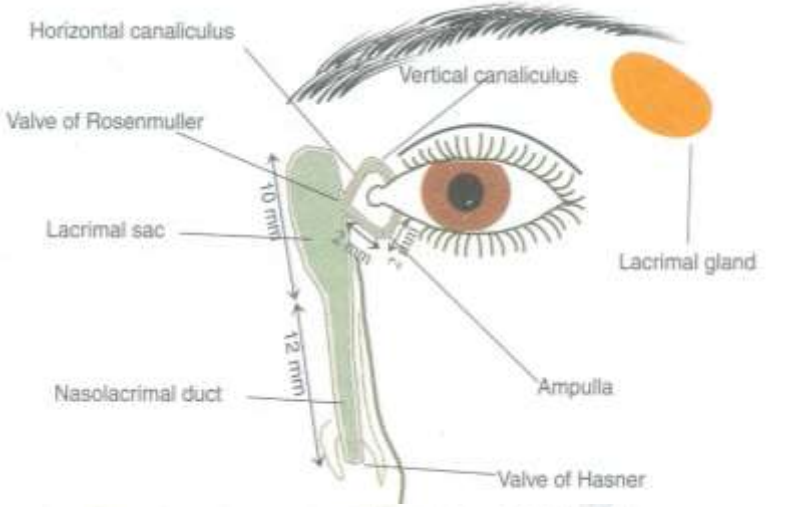
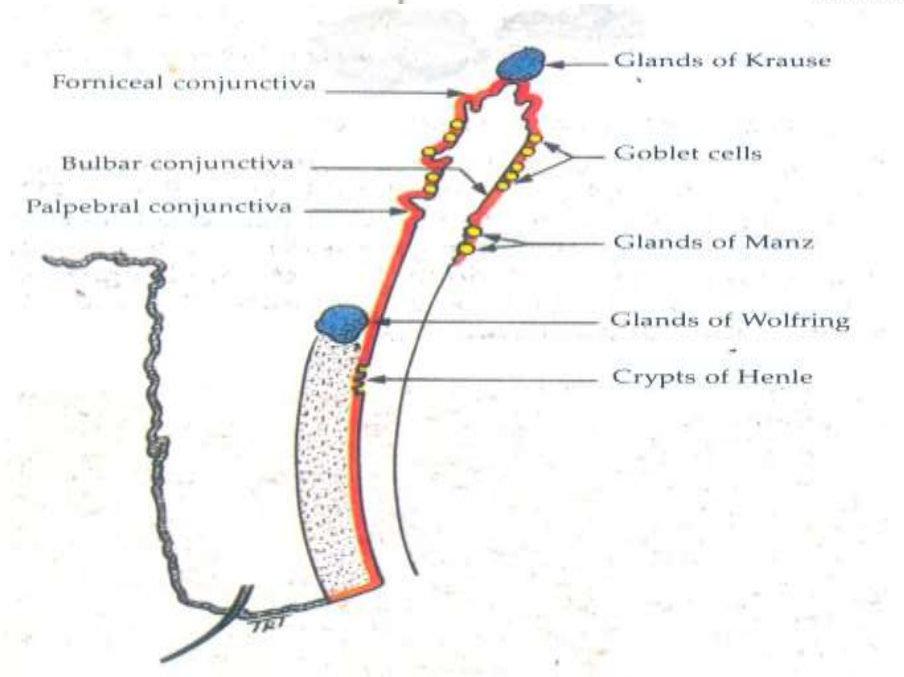
Lacrimal apparatus

Dr. Vibhavari Barhate

Anatomy

- Secretory System
  - Lacrimal Gland
  - Accessory Lacrimal gland
    - Glad of Krasuse
    - Glad of Wolfring
- Lacrimal Drainage System
  - Lacrimal puncta
  - Canaliculi
  - Lacrimal Sac
  - Nasolacrimal Duct





- **Lacrimal gland**
  - Located in the supero lateral quadrant of orbit
  - Two parts – Orbital,
  - Palpabral
  - Lacrimal ducts (10 to 12 Nos) opens at the outer edge to upper fornix

