

# Definition

- Ocular trauma is defined as the result of mechanical, electrical, thermal or chemical energy damage to the eye.

# Epidemiology-

Globally

Incidence - 55 million ocular injuries /year

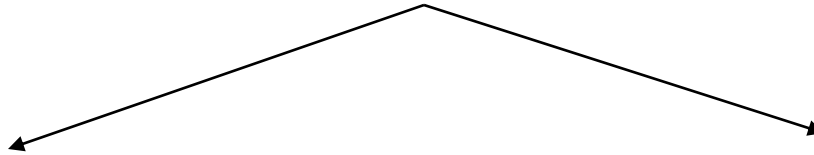
Prevalence-

Blindness due to injuries-1.6 million

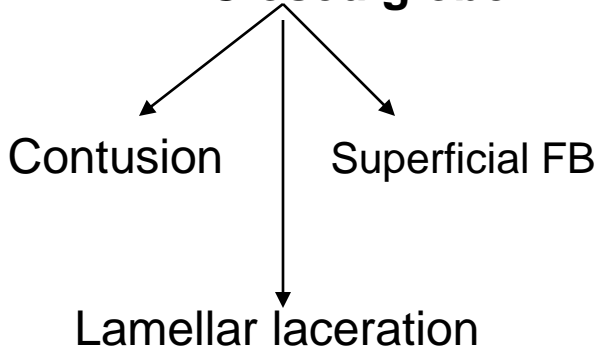
Visual impairment (V/A<3/60) - 19 million

# International Classification

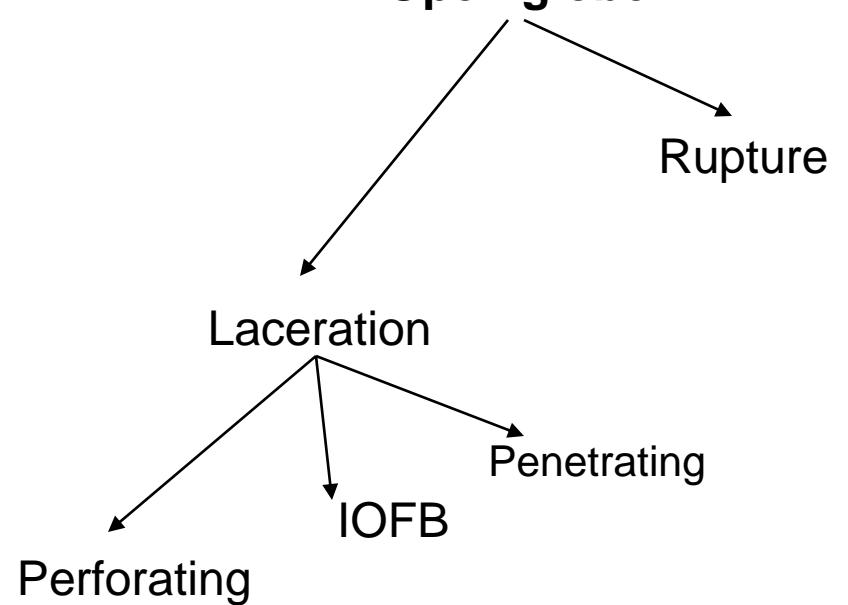
## Eye Injury



### Closed globe



### Open globe



# Closed globe Injury

Grade-Presenting V/A

1.  $\geq 20/40$
2. 20/50 to 20/100
3. 19/100 to 5/200
4. 4/200 to Light perception
5. No light perception of bright light

Pupil - RAPD Positive  
Negative

Zone – I .External bulbar conjunctiva,cornea,sclera  
II. Anterior segment including posterior lens capsule & pars plicata  
III. Posterior segment past posterior lens capsule

# Open globe Injury

Type/ Mechanism of injury-

Grade-Presenting V/A

1.  $\geq 20/40$
2. 20/50 to 20/100
3. 19/100 to 5/200
4. 4/200 to Light perception
5. No light perception of bright light

Pupil - RAPD Positive  
Negative

Zone – I. Isolated to cornea may include limbus  
II, Corneo scleral limbus to 5mm posterior in sclera  
III. Full thickness scleral injuries more than 5mm posterior to the limbus.

