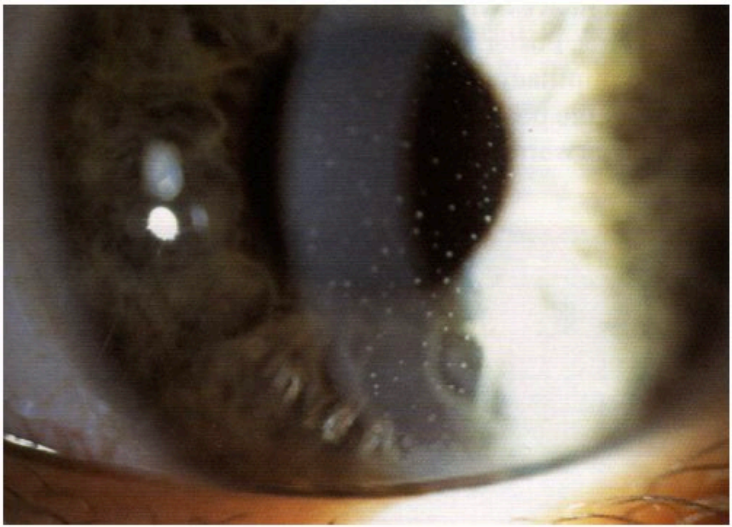
UVEITIS

Ciliary injection:



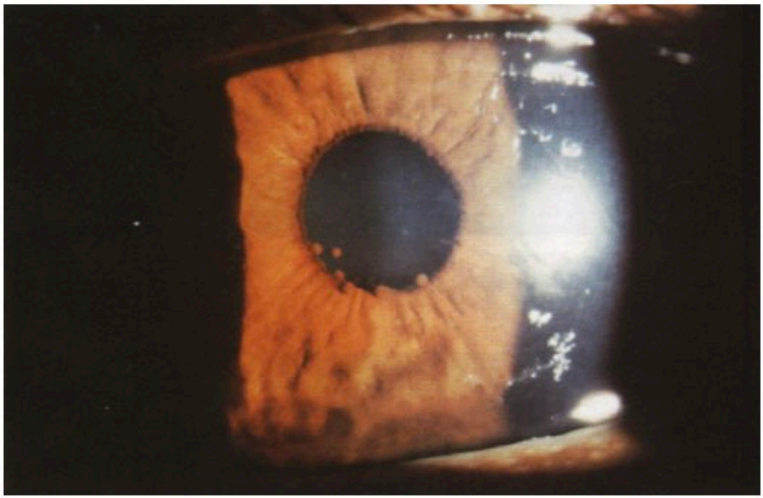
Keratic precipitates:

UVEITIS

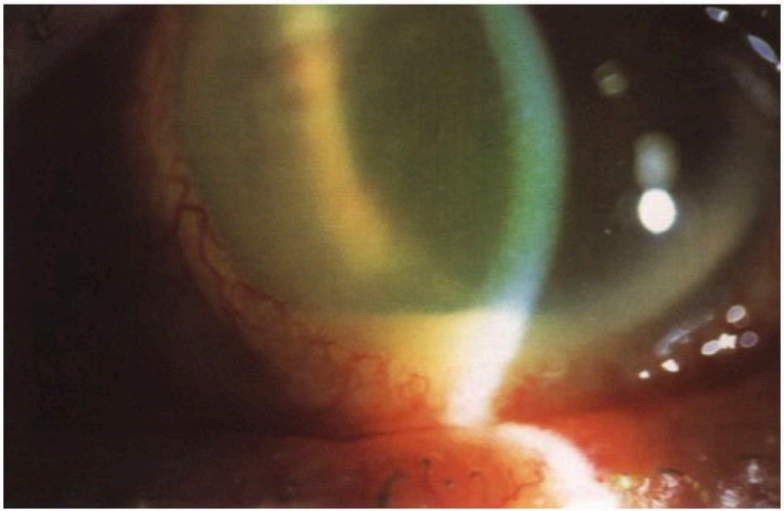


UVEITIS

Iris Nodules

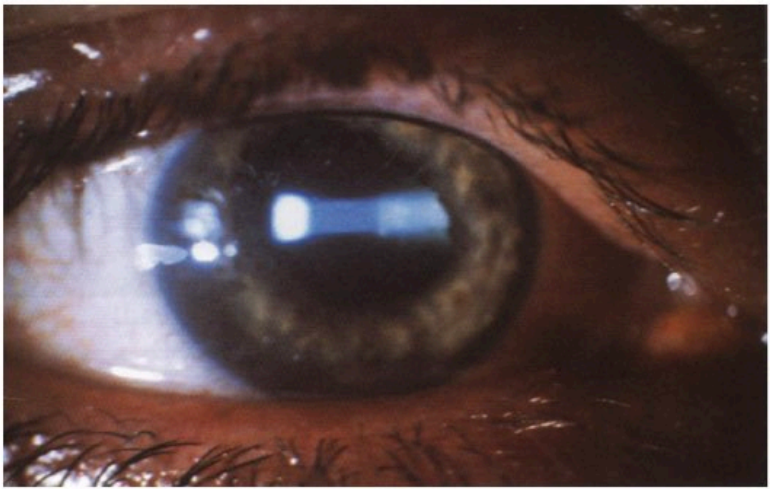


Hypopyon



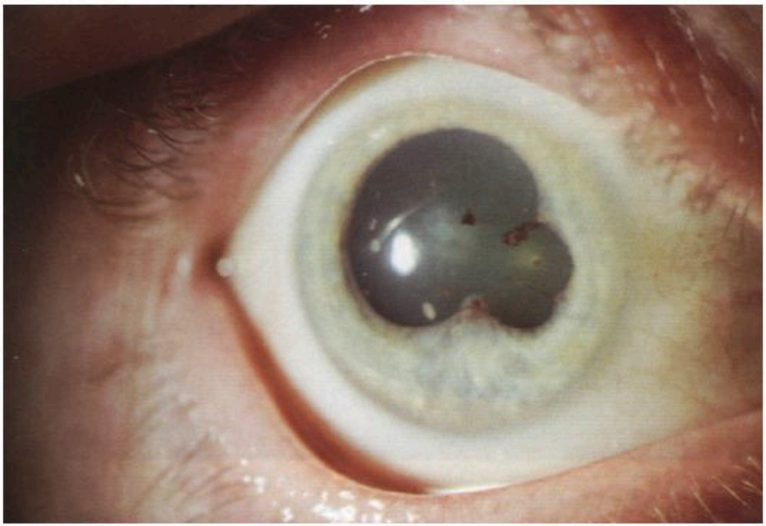
UVEITIS

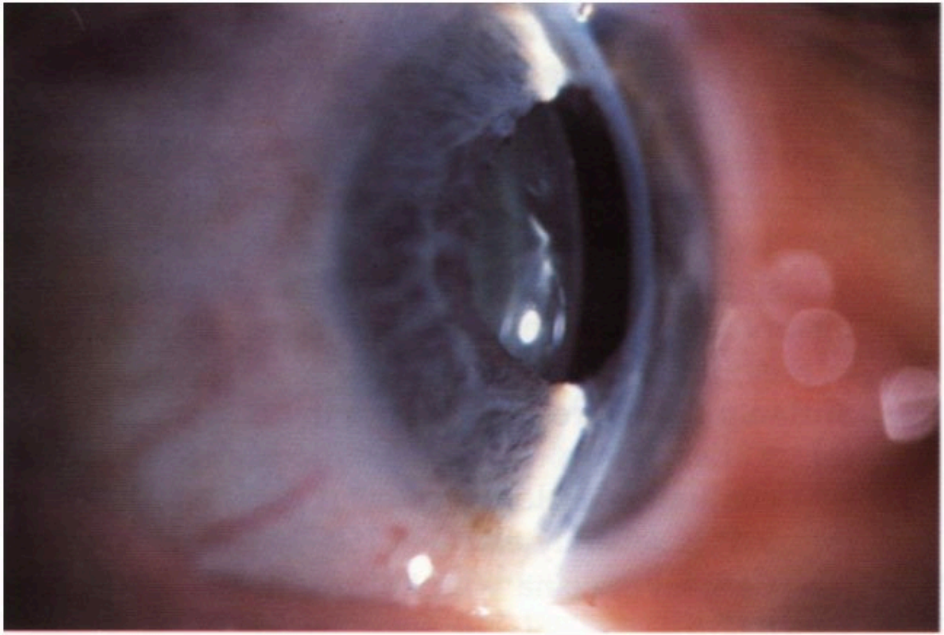
Flare:

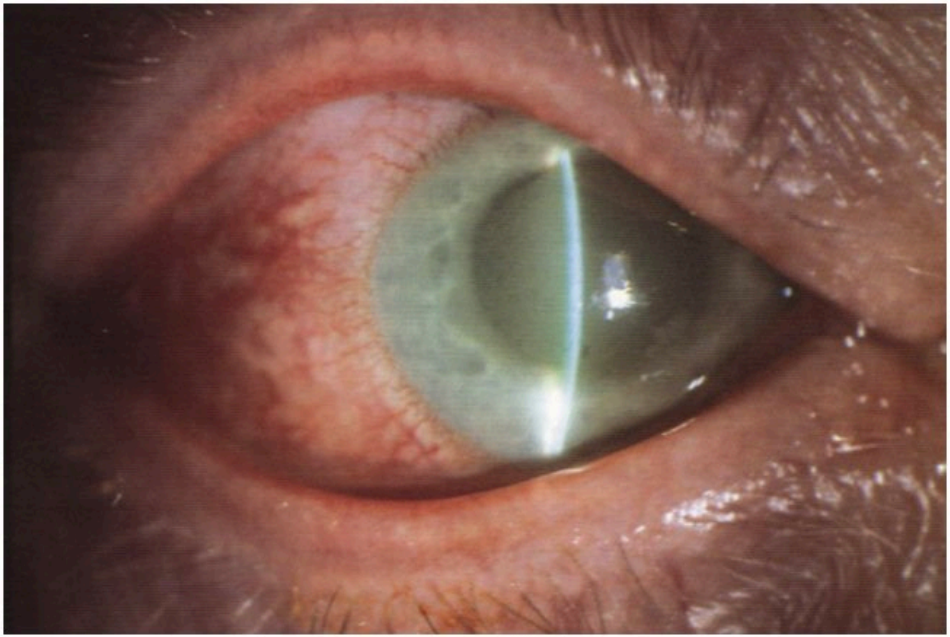


UVEITIS

Posterior synechia







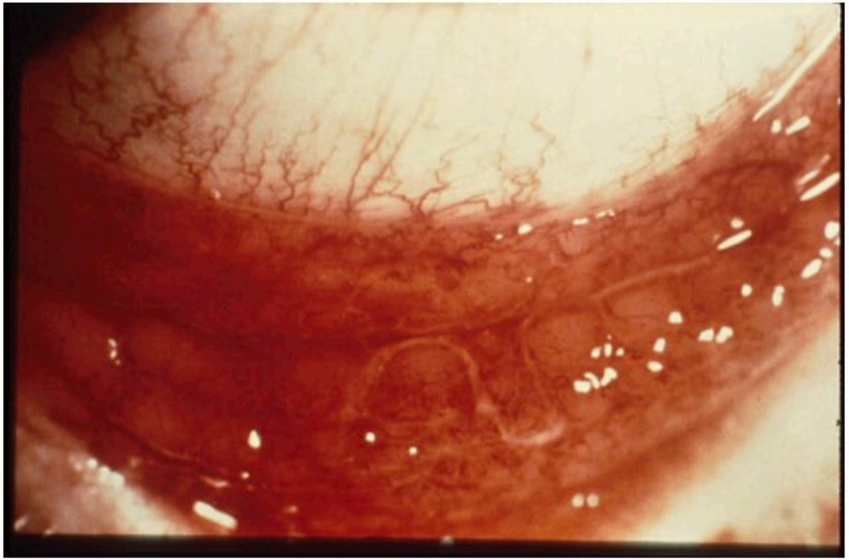
Bacterial Conjunctivitis

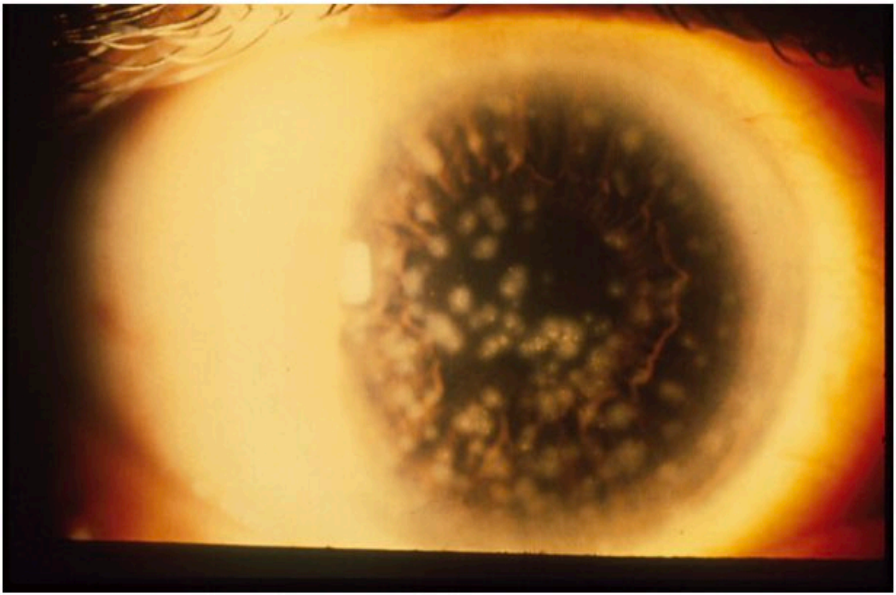
- **Common pathogens:**
  - *Staphylococcus coagulase* or *non-coagulase positive,*
  - *Streptococcus*
  - *Hemophilus influenzae,*
  - *Pseudomonas sp.*

Hyperpurulent Conjunctivitis

- caused by **gonococcus**
- URGENT REFERRAL for intensive IV & topical treatment