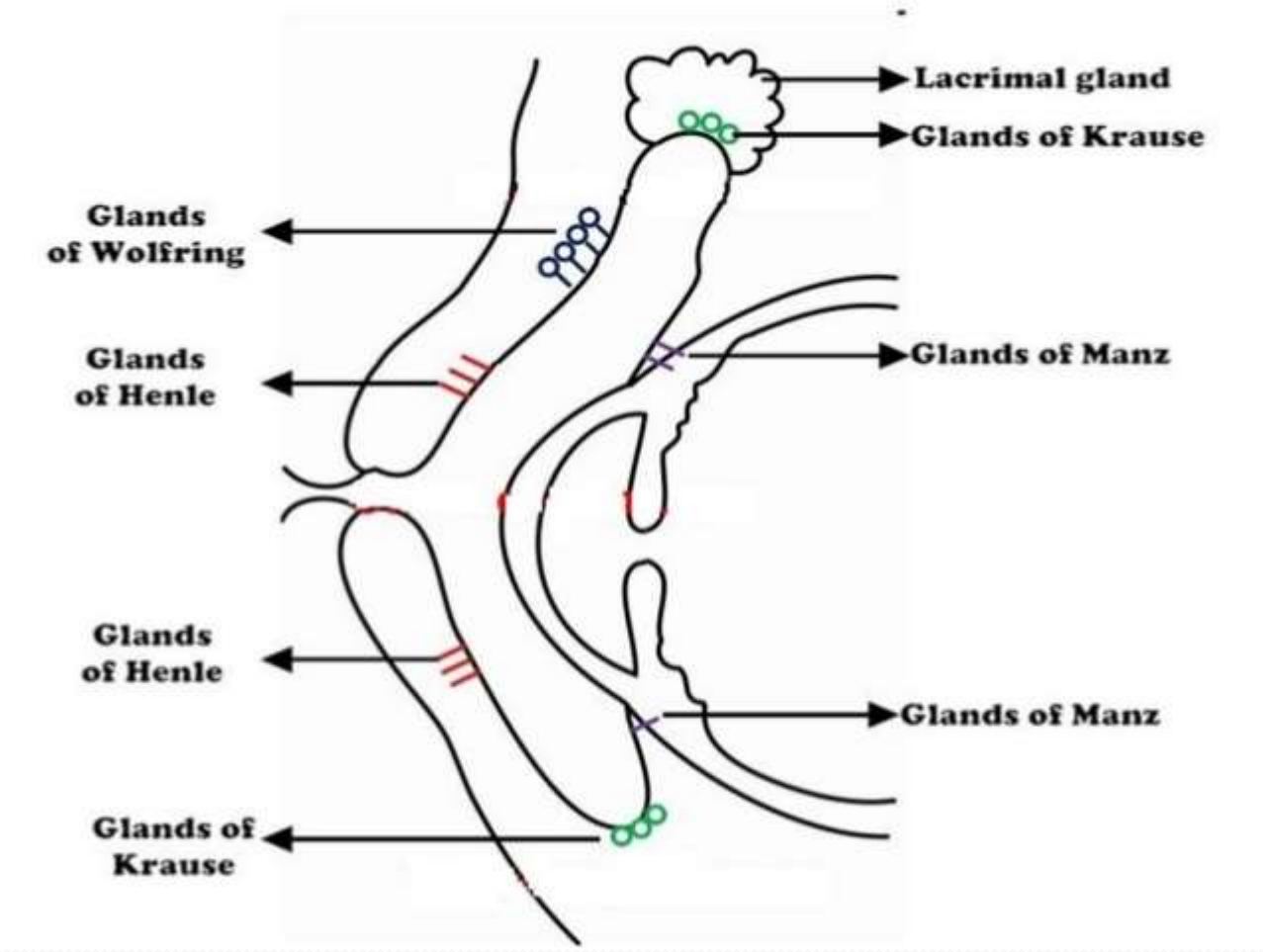
ACCESSORY LACRIMAL GLANDS

- Same structure as main lacrimal gland
- Very small in size

- **Glands of Krause:**
- ✓ Upper lid-40-42
- ✓ Lower lid-6-8
- ✓ Deeply situated in the conjunctiva near the fornix on lateral side

- **Glands of Wolfring:**
  - Few in number
  - Situated near the upper border of the tarsal plate

- **Rudimentary accessory lacrimal glands:**
  - Present in the caruncle,plica semilunaris and infraorbital region.