# Blunt Trauma- Mechanism –



Lid injuries-



Lacerations



Black Eye

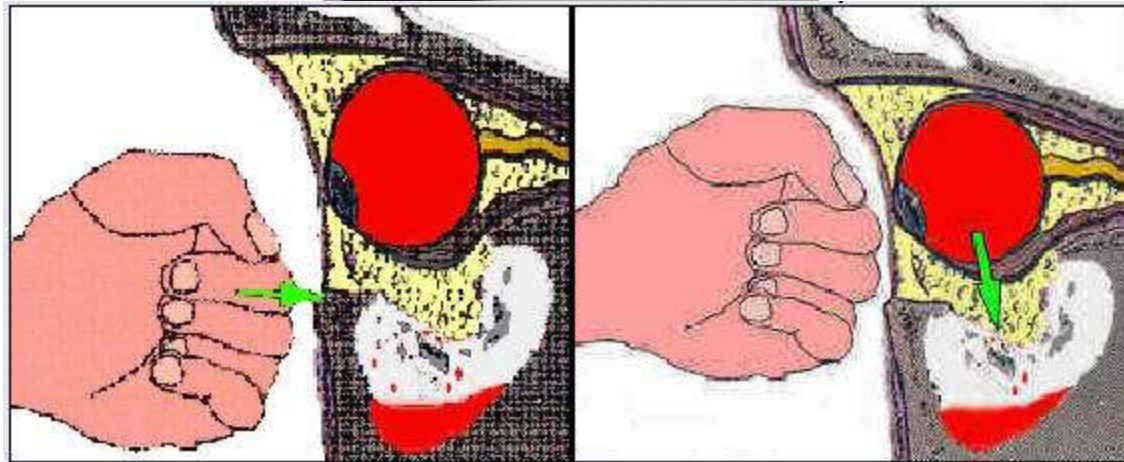
# Orbital Injuries



Orbital Emphysema



Blow out #





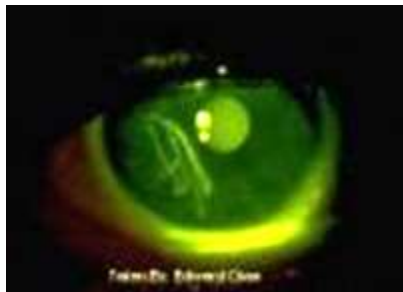
# Tear –Drop sign



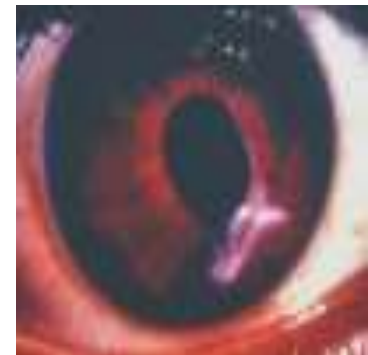
# Injuries of Conjunctiva , Cornea & Sclera



Laceration & H-age



Abrasion

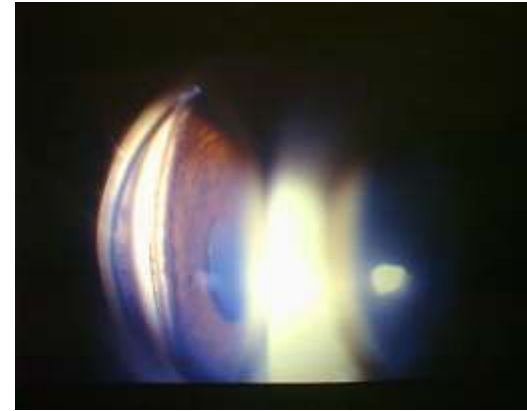


Rupture

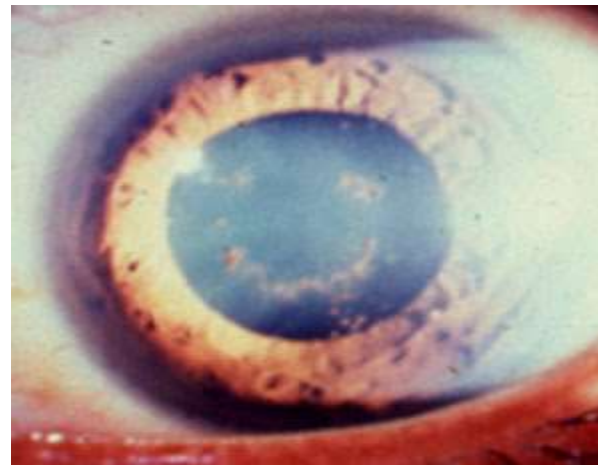
# Injury to Iris, Angle & Traumatic glaucoma