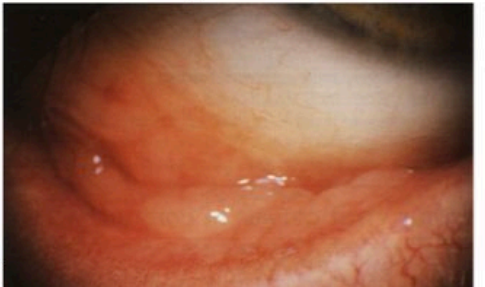
Viral Conjunctivitis





CHLAMYDIAL CONJUNCTIVITIS

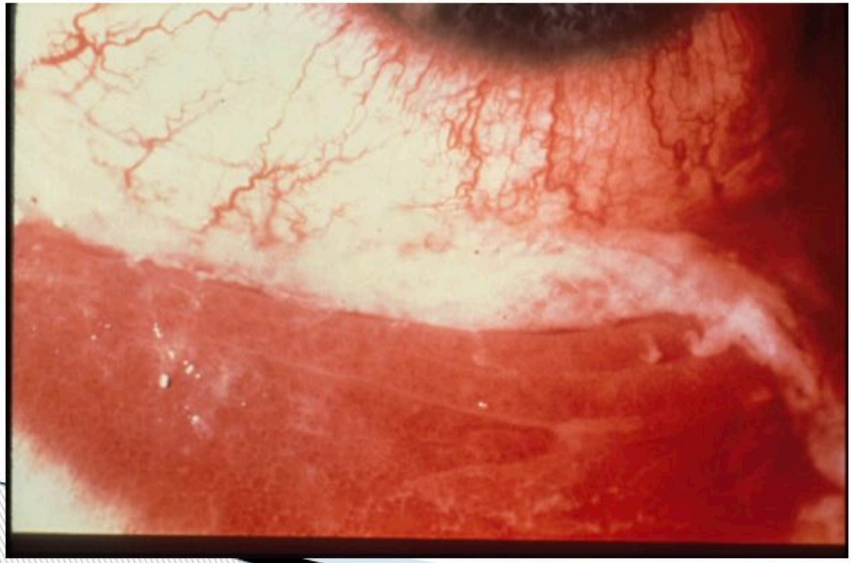
- Signs include: edematous conjunctiva, mucopurulent discharge, papillar then follicular reaction , non-tender lymphadenopathy.
- **Topical therapy is with tetracycline ointment four** times daily for 6 weeks.
- Systemic therapy can be with one of the following:
  - Doxycycline either 300 mg weekly for 3 weeks or 100 mg daily for l-2 weeks.
  - Tetracycline 250mg four times daily for 6 weeks.
  - Erythromycin 250mg four times daily for 6 weeks if tetracycline is inappropriate.



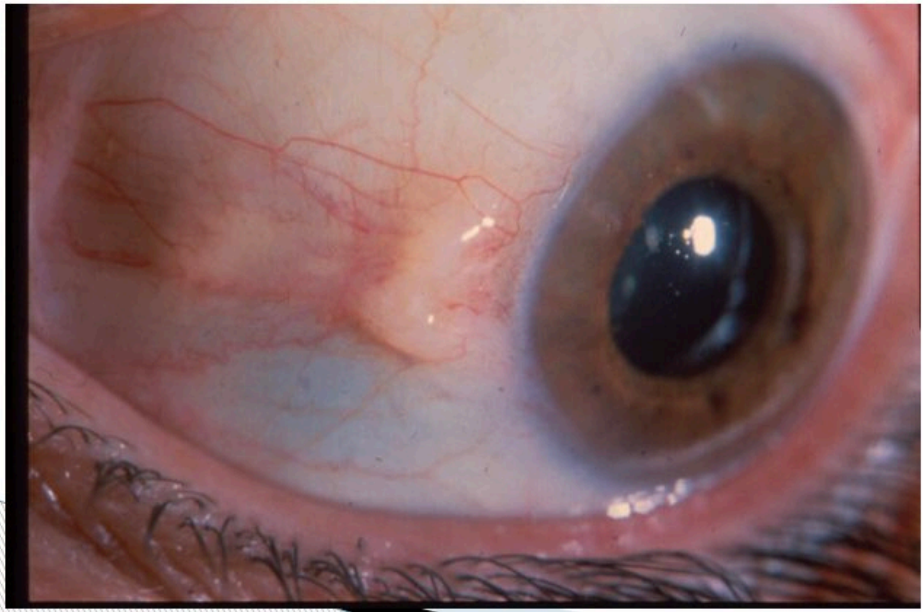
Neonatal chlamydial conjunctivitis

- Treatment is with topical tetracycline and oral erythromycin 25mg/kg body weight twice daily for 14 days.

