TRAUMA

THE EYE. ADNEXAE AND THE ORBIT

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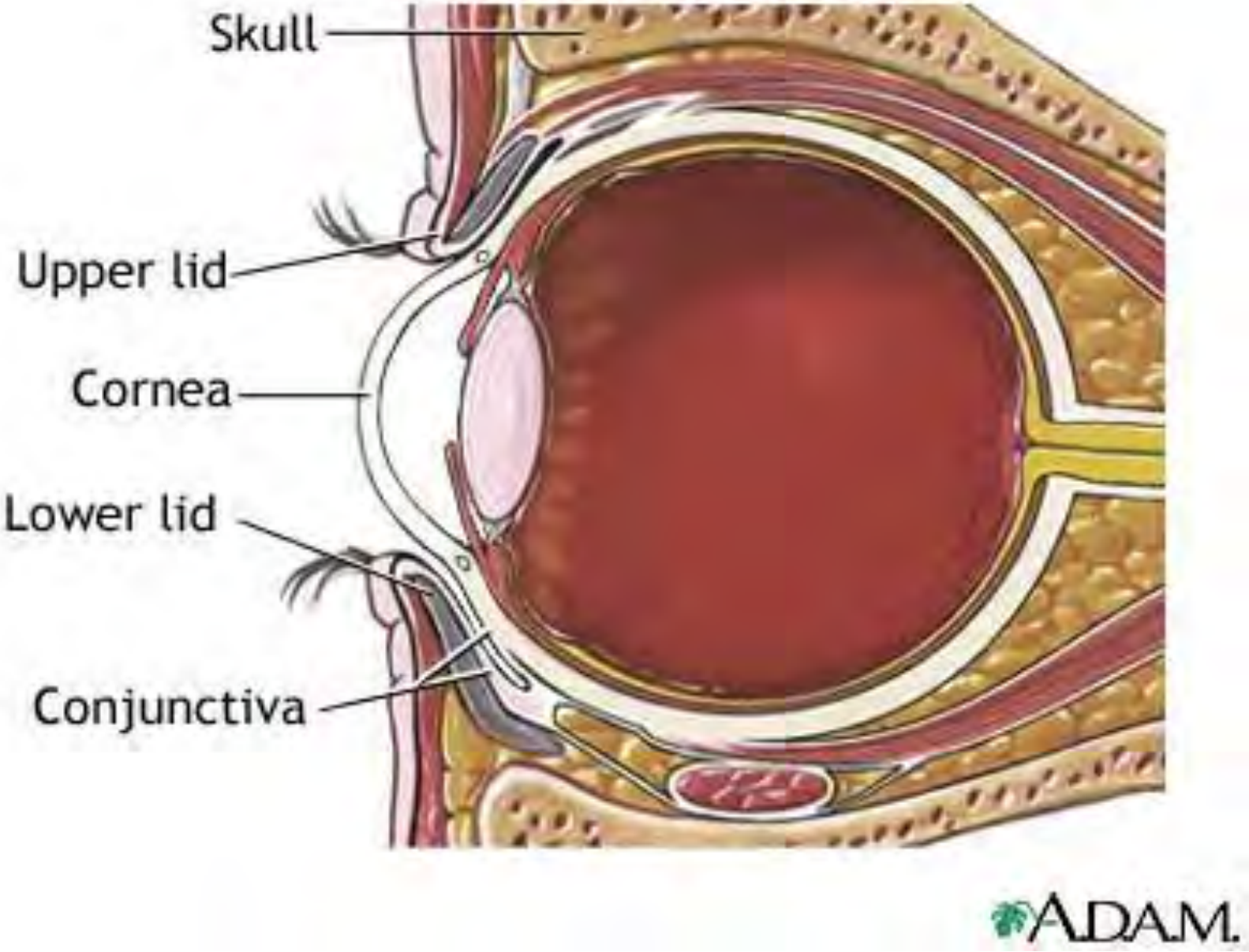
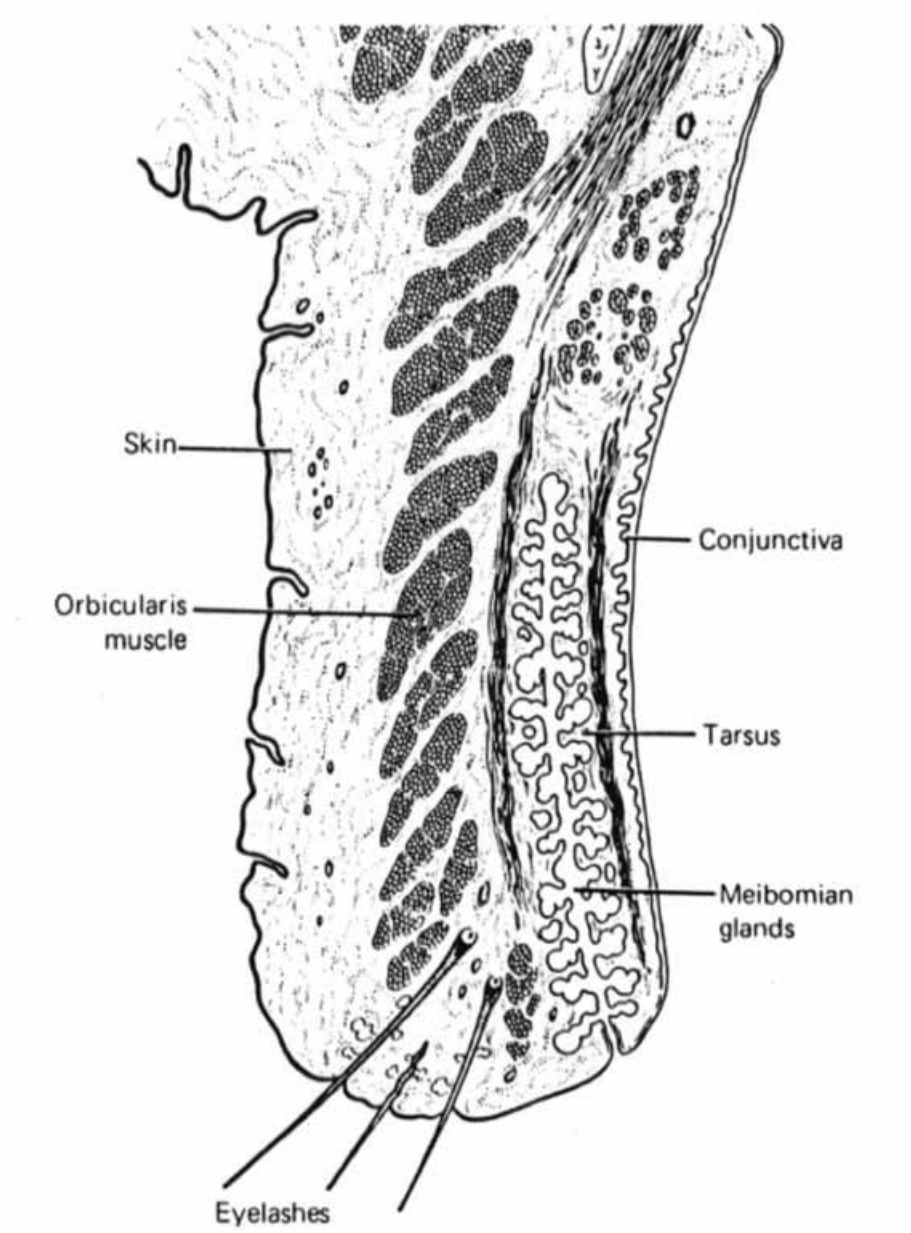
ANATOMY-OVERVIEW

- EYE
- LACRIMAL SYSTEM
- EXTRA OCULAR MUSCLES
- ADNEXAE
- ORBIT


Skull
Upper lid
Cornea
Lower lid
Conjunctiva
A.D.A.M.

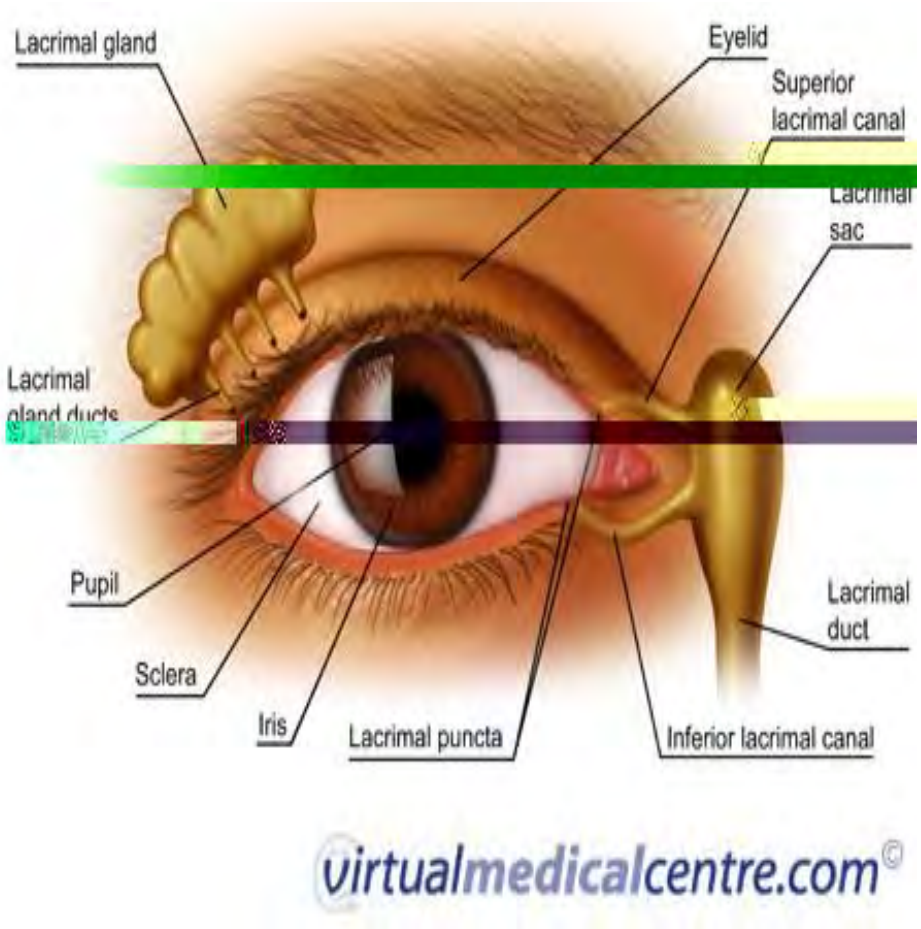
UPPER EYELID (cross-section)