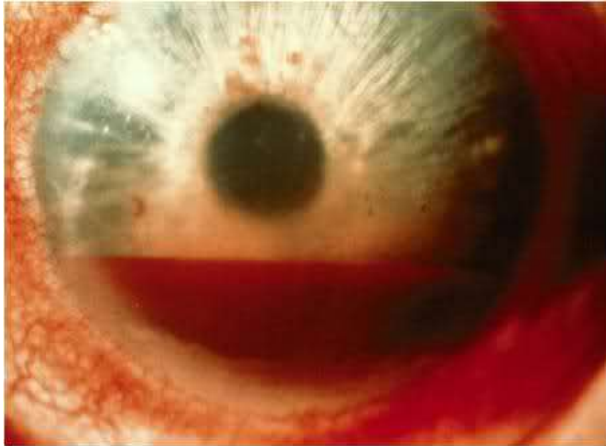
Iridodialysis



Angle recession



Vossius ring



Hyphaema



8Ball hyphaema

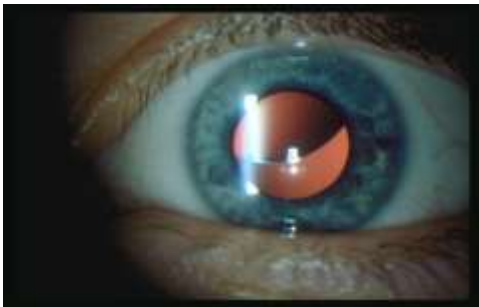


Corneal staining

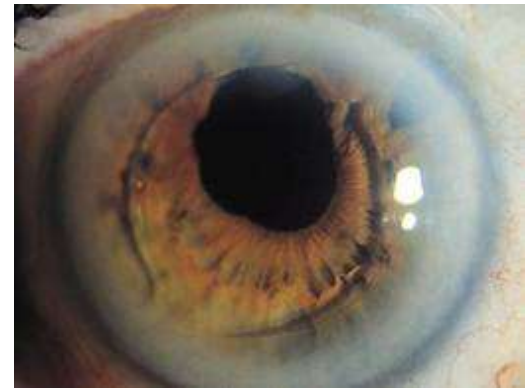
# Lens injuries



Rosette cataract

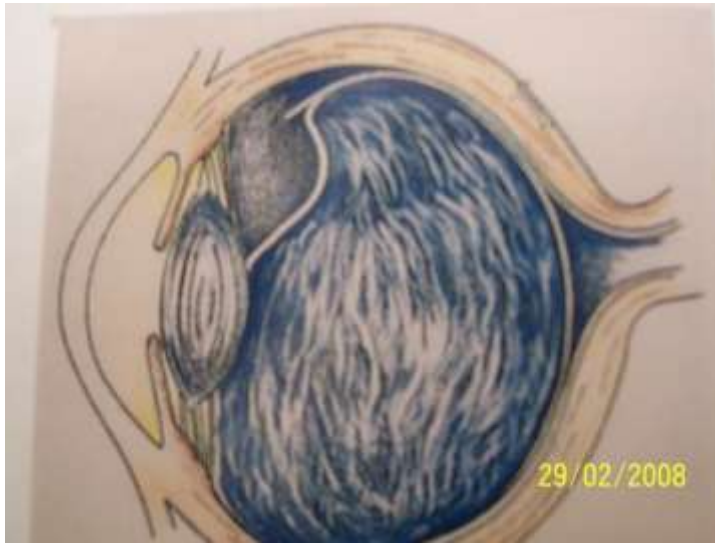


Posterior  
dislocation



Anterior dislocation

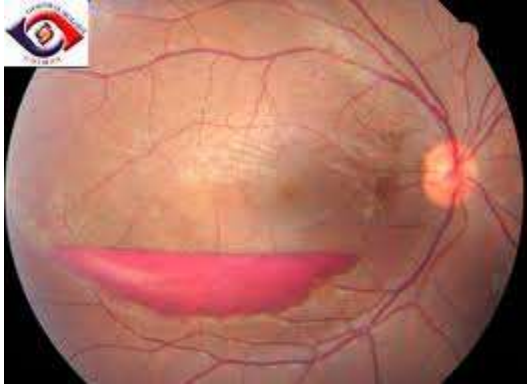
# Vitreous & Retinal injuries



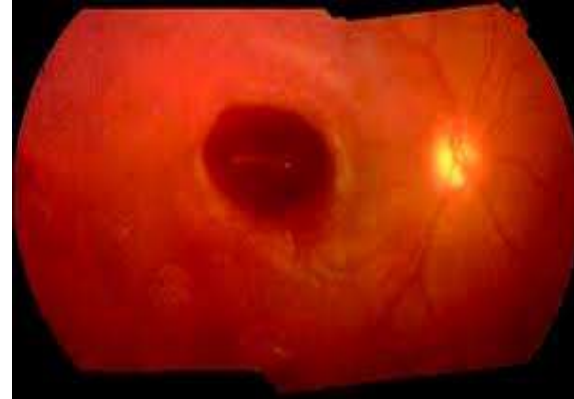
## Vitreous base detachment & Retinal Dialysis



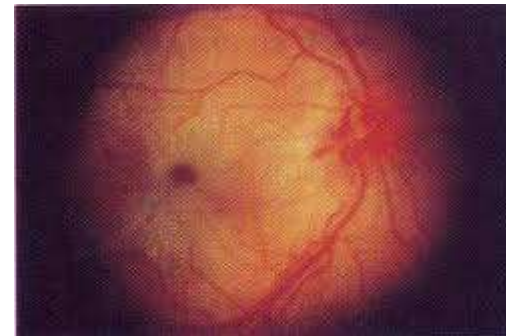
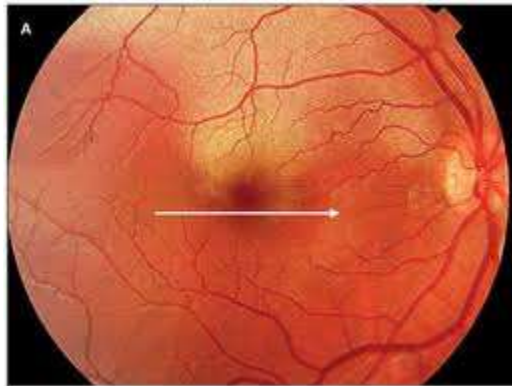
PVD