Lacrimal gland
Glands of Krause
Glands of Wolfring
Glands of Henle
Glands of Manz
Glands of Henle
Glands of Manz
Glands of Krause

BLOOD SUPPLY

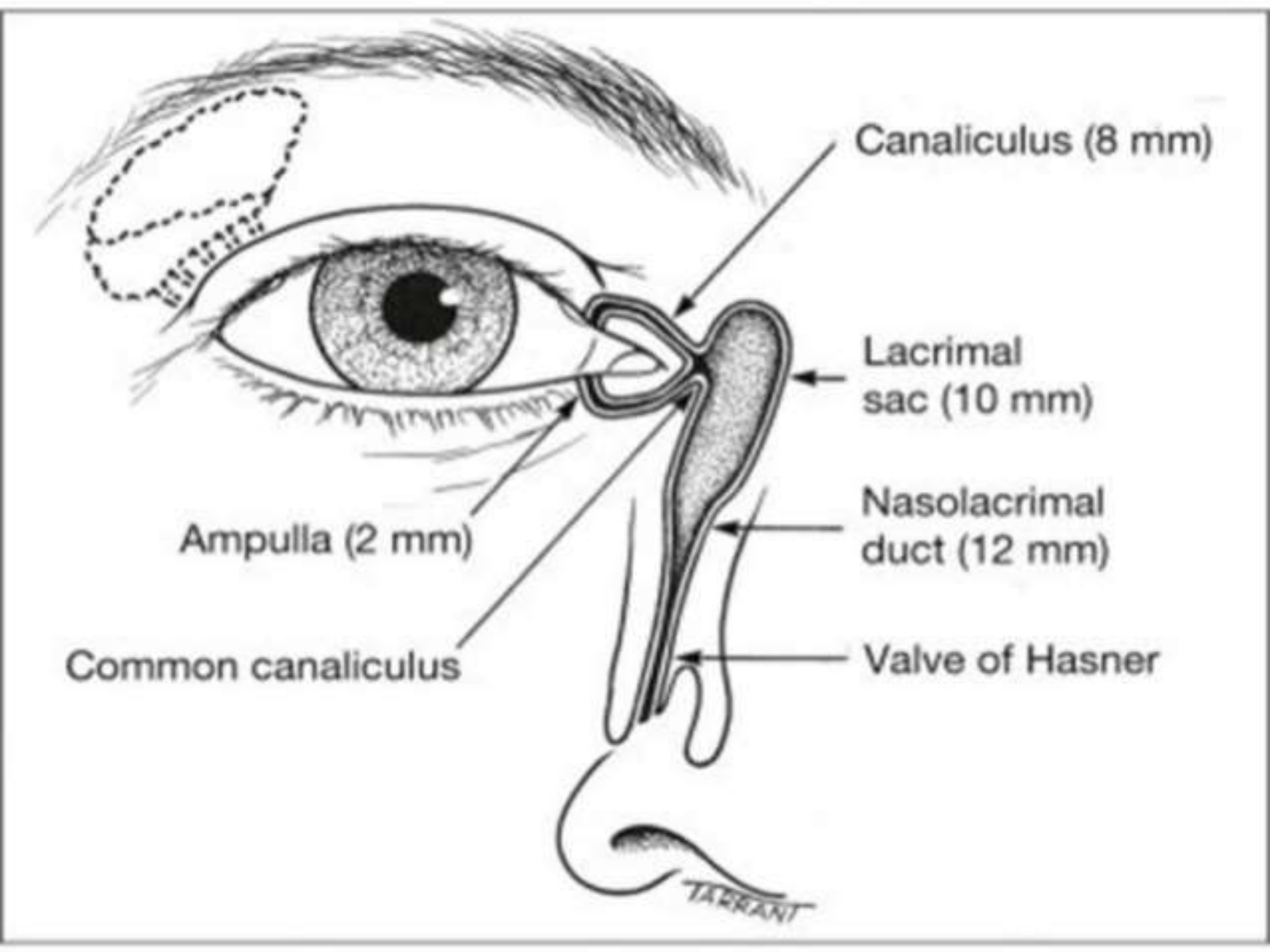
- Artery supply : Lacrimal artery , branch of ophthalmic artery.
- Venous drainages : Ophthalmic Vein.
- Lymphatic drainage : Joins that of conjunctiva & drain into the preauricular lymph nodes.