EYE

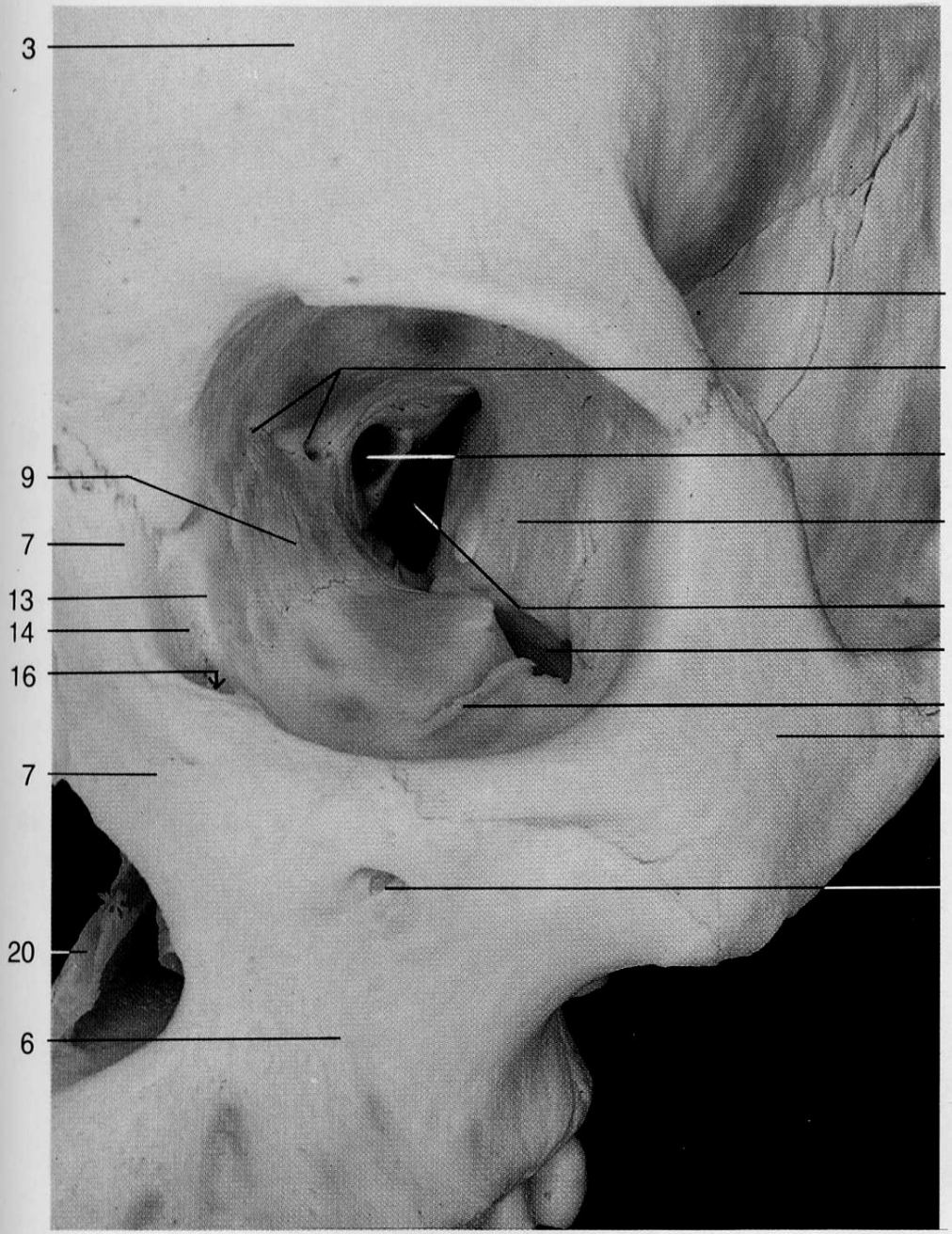
LACRIMAL DRAINAGE

- With each blink, the pretarsal orbicularis oculi compresses the ampullae,shorten the horizontal canaliculi and moves the puncta medially.

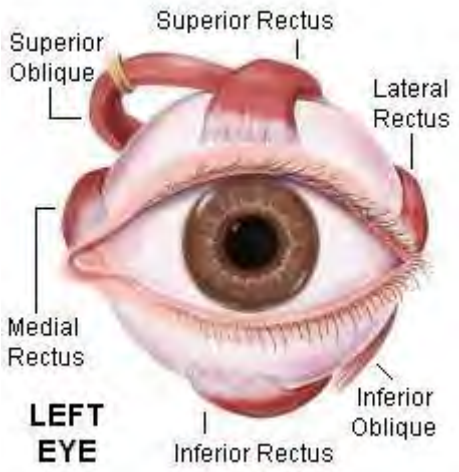


The Nasal and Lacrimal Bones

1 **Occipital bone**
2 **Temporal bone**
3 **Frontal bone**
4 Nasal spine of frontal bone
5 **Zygomatic bone**
6 **Maxilla**
7 Frontal process of maxilla
8 **Ethmoid bone**
9 Orbital plate of ethmoid bone
10 Perpendicular plate of ethmoid bone
11 Site of **lacrimal bone**
12 Lacrimal groove of lacrimal bone
13 Posterior lacrimal crest
14 Fossa for lacrimal sac
15 Lacrimal hamulus
16 Nasolacrimal canal
17 Site of **nasal bone**
18 Nasal foramina of nasal bone
19 Anterior nasal spine of maxilla
20 **Vomer**
21 Greater wing of sphenoid bone
22 Anterior and posterior ethmoidal foramina
23 Optic canal
24 Superior orbital fissure
25 Inferior orbital fissure
26 Infraorbital groove
27 Infraorbital foramen



Left orbit (anterior aspect).


Superior Rectus
Superior Oblique
Lateral Rectus
Medial Rectus
LEFT EYE
Inferior Oblique
Inferior Rectus

EYE LID TRAUMA

EYE LID TRAUMA

HAEMATOMA- BLACK EYE

- ✓Commonly due to blunt injury to the eye or forehead
- ✓Generally innocuous

EXCLUDE THE FOLLOWING

- ✓Trauma to the globe
- ✓Orbital roof fractures
- ✓Basal skull fracture which may give bilateral ring haematomas

Eyelid haematoma

Usually innocuous but exclude associated trauma to globe or orbit

Orbital roof fracture if associated with subconjunctival haemorrhage without visible posterior limit

Basal skull fracture - bilateral ring haematomas (‘panda eyes’)

EYE LID TRAUMA

LACERATION

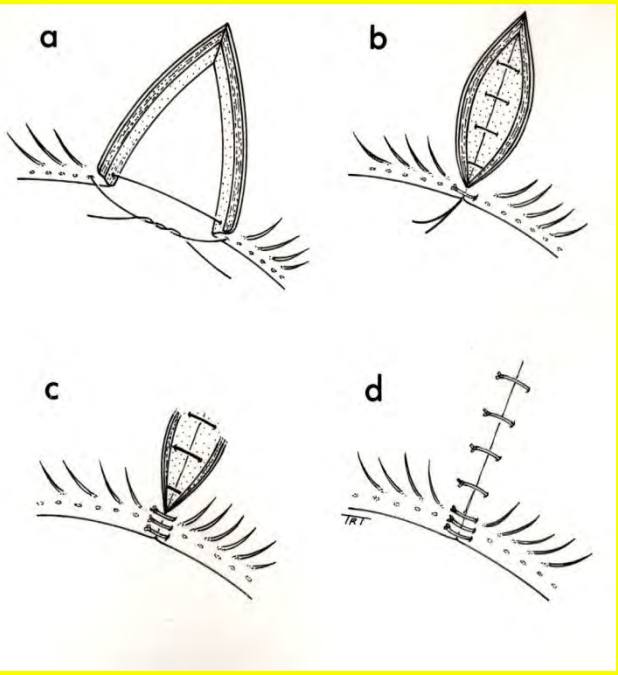
- ✓Mandates a careful exploration of the wound and the globe
- ✓Should be repaired by direct closure
- ✓Superficial lacerations parallel to lid margin- Suture with 6-0 Black Silk. ROS after 5-7 days
- ✓Lid margin lacerations invariably gape. Must be carefully sutured with perfect alignment to prevent notching
- ✓With tissue loss: Refer to Ophthalmologist
- ✓Canalicular lacerations: Refer to Ophthalmologist