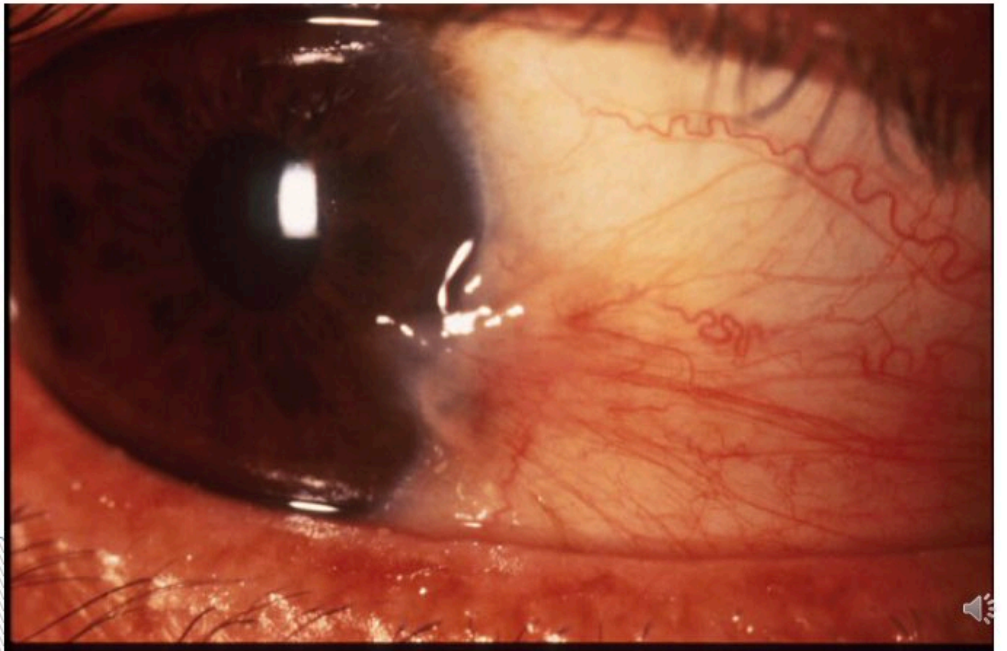
Allergic Conjunctivitis



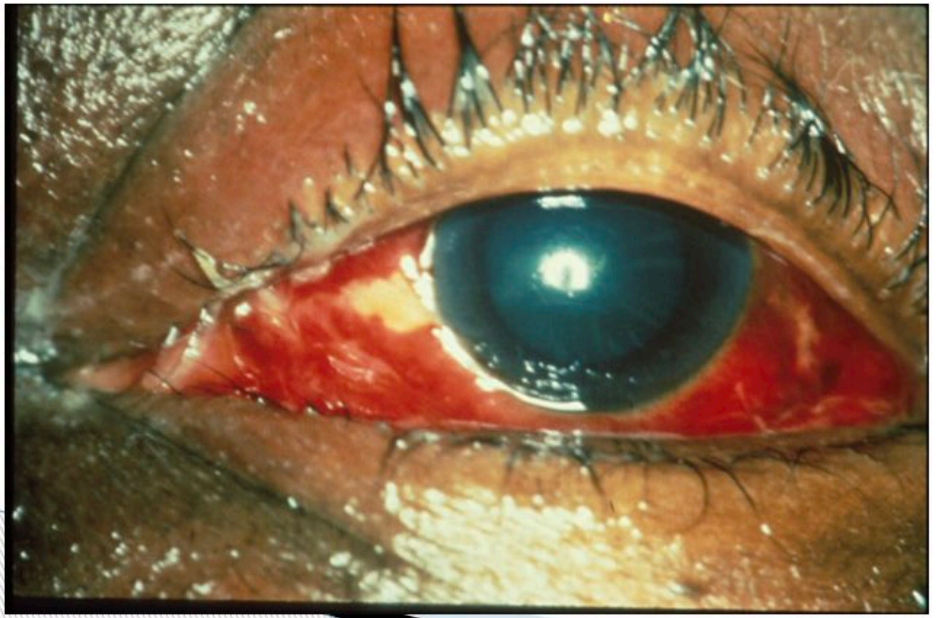
- **Pingueculum**
  - Treatment: lubricant and/or vasoconstrictor