Lacrimal passage

- Lacrimal puncta
- Lacrimal canaliculi
- Common canaliculi-valve of Rosenmuller
- Lacrimal sac

I. Fundus
II. Body
III. Neck

- Naso lacrimal duct –valve of Hasner


Canaliculus (8 mm)
Lacrimal sac (10 mm)
Nasolacrimal duct (12 mm)
Valve of Hasner
Ampulla (2 mm)
Common canaliculus
TABRANT

LACRIMAL DRAINAGE SYSTEM

- **Comprises of :**

1. **The Puncta :**

- ✓ Small, round to oval orifices of 0.2 mm in diameter.
- ✓ Situated on the summit of an elevation, the Papilla Lacrimalis that lies near the medial end of eyelid margins at the junction of its ciliated & non-ciliated parts.
- ✓ The puncta being avascular is paler than its surrounding structures.
- ✓ The puncta are surrounded by a ring of dense fibrous tissue which keeps them patent.


Jordan M. Graff, MD
U of Iowa, 2004

2. The Canaliculi:

- Hollow tubes of 0.5 mm in diameter connecting the puncta to the Lacrimal sac.

- It has :
  i) Vertical Part - 2mm in length
  ii) Horizontal part - 8-10 mm in length

- Upper canaliculi is slightly shorter than the lower.
- There is a dilatation at the junction of these 2 parts- called AMPULLA.

- The canaliculi unite at an angle of 25 degrees to form common canaliculus (0.5mm).
- The common canaliculus is directed an angle of 45 degrees with the sac before entering it.
- This acute entry into the Lacrimal Sac creates a potential mucosal flap or valve across the opening, The Valve of Rosenmuller.
- The point of entry of common canaliculus into the Lacrimal sac is called the Lacrimal sinus of Maier.
- The canaliculi are lined by stratified squamous epithelium.

3. THE LACRIMAL SAC:

Dimensions : 12-15 mm in length
4-6 mm anteroposteriorly
2-3 mm wide

Situation : Lies in the lacrimal fossa formed by the lacrimal bone & frontal process of maxilla in the anterior part of the medial wall of the orbit which is continuous below with the Nasolacrimal duct.

4.NASOLACRIMAL DUCT:

Continuation of Lacrimal sac.

→ It is divided into 2 parts :

a) An Interosseous Part : 12.5 mm

b) An Intermeatal Part : 5.5 mm

→The opening of Nasolacrimal duct has a mucosal fold , the Valve of Hasner, which prevents air from entering the lacrimal sac on sudden blowing the nose.

Vessels

- Artery supply : palpebral branches of the ophthalmic, angular and infraorbital arteries and nasal branch of the sphenopalatine.
- Venous drainages : Angular and infraorbital vessels above, below into the nasal veins
- Lymphatic drainage: submandibular and deep cervical nodes.

Nerves

- Infratrochlear and anterior superior alveolar nerves.

- # Nerve supply
  - Parasympathetic :