Subhyloid H-age



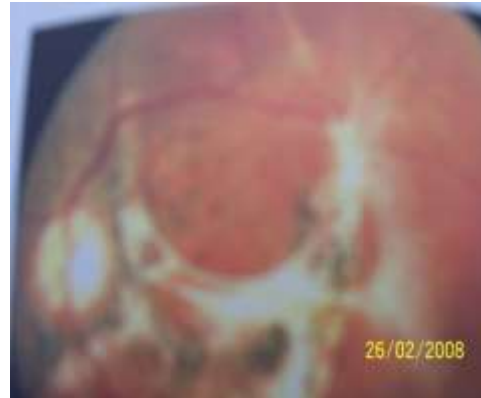
Macular H-age



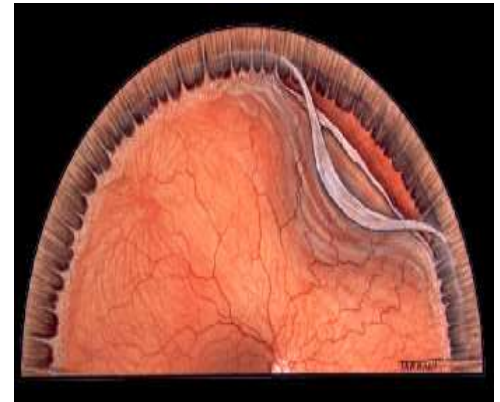
Commotio Retinae



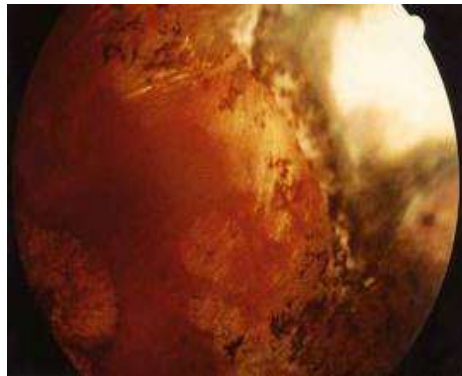
Choroidal Rupture



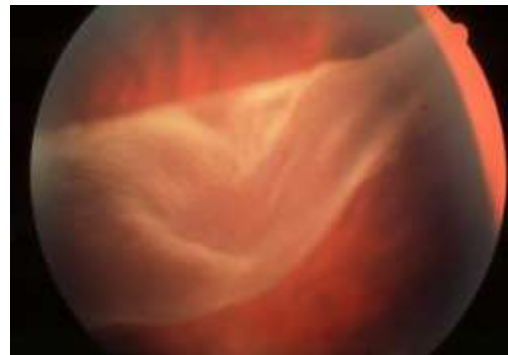
PVR



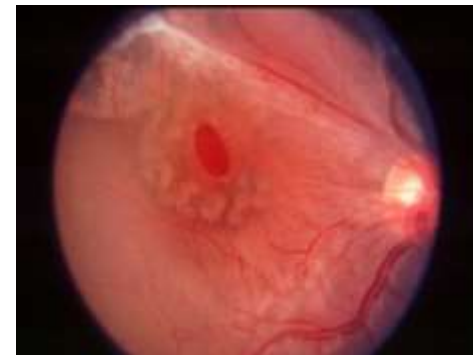
Avulsion of vitreous base & retinal dialysis