- Pterygium



- Subconjunctival Haemorrhage :
  -

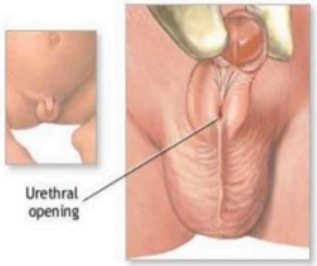


Congenital Cataract

- Lensectomy + posterior capsulotomy + anterior vitrectomy.
-

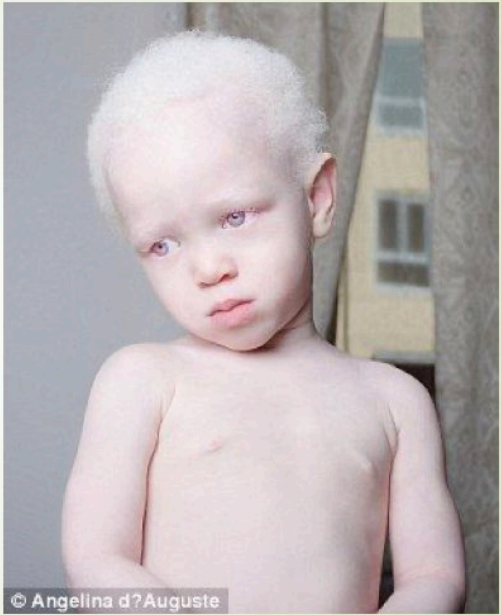
The WAGR Syndrome

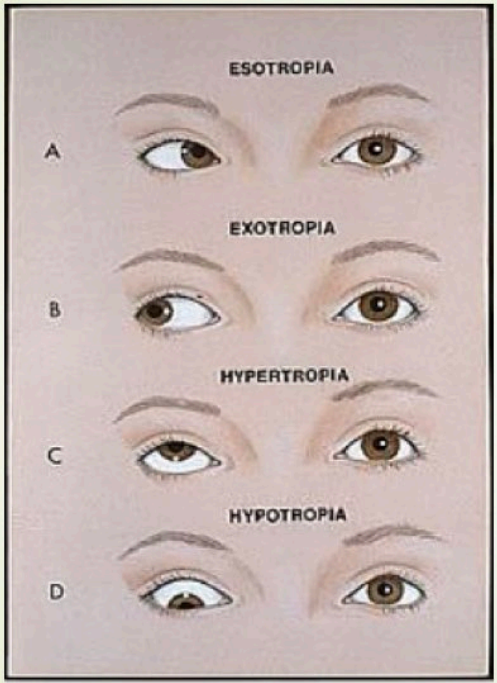
- **W**ilms' Tumor
- **A**niridia
- **G**enito-urinary Malformations
- Mental **R**etardation