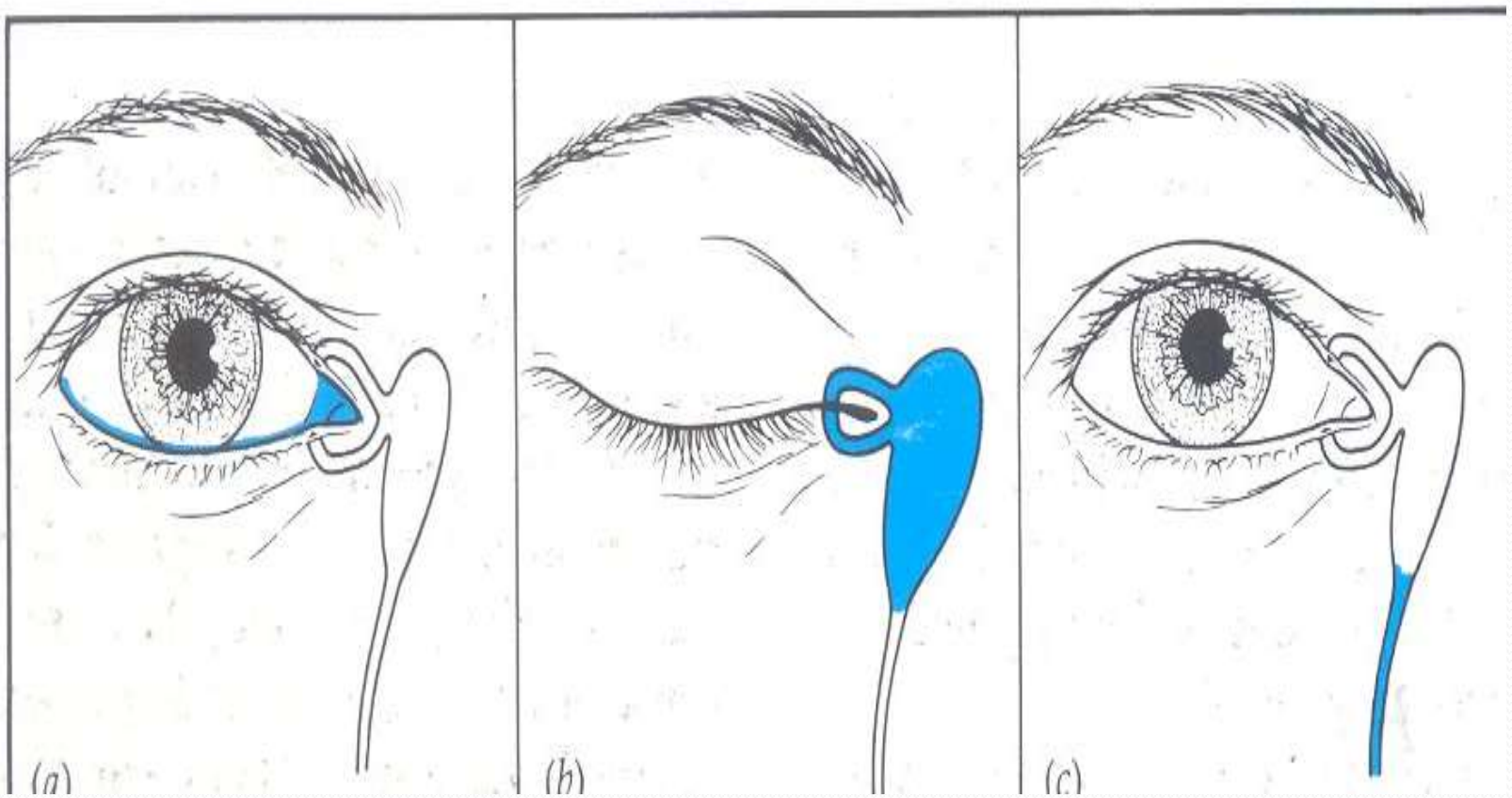
➢ The parasympathetic secretomotor fibres are drived from the lacrimal nucleus of facial nerve .

➢ They reach the Sphenopalatine ganglion via the Greater superficial petrosal nerve

➢ The postganglionic fibres join the Maxillary nerve then through its Zygomatic nerve and further through its Zygomticotemporal branch

Physiology

- Lacrimal pump
  - Orbicularis oculi



INFECTIONS OF LACRIMAL PASSAGES

1. Congenital nasolacrimal duct obstruction
2. Congenital dacryocele
3. Chronic canaliculitis
4. Dacryocystitis
   - Acute
   - Chronic