Retinitis sclopetaria

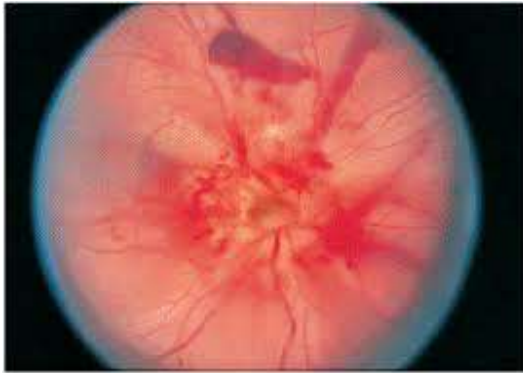


Equatorial tears



Macular hole



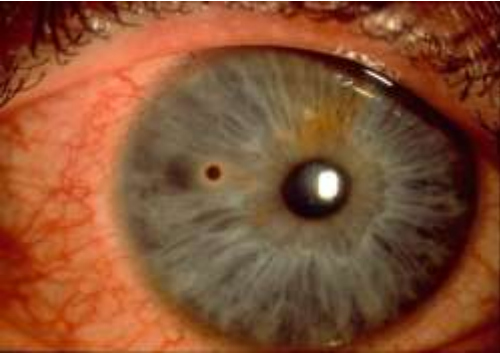


Optic nerve head avulsion



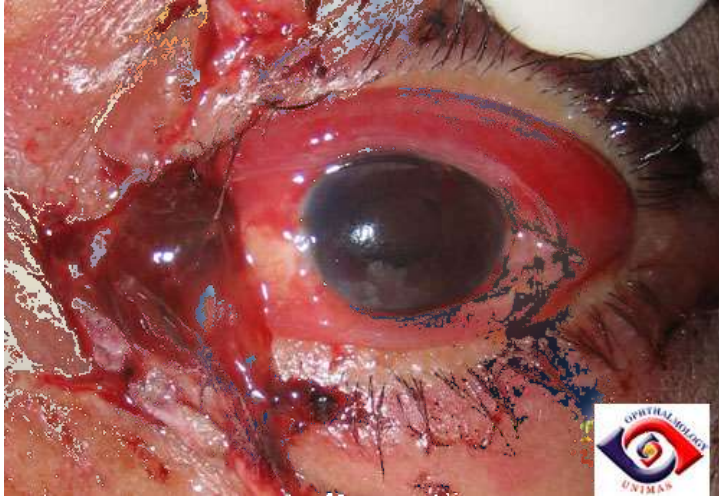
Optic atrophy

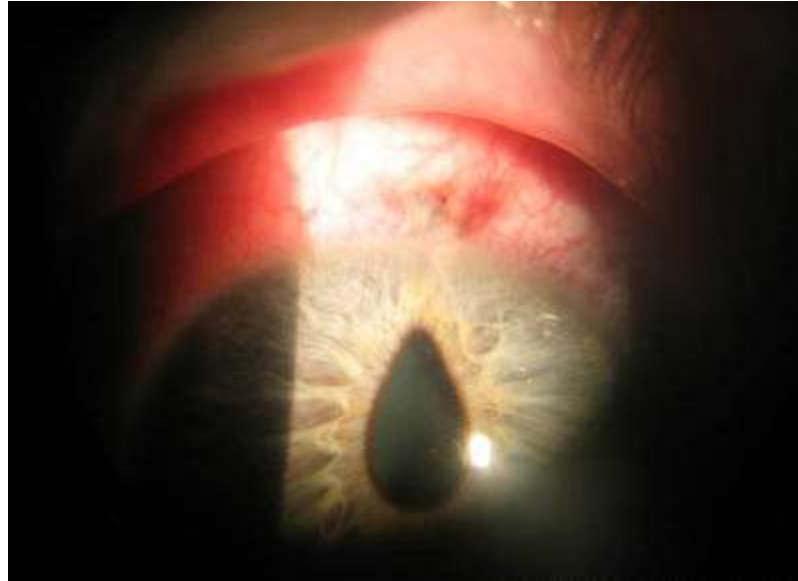
# Superficial FBs



# Penetrating Injury

# Corneal Perforation with/without iris prolapse





Peaked pupil in corneo-scleral tear

Consequences-

Post traumatic iridocyclitis

Infection

Sympathetic Ophthalmitis

Endophthalmitis



Panophthalmitis





Cataract



Penetrating wounds with retention of foreign body(RIOFB)

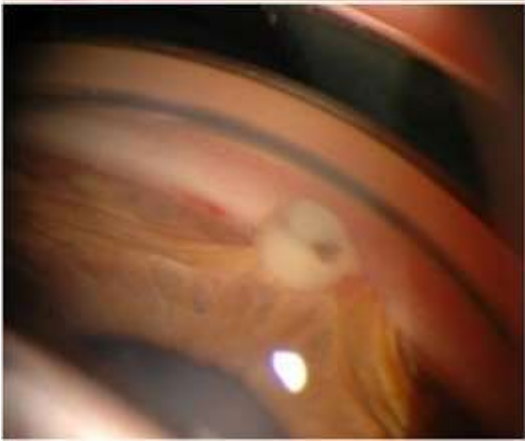
- 90% iron/steel (Industrial injuries)
- stone
- glass
- lead pellets
- Cu percussion caps

**Size & Velocity of missile is important**



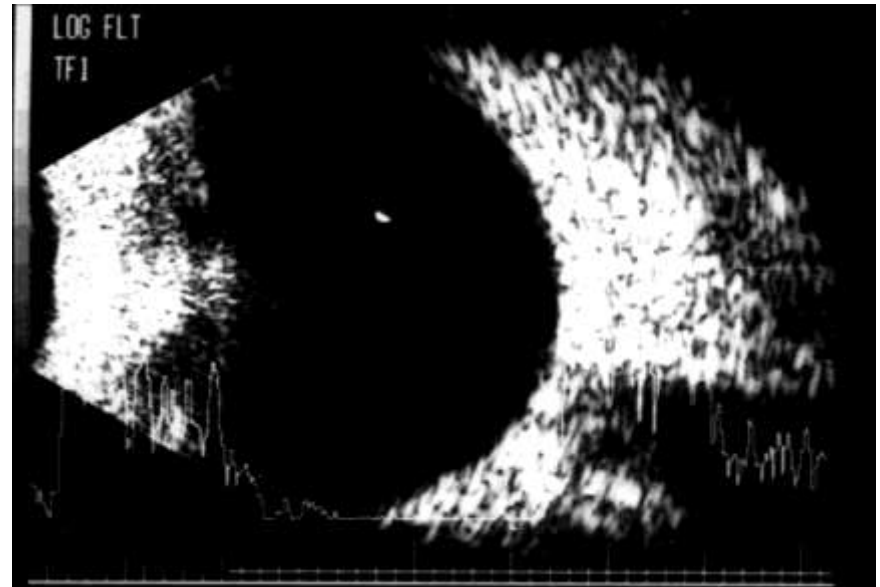
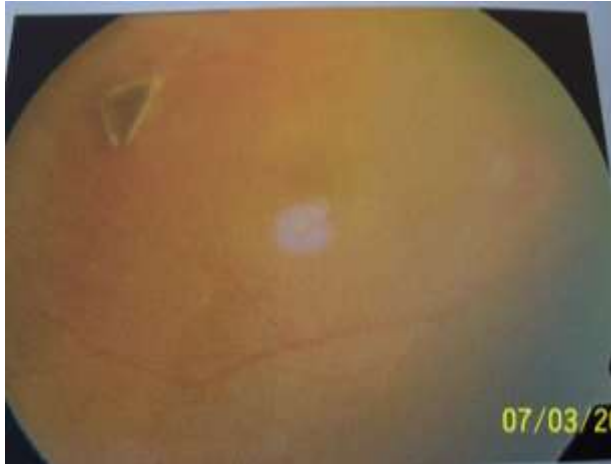
Tract in the Iris & lens