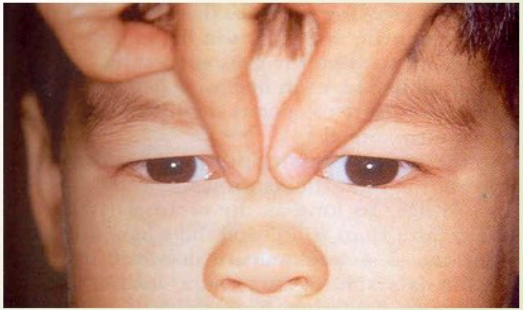
Foveal Hypoplasia

- Causes: Aniridia and Albinism

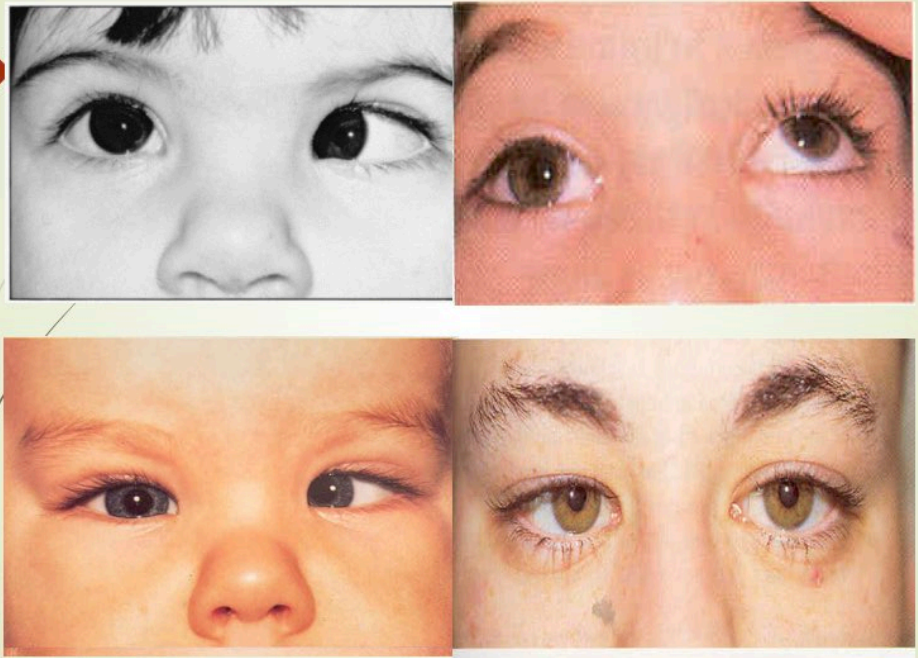



ESOTROPIA
A
EXOTROPIA
B
HYPERTROPIA
C
HYPOTROPIA
D

- **Pseudostrabismus**



Orthotropia



Hirschberg's test

Amount of deviation: note location of corneal light reflex

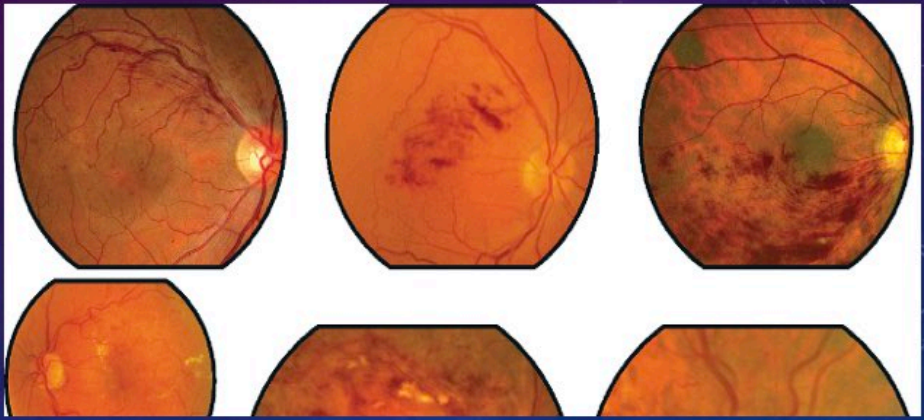
1 mm = 7° or 15Δ

Reflex at border of pupil = 15°

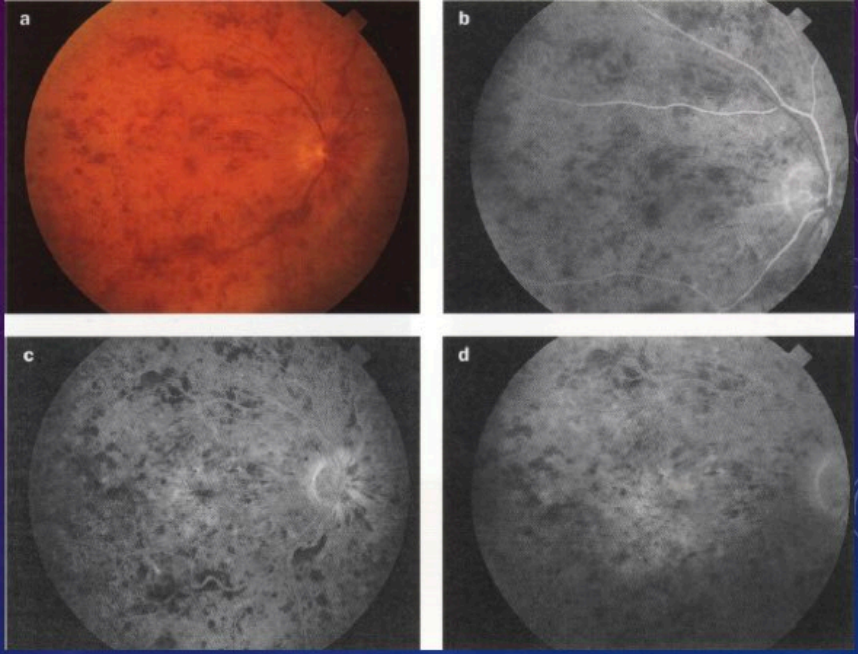
Reflex at limbus = 45°

Hirschberg light Test

- Used to test tropia but not phoria.
- It is performed by shining a light in the person's eyes and observing the light reflection from the corneas.
- Nasal corneal light reflex: exotropia
- Temporal corneal light reflex: esotropia
- Inferior corneal light reflex: hypertropia
- Superior corneal light reflex: hypotropia