Congenital nasolacrimal duct obstruction

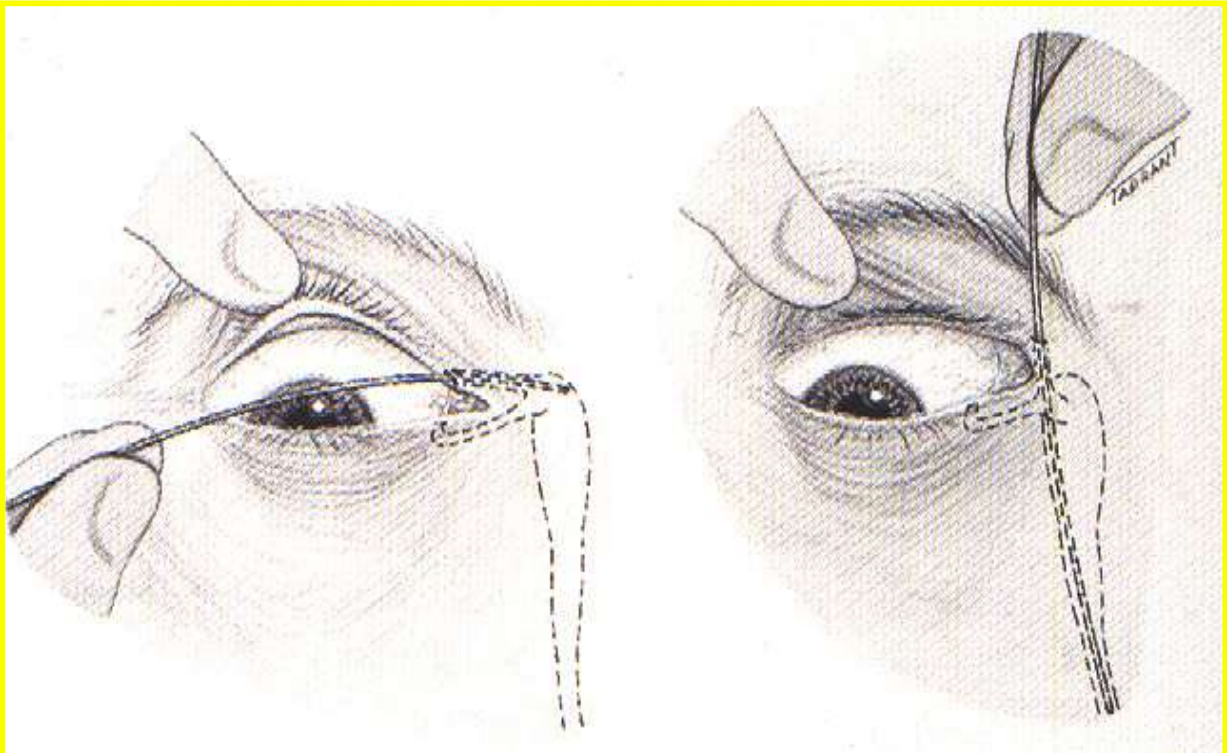
- Caused by delayed canalization near valve of Hasner
- On pressure reflux of purulent material from punctum

Epiphora and matting

Infrequently acute dacryocystitis

- Management
  - Topical antibiotics
  - Massage
  - Nasal decongesants
  - If no response probing is done after 6 to 12 months
  - Probing can be repeated after 6 months
  - If no response after 2nd probing DCR - 3 to 4yrs

- Massage of nasolacrimal duct and antibiotic drops 4 times daily
- Improvement by age 12 months in 95% of cases



- If no improvement - probe at 12-18 months
- Results - 90% cure by first probing and 6% by second

Congenital dacryocele

•Distension of lacrimal sac by trapped amniotic fluid (amniontocele)
•caused by imperforate valve of Hasner

- Bluish cystic swelling at or below medial canthus
- May become secondarily infected
- Do not mistake for encephalocele
  - pulsatile swelling above medial canthal tendon

Treatment

- Initially massage
- Probing if massage fails

DACRYOCYSTITIS

- Inflammation of lacrimal sac
- Often caused by obstruction of naso-lacrimal duct
- Followed by bacterial infection.

CAUSES

- NLD block due to narrowness or chronic inflammation of sac .
- Nasal polyps .
- Following primary conjunctivitis .
- Infection spreading from nasophraynx .
- Organisms responsible : Pneumococcus , streptococcus , staphylococcus , mycobacterium , etc ,...