Lid margin laceration

Carefully align to prevent notching

Align with 6-0 black silk suture

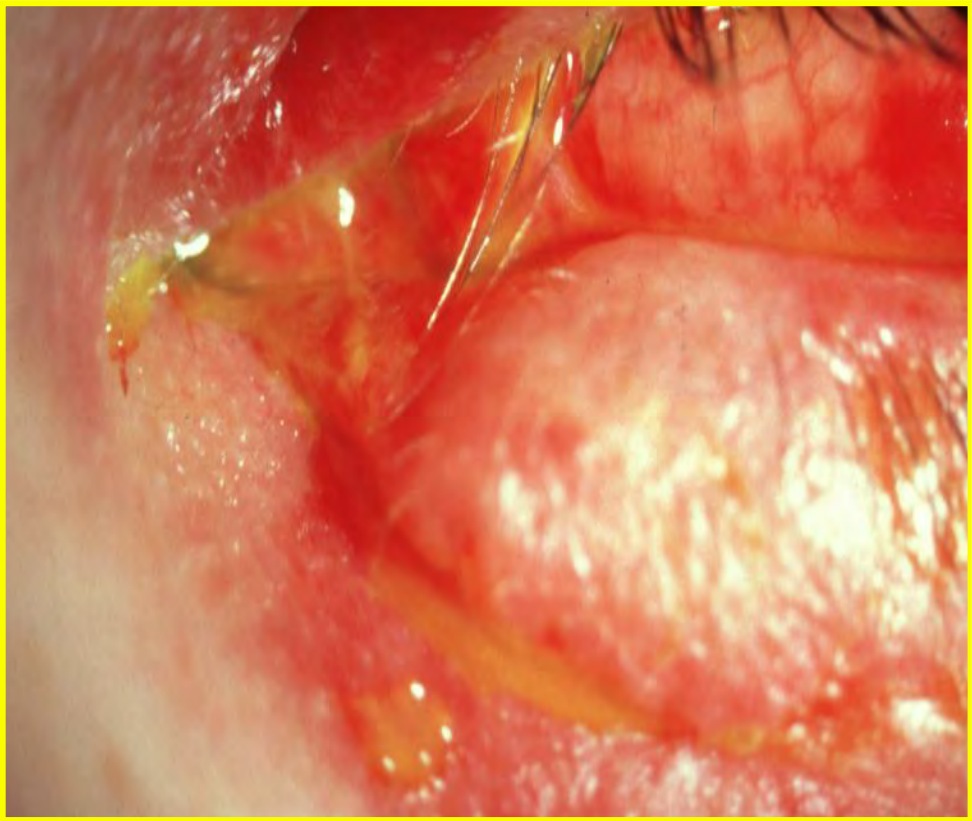
Place additional margin silk sutures



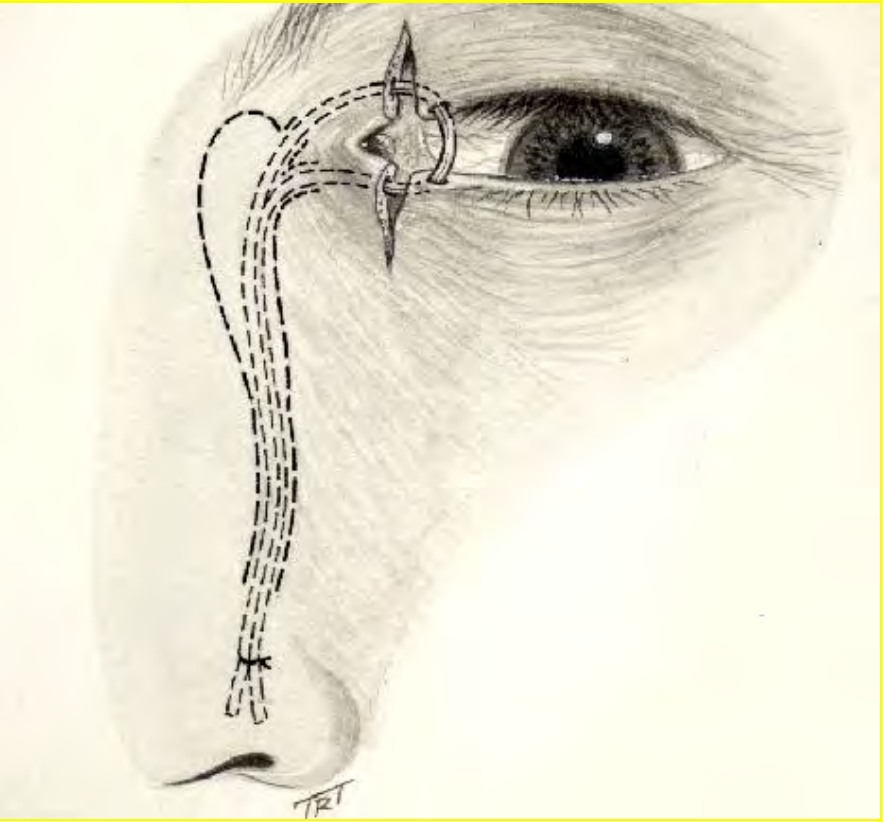
Close tarsal plate with fine absorbable suture

Close skin with multiple interrupted 6-0 black silk sutures

Canalicular laceration



- Repair within 24 hours



- Locate and approximate ends of lacera
- Bridge defect with silicone tubing
- Leave *in situ* for about 3 months

ORBITAL FRACTURES

ORBITAL FRACTURES

BLOW-OUT ORBITAL FLOOR FRACTURE

- ✓Does not involve the orbital rim
- ✓Caused by a sudden increase in the orbital pressure
- ✓Most frequently involves the floor
- ✓Occasionally involves the medial wall

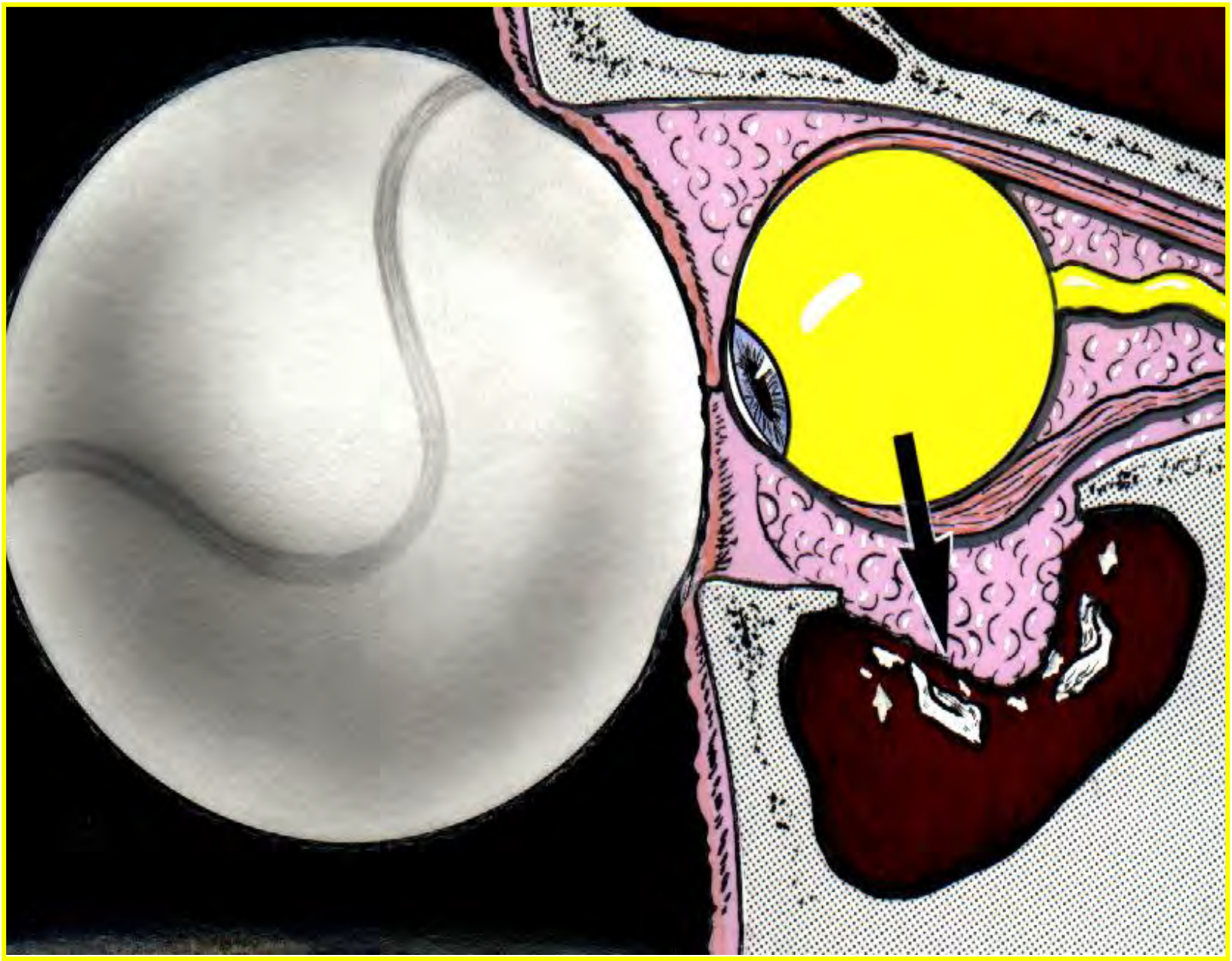
DIAGNOSIS

- ✓Periocular swelling and subcutaneous emphysema
- ✓Infraorbital anaesthesia-lower lid, cheek, side of the nose, upper teeth and gums
- ✓Double Vision(Diplopia)
- ✓ Enophthalmos