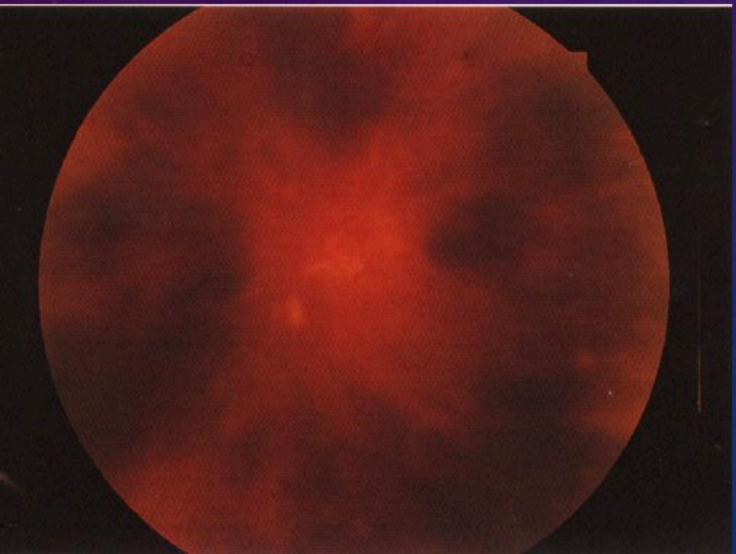


NON-ISCHAEMIC CENTRAL RETINAL VEIN OCCLUSION

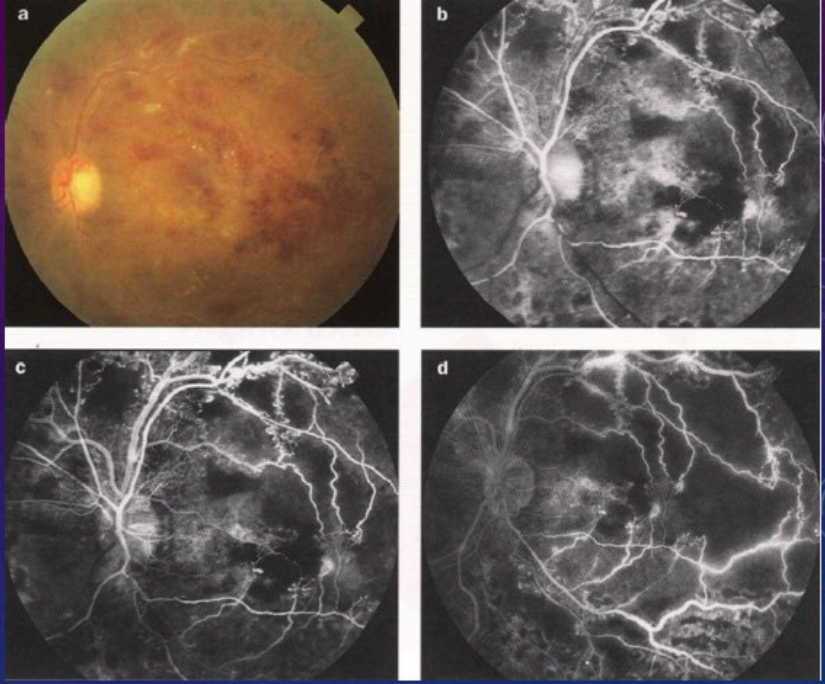


FLUORESCEIN ANGIOGRAM OF NON-ISCHAEMIC CENTRAL RETINAL VEIN OCCLUSION SHOWING CYSTOID MACULAR OEDEMA BUT GOOD PERFUSION

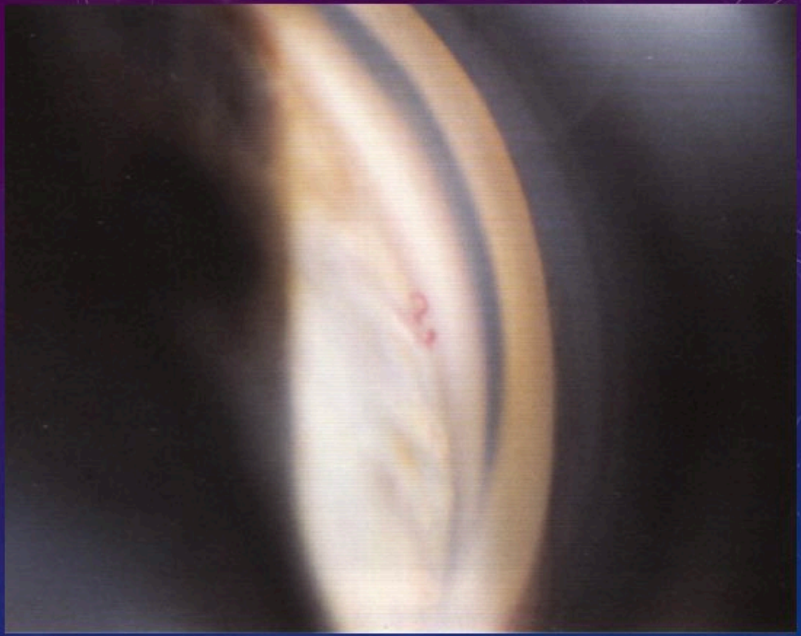
ISCHEMIC CRVO:



- Afferent papillary defect, more hemorrhages and hard exudates(Stormy appearance) with more severe optic disc swelling



FLUORESCEIN ANGIOGRAM OF LSCHAEMIC CENTRAL RETINAL VEIN OCCLUSION SHOWING EXTENSIVE AREAS OF CAPILLARY NON-PERFUSION



GONIOSCOPIC APPEARANCE OF EARLY ANGLE NEOVASCULARIZATION

MANAGEMENT

- Macular edema:
  - Anti-VEGF
  - Steroids
  - Argon laser
  - Vitrectomy in resistant cases
- Neovascularizations:
  - Panretinal Photocoagulation
  - Vitrectomy for advanced stage
  - Specific glaucoma treatment for NVG