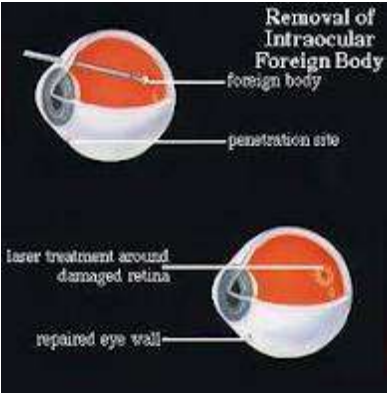


FB in the angle

# Tract in the vitreous & liquefaction of vitreous



# FB on the retina



Double perforation –FB in the orbit



Foreign body removal forceps

## **FB causes damage by:-**

Mechanical effects

Introduction of infection

Specific action on the intraocular tissues

Lodgment of FB in the Posterior Segment can cause-  
Widespread degeneration

Pigment disturbance at the macula

Concussion effects

Vitreous liquefaction

Vitreous H'ge

Fibrous proliferation in the vitreous

Retinal detachment

## **Infection-**

Small flying metallic objects are rendered sterile.

Infection occurs because of wood/stone.

Prognosis bad despite prophylactic antibiotics.



# Reaction of ocular tissues to FB-

## Non organic FB-

Inert- delayed onset iridocyclitis

Glass, plastic, porcelain

Gold, silver, platinum, titanium

Lead-Coated with carbonate → less reaction

## Fibrosis & Encapsulation

Aluminium- powdered → local reaction

Suppuration- Zn, Ni, Hg

Degeneration- Fe & Cu are widely distributed in the eye due to electrolytic dissociation.

Iron/Steel depending on ferrous content-  
**Siderosis**

Iron combines with cellular proteins → damage esp to  
epithelial cells  
→atrophy.

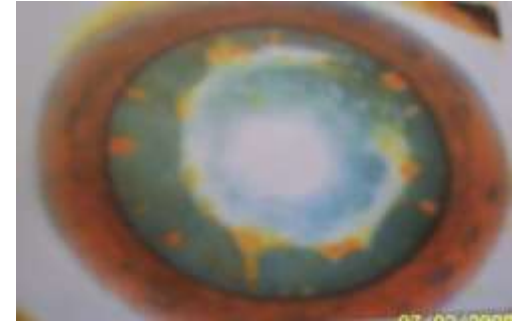
Earliest Manifestation-Deposition in the anterior lens capsular cells



Oval patches of rusty deposits of the size of dilated pupil.



Iris heterochromia



Sphincter atrophy- Mydriasis

Retinal blood vessels  
attenuation.

RP like pigmentation.

ERG- ↑ amplitude of a  
wave as

condition  
progresses b wave also ↓

ERG becomes flat

Prussian blue stain.

Copper-

Pure Cu- violent reaction → profuse fibrosis  
→ encapsulation/Suppuration → phthisis

Alloy-Chalcosis

Cu is deposited where resistance to migration occurs due to continuous membranes like DM

# Kayser Flaisher ring



# Sunflower cataract



History

Thorough exam

Wound of entry

Gonioscopy

Tracks in lens

Fundus exam

Radiography-Caldwell and Lateral view

Limbal ring/ Contact lens- Meridian

Distance from limbus

CT

MRI-wood and vascular changes detected

Contraindicated in mettalic FB

USG

Locater

Treatment –

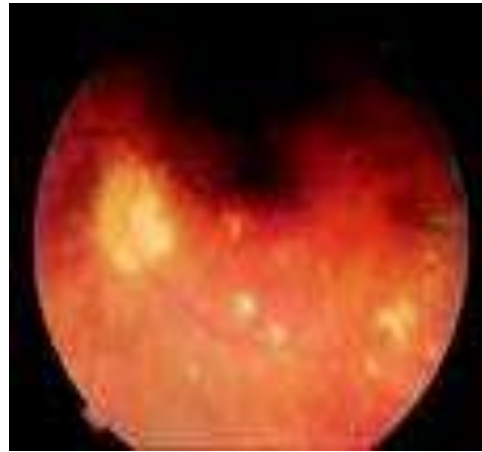
Removal

Intravitreal magnets

Lens extraction



# Sympathetic Ophthalmitis



Dalen Fuch's nodules

# Chemical Injuries Of The Eye

# Common causes of chemical injuries

Class	Compound	Sources	Comments
Alkali	Ammonia [NH <sub>4</sub> ]	Fertilizers Cleaning agents, refrigerant	Combines with water In tear film to form NH <sub>4</sub> OH Rapid deep entry
	Lye NaOH	Drain Cleaner	Rapid deep entry
	Mg(OH) <sub>2</sub>	Sparklers	Thermal&Alkali injury
	Lime Ca(OH) <sub>2</sub>	Plaster Cement White Wash	Most common cause Poor penetration Toxicity ↑ by retained particles

Acid	Sulphuric	Battery acid	Combines with water to produce charring may be associated with FB/laceration
	Sulphurous	SO <sub>2</sub> Fruit/Veg preservative Bleach Refrigerant	Penetrates more easily than other acids
	Hydro fluoric acid	Glass etching	Penetrates easily Causes most severe acid injury
	Acetic	Vinegar	Mild with lesser severe with higher concentration

## Pathophysiology-

Severity related to surface area of contact & degree of penetration.