ORBITAL FRACTURES…

- ✓Ocular damage
- ✓CT Scan- Coronal Views
- ✓Hess Test- monitoring progression

Pathogenesis of orbital floor blow-out frac



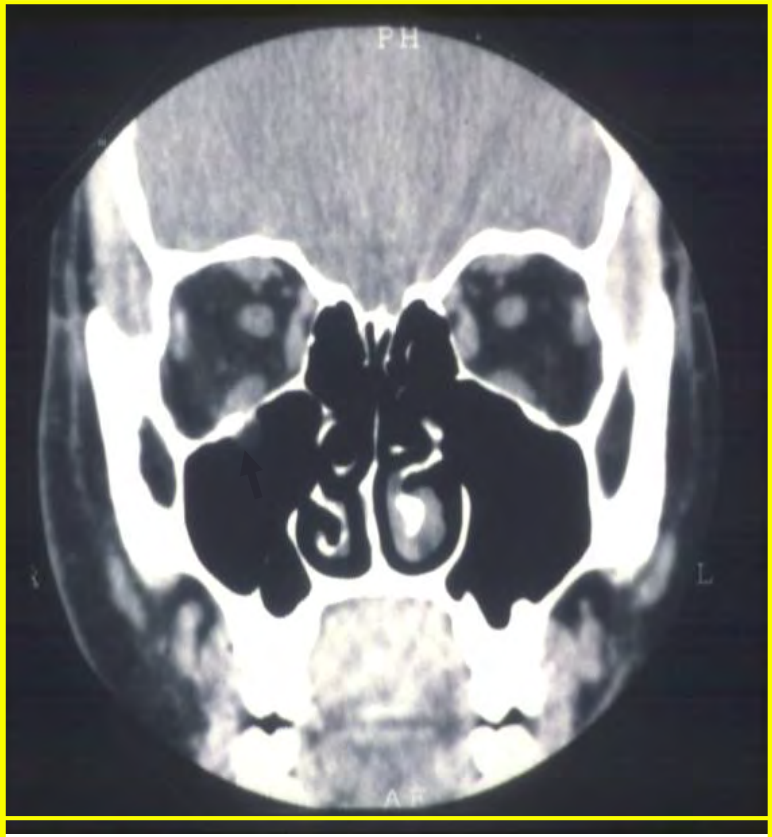
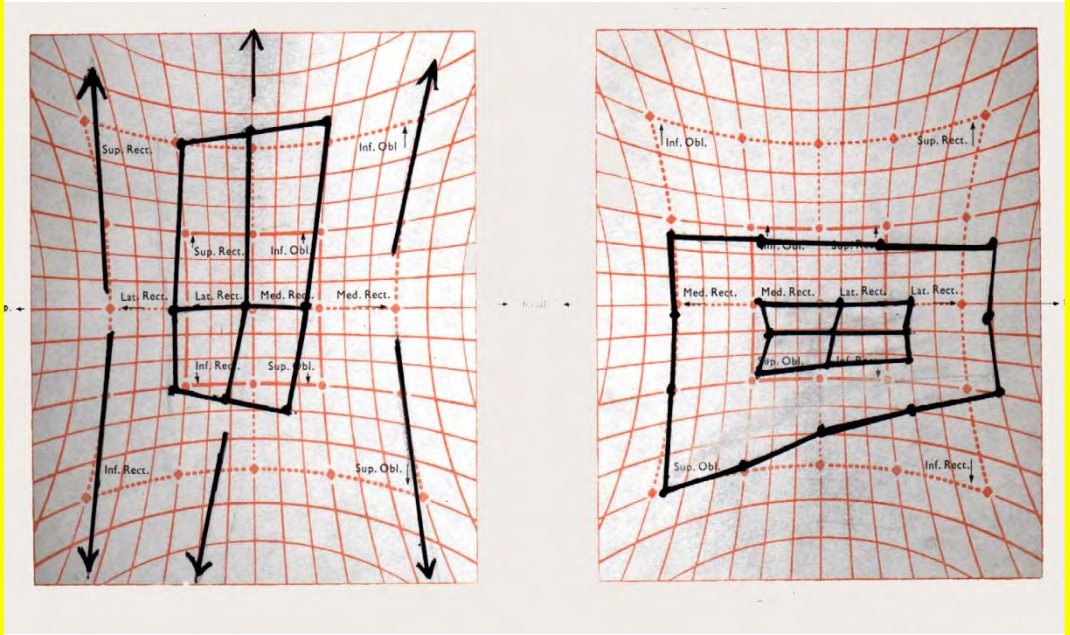
Signs of orbital floor blow-out fracture

- Periocular ecchymosis and oedema
- Infraorbital nerve anaesthesia

- Ophthalmoplegia - typically in up- and down-gaze (double diplopia)

- Enophthalmos - if severe

Investigations of orbital floor blow-out fractu

Coronal CT scan	Hess test
	
• Right blow-out fracture with ‘tear-drop’ sign	• Restriction of right upgaze and downgaze • Secondary overaction of left eye

ORBITAL FLOOR FRACTURES

- TREATMENT

✓Initial treatment: Ice packs and nasal decongestants

✓Patient not to blow nose

✓Systemic steroids for severe orbital oedema

✓Subsequent treatment aimed at preventing diplopia and unacceptable enophthalmos

ORBITAL FRACTURES

- BLOW OUT MEDIAL WALL FRACTURES

✓Signs

✓ Periorbital ecchymosis

✓Defective ocular motility in abduction and adduction

✓CT Scan shows extent of damage

✓Treatment involves releasing entrapped tissue and repair of the bony defect

Medial wall blow-out fracture

Signs

Periorbital subcutaneous emphysema

Ophthalmoplegia - adduction and abduc
if medial rectus muscle is entrapped

Treatment

- Release of entrapped tissue
- Repair of bony defect

ORBITAL FRACTURES

- ROOF FRACTURES

✓Rarely encountered in Ophthalmology

✓Caused by falling on a sharp object

✓Blow to the brow or forehead

✓Presentation

✓Haematoma of the upper eye lid

✓Periocular ecchymosis develops after a few hours

✓May later spread to the fellow eye

ORBITAL FRACTURES

- ROOF FRACTURES

✓Signs: Inferior or axial displacement of the globe

✓Pulsation of the eye with large fractures

✓Treatment:

✓Always exclude CSF leak

✓Reconstructive surgery for large fractures

Fig. 21.8 Pre-operative image of a patient with a roof fracture caused by a ball-point pen
(Courtesy of R Bates)

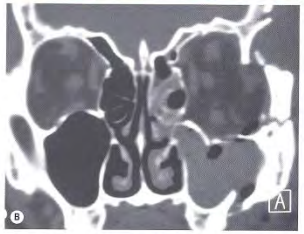


Fig. 21.9 Lateral wall fracture. **(A)** Severe facial trauma; **(B)** CT axial view shows a left lateral wall fracture
(Courtesy of A Pearson)

a. Determination of the nature and extent of any life-threatening problems.
b. History of the injury, including the circumstances, timing and likely object.
c. Thorough examination of the eyes and the orbits.

2. **Special investigations**
   a. ***Plain radiographs*** may be taken when a foreign body is suspected (Fig. 21.10A).
   b. ***CT*** is superior to plain radiography in the detection and localization of intraocular foreign bodies (Fig. 21.10B). It is also of value in determining the integrity of intracranial, facial and intraocular structures.
   c. ***MR*** is more accurate than CT in the detection and assessment of injuries of the globe itself such as an occult posterior rupture, though not for bony injury. MRI should never be performed if the presence of a ferrous metallic foreign body is suspected.
   d. ***US*** may be useful in the detection of intraocular foreign bodies (Fig. 21.10C), globe rupture,

LATERAL WALL FRACTURES

- ✓Rarely encountered
- ✓Usually associated with extensive facial damage

TRAUMA TO THE GLOBE

TRAUMA TO THE GLOBE

DEFINITIONS

- ✓Closed injury: Due to blunt trauma. C/scleral wall is intact
- ✓Open injury: Full thickness wound of the C/Scleral wall
- ✓Contusion:
- ✓Closed injury resulting from blunt trauma
- ✓Rupture: Full thickness wound caused by blunt trauma
- ✓Laceration: Full thickness defect produced by a tearing injury
- ✓Lamellar laceration:Partial thickness laceration
- ✓Penetrating Injury:Single full thickness wound with no exit wound

TRAUMA TO THE GLOBE

- ✓Perforation: Two full thickness wounds, one entry and one exit.
- PRINCIPLES OF EVALUATION
- ✓Determine the nature and extent of life threatening problems
- ✓History of injury, including circumstances, time and likely object
- ✓Thorough examination of the eyes and the orbits