4. Causative organisms

- Most common – Staphylococci, Pneumococci, Streptococci, Pseudomonas pyocyanea

- **ACUTE DACRYOCYSTITIS**

- **STAGE OF CELLULITIS**
  - Systemic and topical Antibiotics
  - Systemic Anti-inflammatory
  - Hot fomentation

- **STAGE OF ABSCESS FORMATION**
  - I & D

Stage of Fistula formation

- Control infection
- DCT/DCR with fistulectomy

COMPLICATIONS

- Fistula formation
- Lacrimal sac abscess
- Orbital cellulitis
- Meningitis
- Cavernous sinus thrombosis

Chronic Dacryocystitis

- Predisposing Factors
- Anatomical
- Foreign body
- Mild grade inflammation
- Nasal factors

Stages of Chronic Dacryocystitis

- 1. Stage of chronic catarrhal dacryocystitis
- 2. Stage of lacrimal mucocoele
- 3. Stage of chronic suppurative dacryocystitis
- 4. Stage of chronic fibrotic sac

Complications

- Conjunctivitis
- Ectropion
- Corneal ulceration
- Endophthalmitis

TREATMENT

- Conservative treatment – repeated lacrimal syringing
- Balloon catheter dilation
- Dacryocystorhinostomy
- Dacryocystectomy – only when DCR is contraindicated
- Conjunctivodacryocystorhinostomy

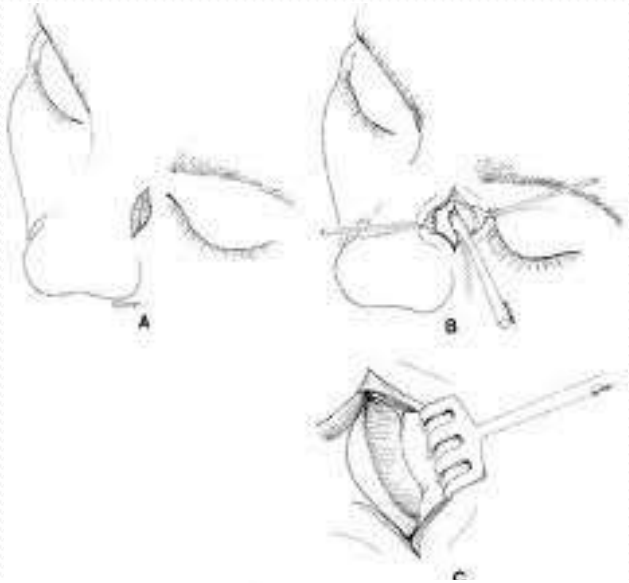
Surgeries on the Lacrimal Sac

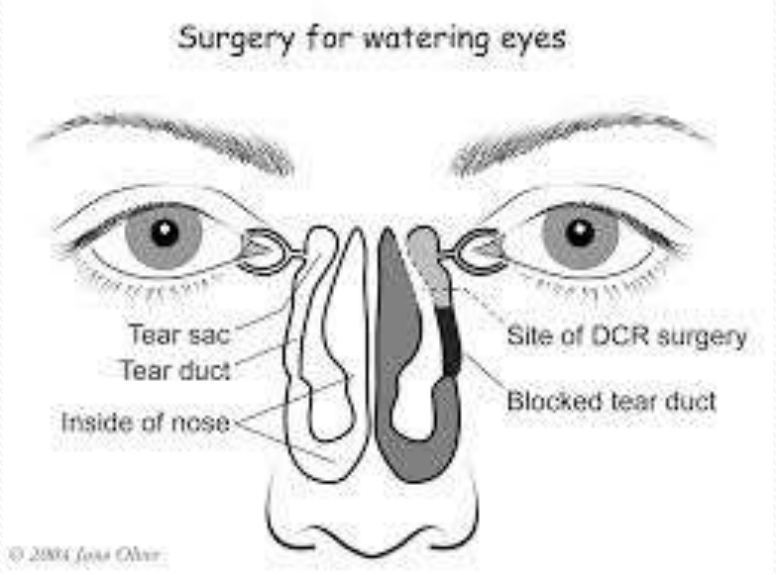
DCT(constant watering)

Conventional DCR (external scar)

Endoscopic DCR (lower success)

Endolaser DCR (lower success)