## **Alkalies penetrate deeper**

Depending on degree of penetration there may be damage to

Corneal & conjunctival epithelium, limbal stem cells,

keratocytes,stromal nerve endings,

endothelium, lens,ciliary body and vascular endothelium

of conjunctiva,episclera,iris,and ciliary body.

The depth of ocular surface penetration & possible limbal stem cell damage can be evaluated indirectly by

Vascular ischaemia

and

Necrosis of limbal & bulbar conjunctiva.

## **Thoft classification-**

**Grade I-** Little/no loss of limbal stem cells and presents with little/no ischaemia

**Grade II-** Subtotal loss of limbal stem cells and ischaemia of less than one half of limbus

**Grade III-** Total loss of limbal stem cells with preservation of proximal conjunctival epithelium and presents with ischaemia of one half to entire limbus.

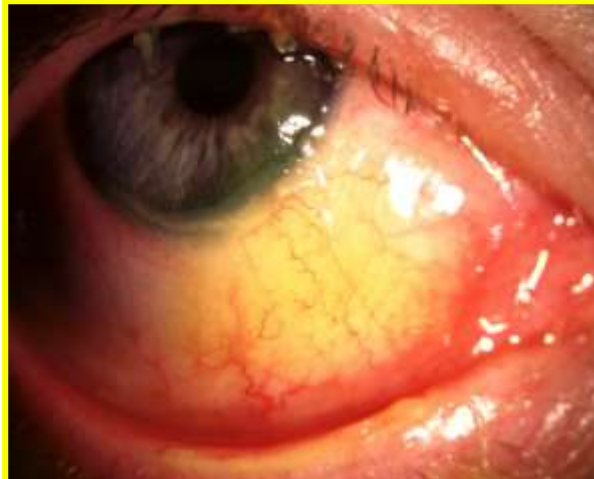
**Grade IV-** Total limbal stem cell loss as well as loss of proximal conjunctival epithelium presents with extensive damage to the entire anterior segment.

# Grading of severity of chemical injuries

## Grade I (excellent prognosis)

- Clear cornea
- Limbal ischaemia - nil

## Grade II (good prognosis)



- Cornea hazy but visible iris details
- Limbal ischaemia < 1/3

## Grade III (guarded prognosis)



- No iris details
- Limbal ischaemia - 1/3 to 1/2

## Grade IV (very poor prognosis)



- Opaque cornea
- Limbal ischaemia > 1/2



The principles guiding evaluation and management are based on addressing the following pathophysiologic mechanisms-

1. Regeneration of ocular surface epithelium and its state of differentiation
2. Stromal matrix remodelling including repair and degradation
3. Infection.

# Pathophysiologic & Clinical course-McCully

Phase	Period	Patho physiology	Evaluation	Treatment
Immediate			Extent Depth Toxicity Concentration	Thorough wash for 30 min till neutralization Removal of particles under L.A Debridement
Acute	0 -7 days	Within 0 -24 hrs Peripheral PMN Infiltration ↑IOP Re epithelization ↑MMP-9 Degradation MMP1,8 &Remodelling of stroma.	Re epithelization  IOP  Progressive inflammation	Topical- corticosteroids 2 hrly 10% Na ascorbate 2hrly 10 % Na citrate 2 hrly 1% Tetracycline ointment Qid Antiglaucoma T/t Cycloplegics Lubricants Oral-Na ascorbate 1g Qid Doxycycline 100 mg Bid Gr-IV-Conjunctival &Tenon'advancement

<p>Early repair</p>	<p>7 -21 days</p>	<p>Epithelial migration in less severe injuries</p> <p>14 -21 days maximum collagen synthesis</p> <p>Collagenolysis</p> <p>2<sup>nd</sup> wave of inflammatory cell infiltration &amp; persistence till lack of epithelization</p> <p>&amp;/stimulus from necrotic conjunctival tissue</p>	<p>Epithelization defects &amp; change in ischaemic pattern.</p>	<p>Taper topical steroids after close monitoring</p> <p>Topical progestational steroids</p> <p>NSAIDs/both 2 hrly</p> <p>Continue other T/t</p>
<p>Late repair</p>	<p>21 days – several months</p>	<p>Balance of degradation and collagen synthesis depends on epithelization</p>	<p>Healing pattern</p>	<p>Taper medical therapy after reepithelization (Gr-II)</p> <p>Perform ocular surface transplantation(Gr-III/IV)</p> <p>Perform tectonic procedures</p> <p>tissue adhesive</p> <p>Keratoplasty</p> <p>Large diameter keratoplasty</p> <p>Keratoprosthesis only if absolutely necessary.</p> <p>Treat sequelae</p>

# Revision

- What are the effects of blunt trauma on the anterior segment of the eye?