TRAUMA TO THE GLOBE

- SPECIAL INVESTIGATIONS

✓Plain Radiographs when suspecting a FB

✓CT Scan: Superior to Xrays in detection and localization of FB's. Also valuable in determining the integrity of the intracranial, facial and intraocular structures

✓MR: More accurate than CT in detection and assessment of injuries of the globe. Not to be performed when a ferrous metallic FB is suspected

✓US may be useful in detection of IOFB, globe rupture and retinal detachment

✓Avoid pressure on a ruptured globe

BLUNT TRAUMA

BLUNT TRAUMA

- COMMON CAUSES
- ✓Balls: Squash, soccer, cricket
- ✓Elastic laggage straps
- ✓Sjambok
- ✓Champagne Corks
- PATHOGENESIS
- ✓Antero-posterior compression with simultaneous expansion in the equatorial plane
- ✓Damage can occur at a distant site
- ✓Commonly results in long term effects

BLUNT TRAUMA

- CORNEAL
- Corneal abrasions stain with fluorescein. Treat with Eye pad and Chloromycetin Ointment
- Acute Corneal Oedema: Usually clears spontaneously
- Tears in the Descemet Membrane

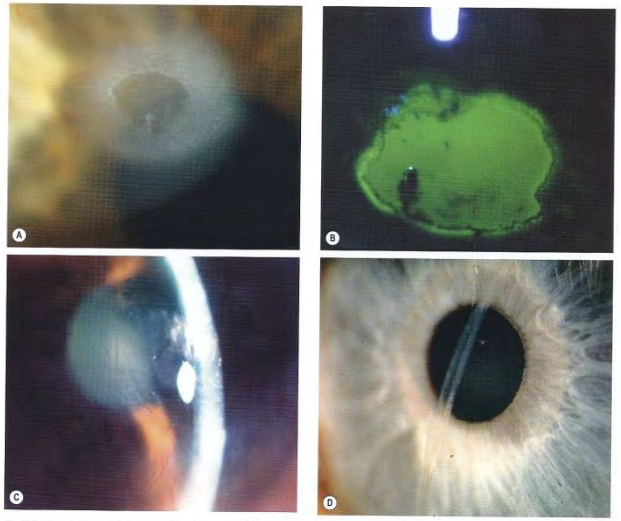


Fig. 21.12 Corneal complications of blunt trauma. **(A)** Small unstained corneal abrasion; **(B)** large abrasion stained with fluorescein; **(C)** stromal oedema and folds in Descemet membrane; **(D)** tears in Descemet membrane
(Courtesy of R Curtis – fig. D)

al and/or func-

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lens by severe
t imprinting of
Transient miosis
denced by the
the size of the
4A). Damage to
natic mydriasis,
nent; the pupil
both light and

BLUNT TRAUMA

- HYPHAEMA

✓Haemorrhage into the Anterior Chamber

✓Bleeding from the iris or the ciliary body

✓Treatment: Aimed at prevent secondary bleeding and high IOP

✓Limit mobility

✓Anti glaucoma medication if IOP is high

✓Steroid eye drops for inflammation

✓Mydriatic eye drops to prevent posterior synechiae

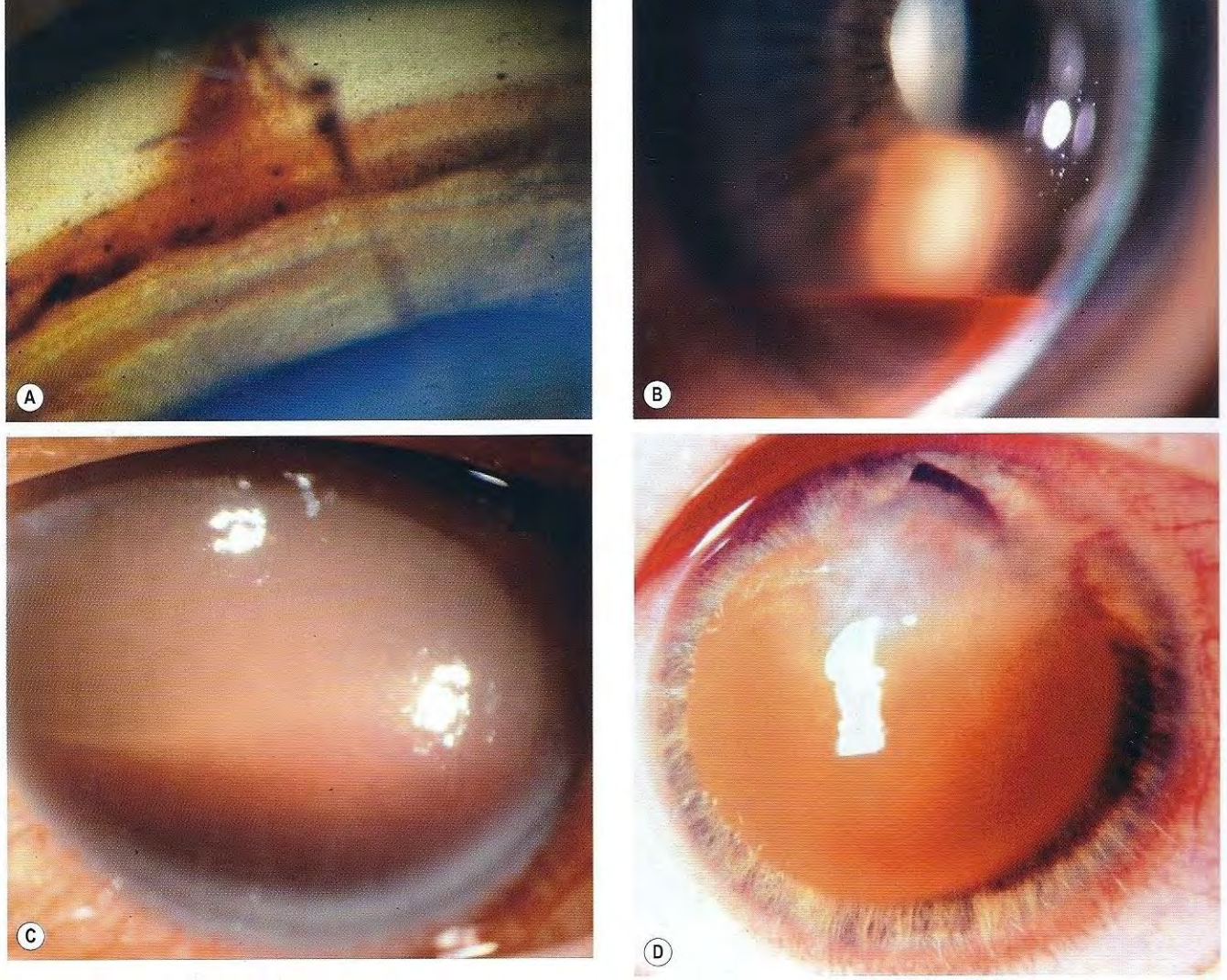
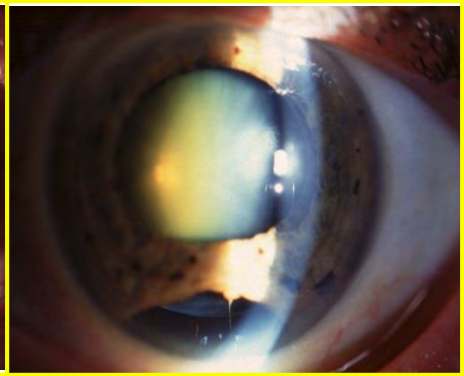
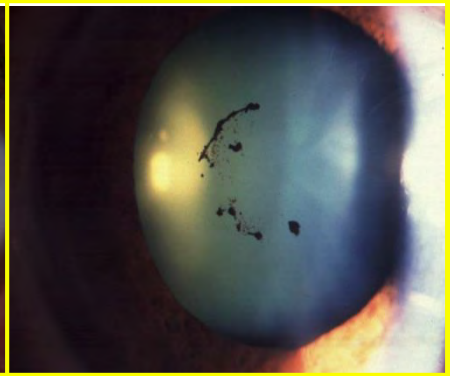
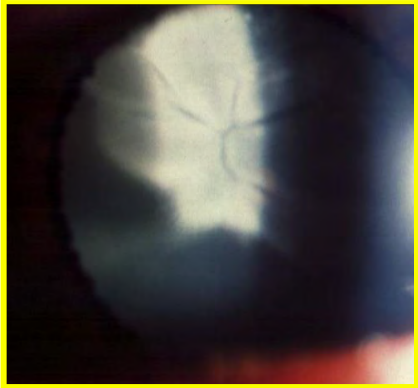
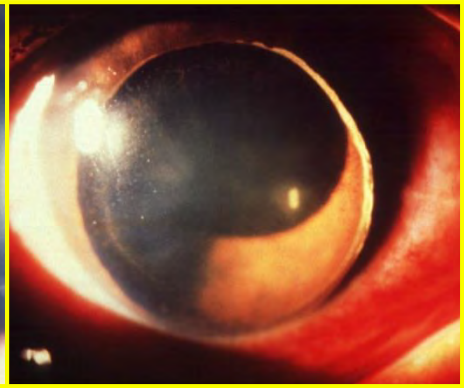
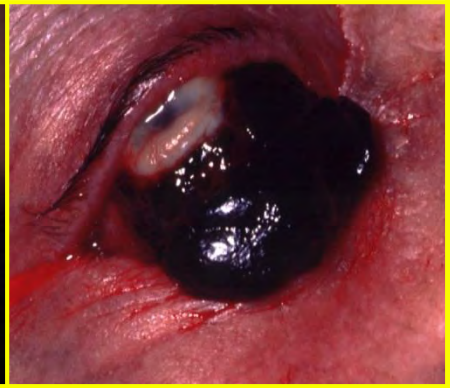


Fig. 21.13 Traumatic hyphaema. **(A)** Bleeding from the ciliary body; **(B)** small hyphaema; **(C)** total hyphaema; **(D)** corneal blood staining

(Courtesy of R Curtis – fig. A; Krachmer, Mannis and Holland, from Cornea, Mosby 2005 – fig. D)

carefully, particu-
trauma. Elevation

Anterior segment complications of blunt trau

			
Hyphaema	Sphincter tear	Iridodialysis	Vossius ring
			
Cataract	Lens subluxation	Angle recession	Rupture of globe

BLUNT TRAUMA

- PUPIL

✓Transient Miosis

✓Vossius Ring

✓Traumatic mydriasis- temporary or permanent

✓Sphincter radial tears

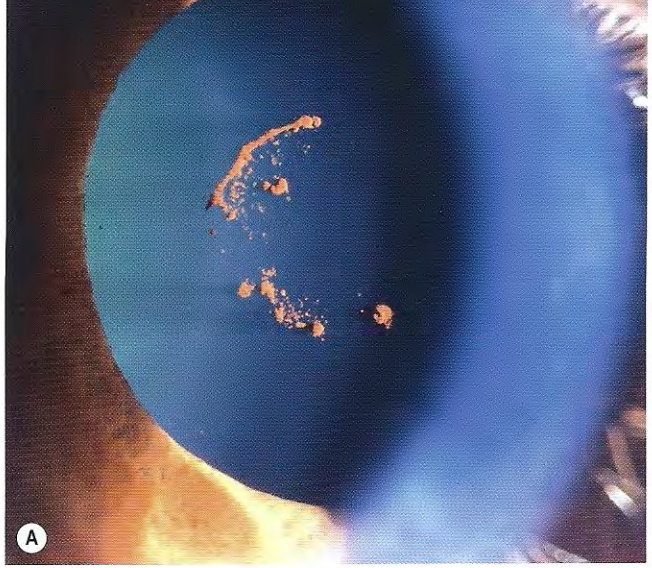
✓Iridodialysis: Pupil is D shaped

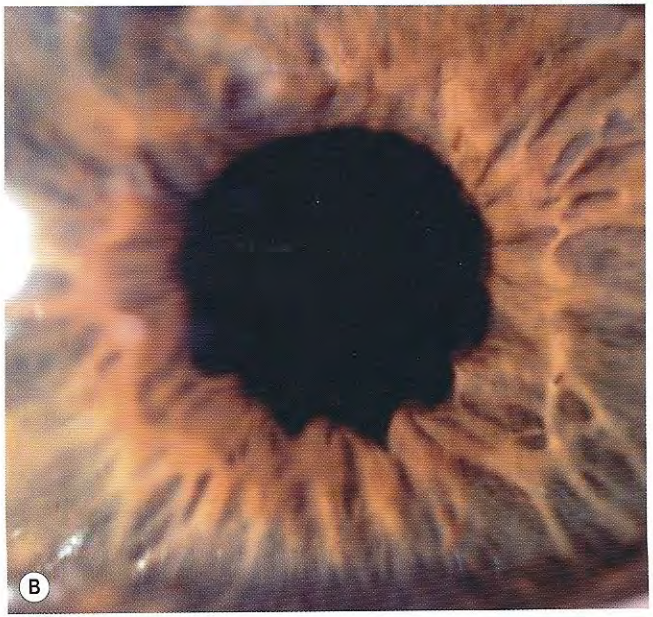
- IOP

✓May be high due to hyphaema or inflammation

✓May be low due to ciliary shut-down

(B) radial sphincter tears, (C) iridodialysis

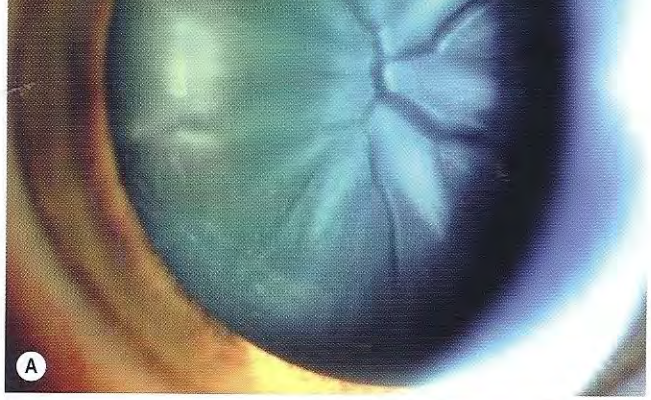


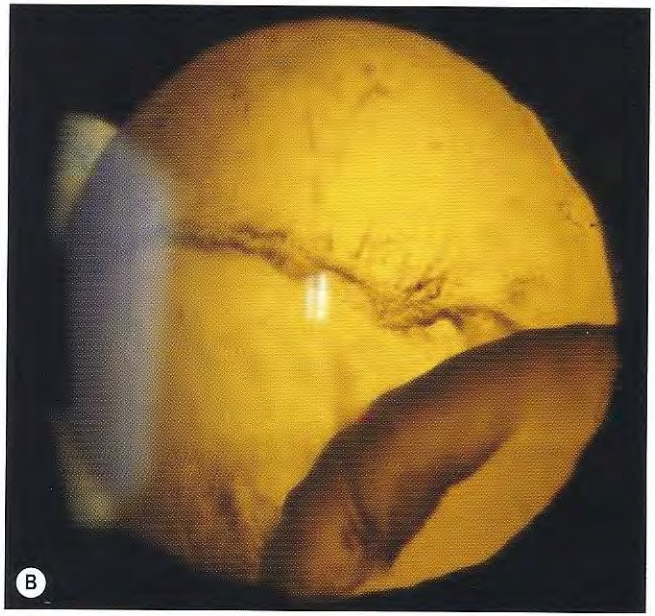


ated with little visible damage to the anterior segment, but should be suspected if there is asymmetry of anterior chamber depth – the anterior chamber of an affected eye is classically deep, with posterior rotation of the iris–lens diaphragm – and intraocular pressure in the affected eye is low. Gentle B-scan ultrasonography may demonstrate a posterior rupture, but CT or MR may be necessary; MR is not performed if there is a risk of ferrous intraocular

BLUNT TRAUMA

- LENS
- Cataract
- Subluxation of the lens
- Dislocation of the lens





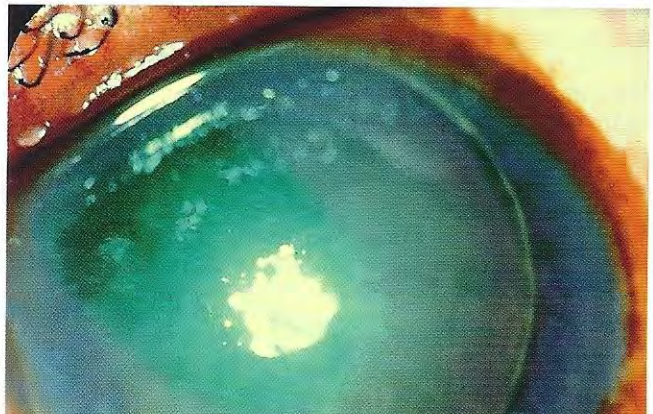


Fig. 21.16 Ruptured globe

BLUNT TRAUMA

- GLOBE RUPTURE

✓Usually anterior

✓May be associated with prolapse of lens, iris, ciliary body or vitreous

✓Posterior rupture must be suspected if the IOP is low

- VITREOUS HAEMORRHAGE

✓May occur in association with PVD

✓Must prompt a careful retinal assessment

BLUNT TRAUMA

- RETINA
- Commotio retinae:

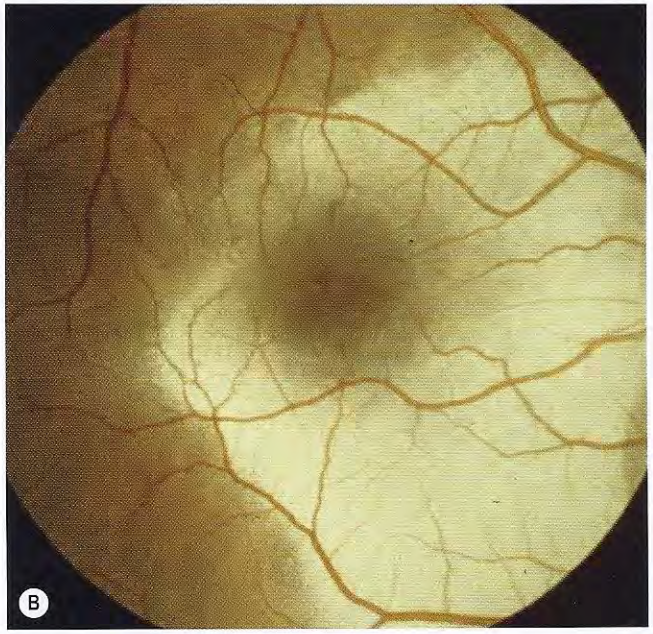
✓ Concussion of the retina.