# Anterior segment complications of blunt trauma



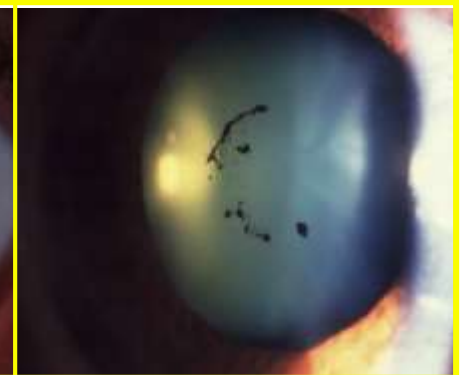
**Hyphaema**



**Sphincter tear**



**Iridodialysis**



**Vossius ring**



**Cataract**



**Lens subluxation**



**Angle recession**



**Rupture of globe**

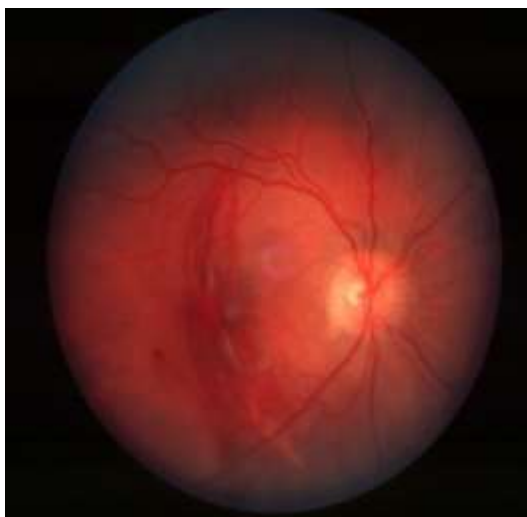
## Q-2

- What are the effects of blunt trauma on the posterior segment of the eye?

# Posterior segment complications of blunt trauma



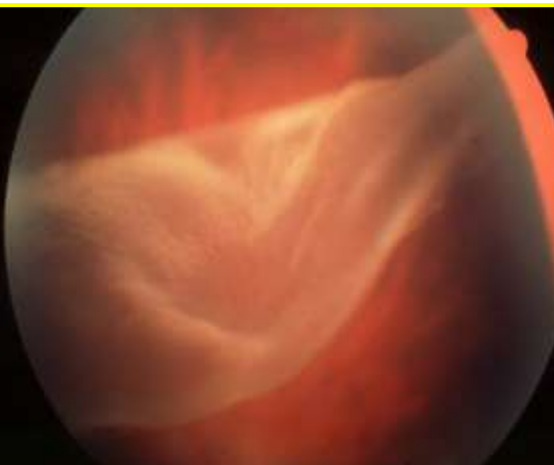
**Commotio retinae**



**Choroidal rupture and haemorrhage**



**Avulsion of vitreous base and retinal dialysis**



**Equatorial tears**



**Macular hole**



**Optic neuropathy**

## Q-3

- What are the complications of penetrating trauma?



# Complications of penetrating trauma



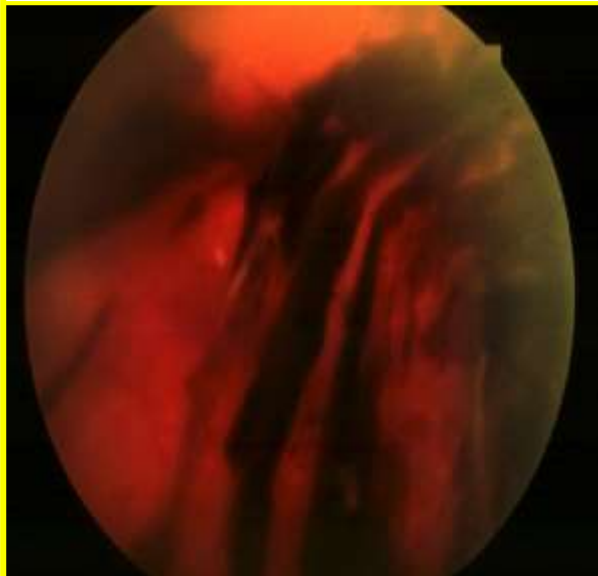
**Flat anterior chamber**



**Uveal prolapse**



**Damage to lens and iris**



**Vitreous haemorrhage**



**Tractional retinal detachment**



**Endophthalmitis**

# Q-4

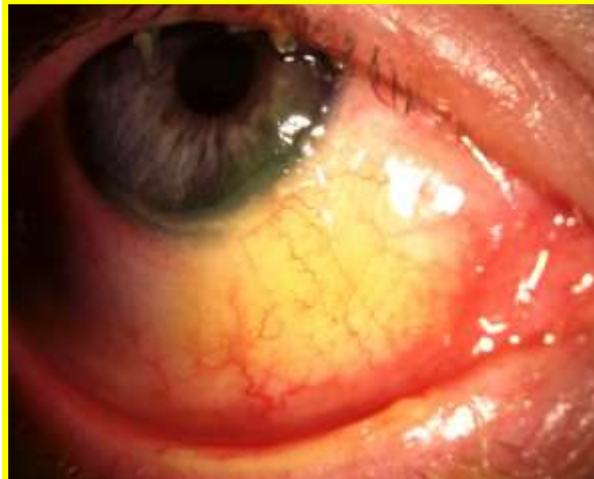
- What are the grades of chemical trauma?

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