✓Results from cloudy swelling of the retina.

✓Prognosis is good if mild. Resolves in 6 weeks

✓Prognosis poor if it involves the maculla. May result in macular holes and pigmentary retinal changes


A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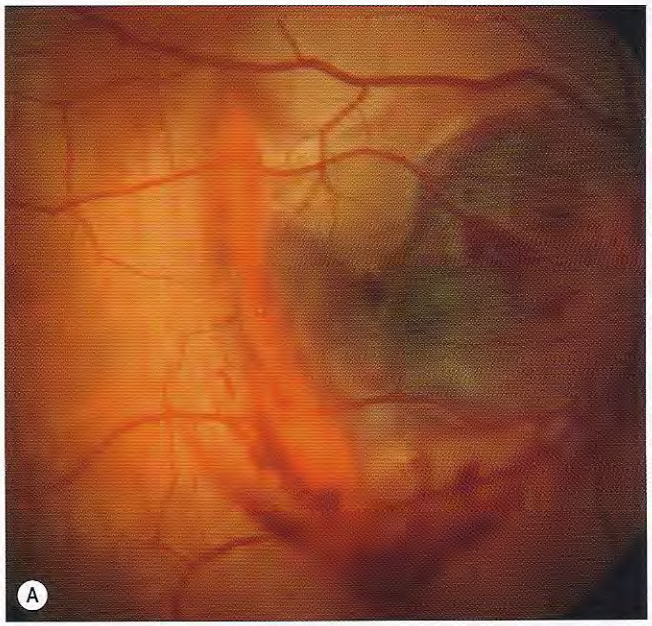
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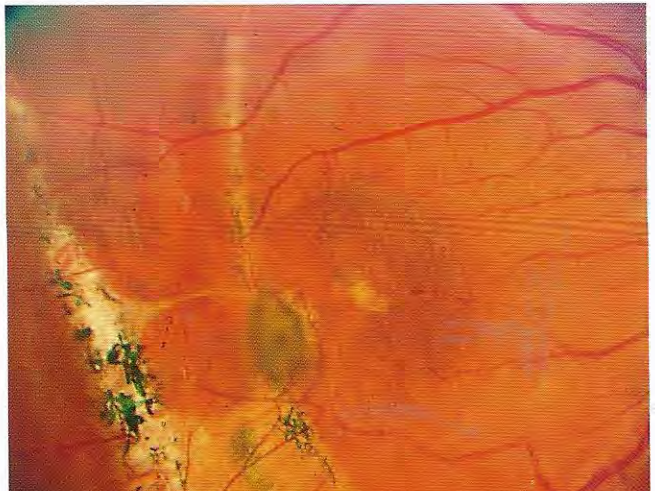


BLUNT TRAUMA

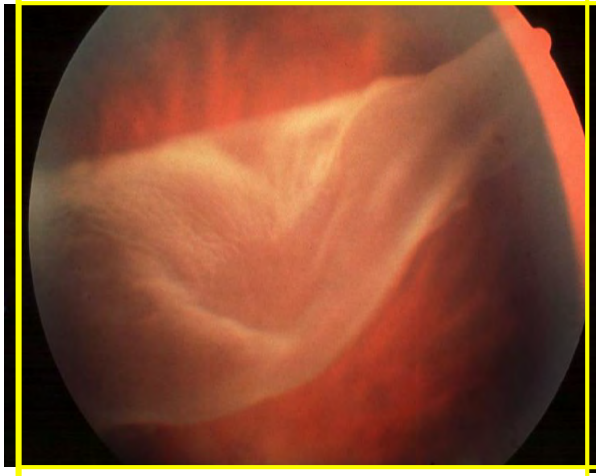
- ✓Retinal Breaks
- ✓Retinal Detachment
- ✓OPTIC NERVE
- ✓Traumatic Optic Neuropathy
- ✓Following Ocular, Orbital and head trauma
- ✓Presents with sudden profound visual loss which cannot be explained by other ocular pathology
- ✓May be due to contusion, deformation, compression or transection, intraneural haemorrhage
- ✓Afferent Pupil Defect the only objective sign
- ✓Treatment: I/V Methylprednisolone. O/N decompression

Posterior segment complications of blunt tra

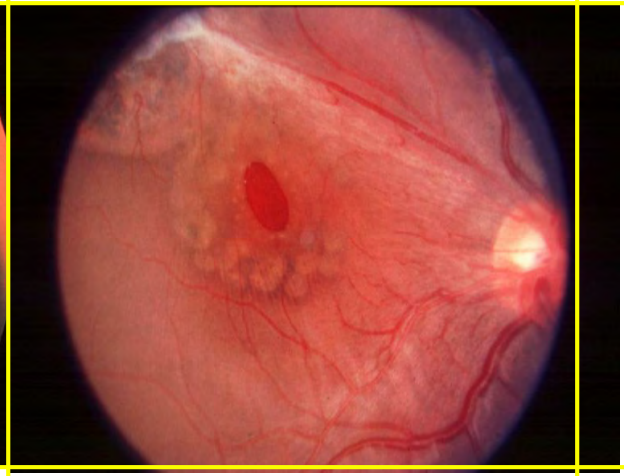
Commotio retinae

Choroidal rupture and haemorrhage

Avulsion of vitreous base and retinal dialysis



Equatorial tears



Macular hole

Optic neuropathy

SHAKEN BABY SYNDROME

SHAKEN BABY SYNDROME

- ✓Also called non-accidental head injury/ abusive head trauma
- ✓Typically in children under the age of 2 years
- ✓Caused principally by shaking, often in association with impact injury
- ✓Must be managed with paediatrician

SHAKEN BABY SYNDROME

- PATHOGENESIS

✓Results from rotational acceleration and deceleration of the head

✓Direct trauma not the main mechanism of brain injury

✓Brain stem traction lead to apnoea. Consequent hypoxia lead to Raised ICP and ischaemia

SHAKEN BABY SYNDROME

- PRESENTATION

✓Irritability, Lethargy and vomiting

✓Systemic features may include signs of impact head injury, ranging from skull fractures to soft tissue bruises

✓Multiple rib and ling bone fractures may be present

✓Features may be limited to Ocular features only

SHAKEN BABY SYNDROME

- OCULAR FEATURES
- Retinal Haemorrhages may be uni- or bilateral
- Peri ocular bruising and Subconjunctival haemorrhages
- Poor visual responses and APD
- Visual Loss due to cerebral damage

PENETRATING TRAUMA

PENETRATING TRAUMA

- CAUSES

✓Assaults

✓Domestic and Occupational accidents

✓Sport

✓ The extent of injury is determined by the size of the object, its speed at the time of impact and its composition

PENETRATING INJURIES

- CORNEAL

✓Small shaving wounds. Heal spontaneously

✓Medium sized wounds require suturing with 10/0 Nylon

✓With Iris Involvement Require Iris abscission and wound suture

✓With lens damage. Require wound suture and removal of the lens

- SCLERAL
- Anterior scleral lacerations have a better prognosis
- May be associated with prolapse of iris, ciliary body and /or vitreous

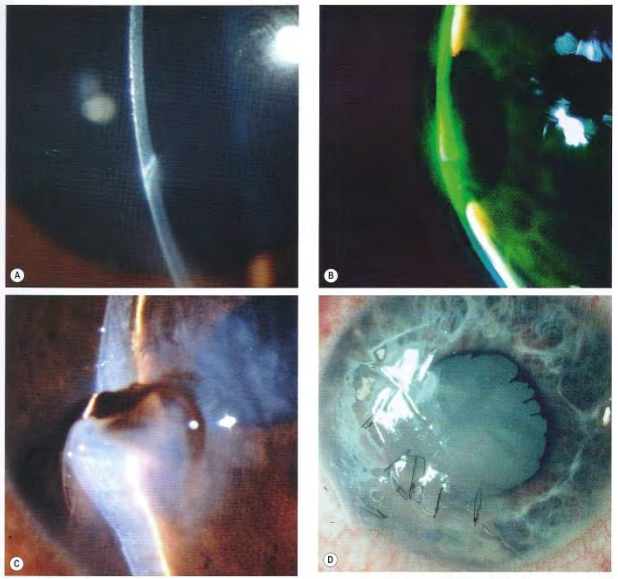


Fig. 21.22 Penetrating corneal wounds. **(A)** Small shelving with formed anterior chamber; **(B)** with flat anterior chamber; **(C)** with iris involvement; **(D)** with lens damage

(Courtesy of R Bates – fig. D)

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or significant
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ould be as for a
are often sterile,
re during transit
ign bodies carry

is essential to
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PENETRATING INJURIES

- SCLERAL

✓Anterior scleral lacerations have a better prognosis

✓May be associated with prolapse of iris, ciliary body and /or vitreous

✓Posterior scleral lacerations are often associated with retinal detachments

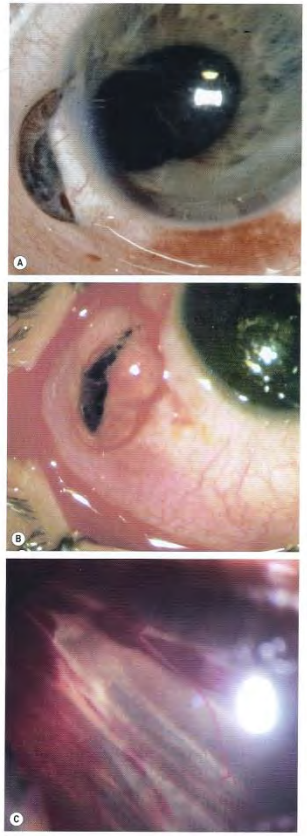


Fig. 21.23 Penetrating scleral wounds. **(A)** Anterior circumferential scleral laceration with iridociliary prolapse; **(B)** radial anterior scleral laceration with ciliary and vitreous prolapse; **(C)** fibrous proliferation

(Courtesy of Wilmer Institute – fig. A; EM Eagling and MJ Roper-Hall, from Eye Injuries, Butterworths 1986 – fig. B)

c. Magnetic removal may be useful for a deeply embedded metallic foreign body.
d. A residual 'rust ring', is easiest to remove with a sterile 'burr', if available.
e. Antibiotic ointment is instilled together with a cycloplegic and/or typical NSAIDs to promote comfort.

Intraocular foreign bodies

An intraocular foreign body (IOFB) may traumatize the eye mechanically, introduce infection or exert other toxic effects on the intraocular structures. Once in the eye, the foreign body may lodge in any of the structures it encounters; thus it may be located anywhere from the anterior

PENETRATING INJURIES

- SUPERFICIAL FB'S

✓Sub tarsal FB's adhere to the tarsal conjunctiva and abrade the cornea with every blink

✓Corneal FB's are common. And if allowed to remain,a risk of secondary infection and corneal ulceration is significant

✓Management:

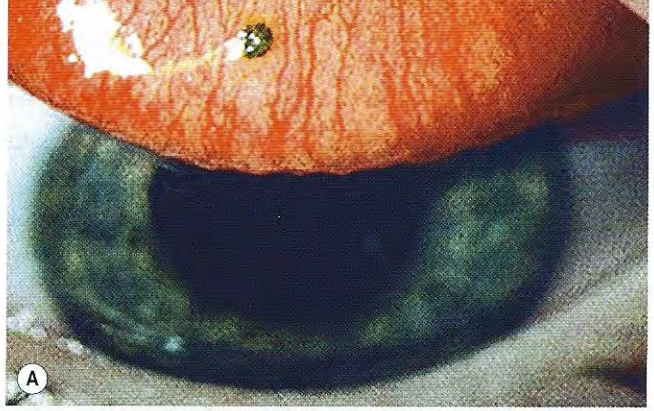
✓Locate the exact position and depth of FB

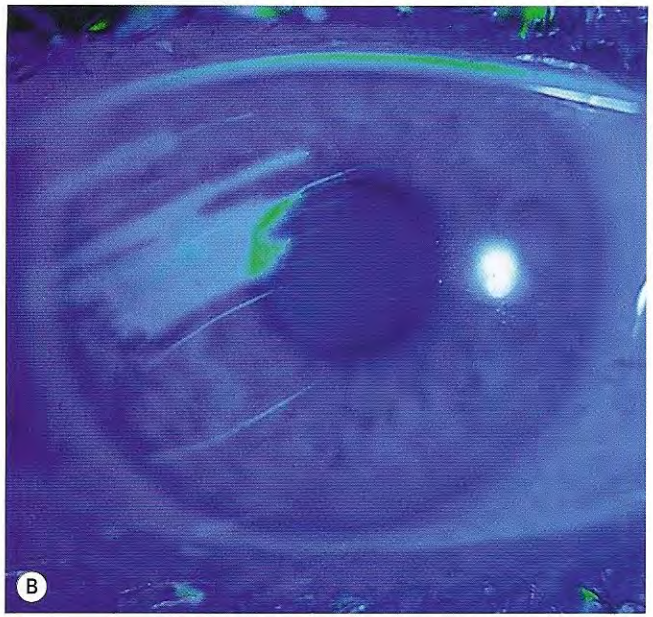
✓Removed with a sterile 26 gauge needle

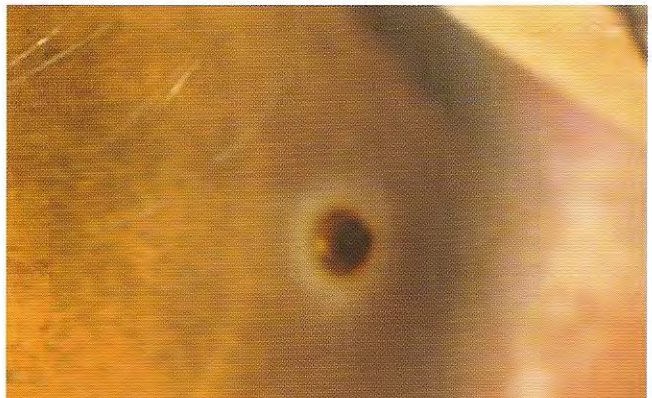
✓Rust ring removed with a burr

✓Antibiotic ointment and an Eye pad

Many substances including glass, many plastics, gold and silver are inert. However, iron and copper may undergo dissociation and result in siderosis and chalcosis respectively.







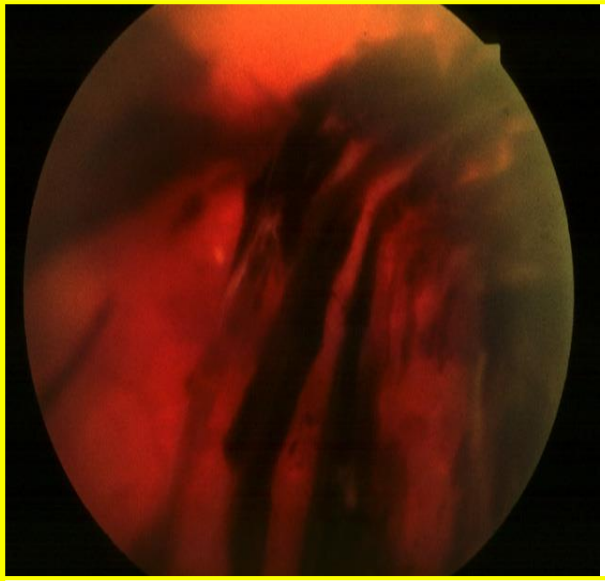
cally projected into the eye by hammering or power tool use. A ferrous IOFB undergoes dissociation resulting in the deposition of iron in the intraocular epithelial structures, notably the lens epithelium, iris and ciliary body epithelium and the sensory retina, where it exerts a toxic

Complications of penetrating trauma

Flat anterior chamber

Uveal prolapse

Damage to lens and iris



Vitreous haemorrhage

Tractional retinal detachment

Endophthalmitis

PENETRATING INJURIES

- INTRA OCULAR FOREIGN BODIES
- INITIAL MANAGEMENT

✓Accurate history

✓Full ocular examination

✓CT scan

✓Refer to an Ophthalmologist

CHEMICAL INJURIES

- CAUSES

✓Alkali burns are the commoner than Acid burns

✓The severity of the chemical injury is related to the properties of the chemical, the area of affected ocular surface, duration of exposure and related effects such as thermal damage

- PATHOPHYSIOLOGY

✓Necrosis of the conjunctiva and corneal epithelium

✓Disruption of limbal vasculature

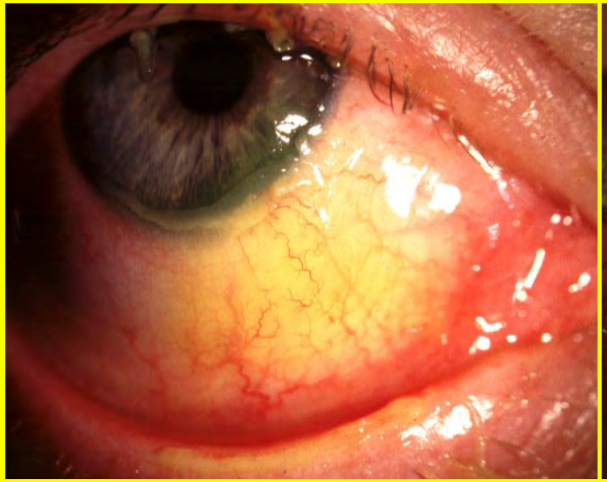
✓Vascularisation of the cornea

✓Persistent epithelial defects

Grading of severity of chemical injuries

Grade I (excellent prognos s)

- Clear cornea
- Limbal ischaemia - nil

Grade II (good prognosis)	Grade III (guarded prognosis)	Grade IV (very poor prognosis)
		
• Cornea hazy but visible iris details • Limbal ischaemia < 1/3	• No iris details • Limbal ischaemia - 1/3 to 1/2	• Opaque cornea • Limbal ischaemia > 1/2

CHEMICAL INJURIES

- IT'S AN EMERGENCY

✓Copious Irrigation with Ringers Lactate or Normal Saline

✓The speed and efficacy of irrigation is the most important prognostic factor

✓Tap water should be used if necessary

✓Instil a topical anaesthetic

✓Evert the lids to remove residual particles

✓Debride necrotic areas of cornea

✓Admit and contact an Ophthalmologist

Medical Treatment of Severe Injuries

1. Copious irrigation (15-30 min) - to restore normal pH
2. Topical steroids (first 7-10 days) - to reduce inflammation
3. Topical and systemic ascorbic acid - to enhance collagen production
4. Topical citric acid - to inhibit neutrophil activity
5. Topical and systemic tetracycline - to inhibit collagenase and neutrophil activity