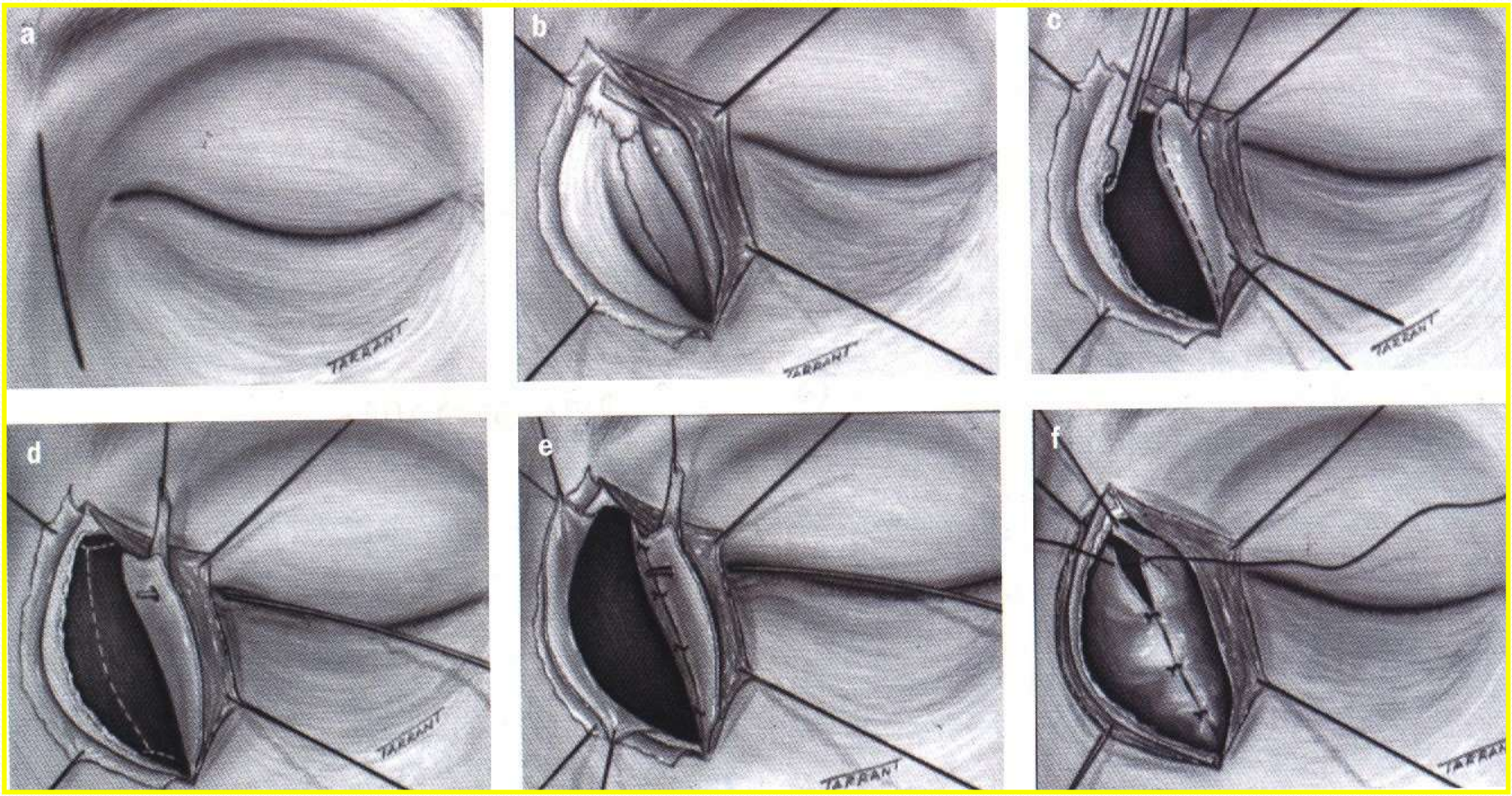




Dacryocystectomy(DCT)

- Indications
- Too young or too old pt
- Markedly shrunken or fibrosed sac
- T B ,syphilis ,leprosy ,mycotic inf of sac
- Tumours of sac
- Gross nasal diseases
- Unskilled surgeon

Dacryocystorhinostomy

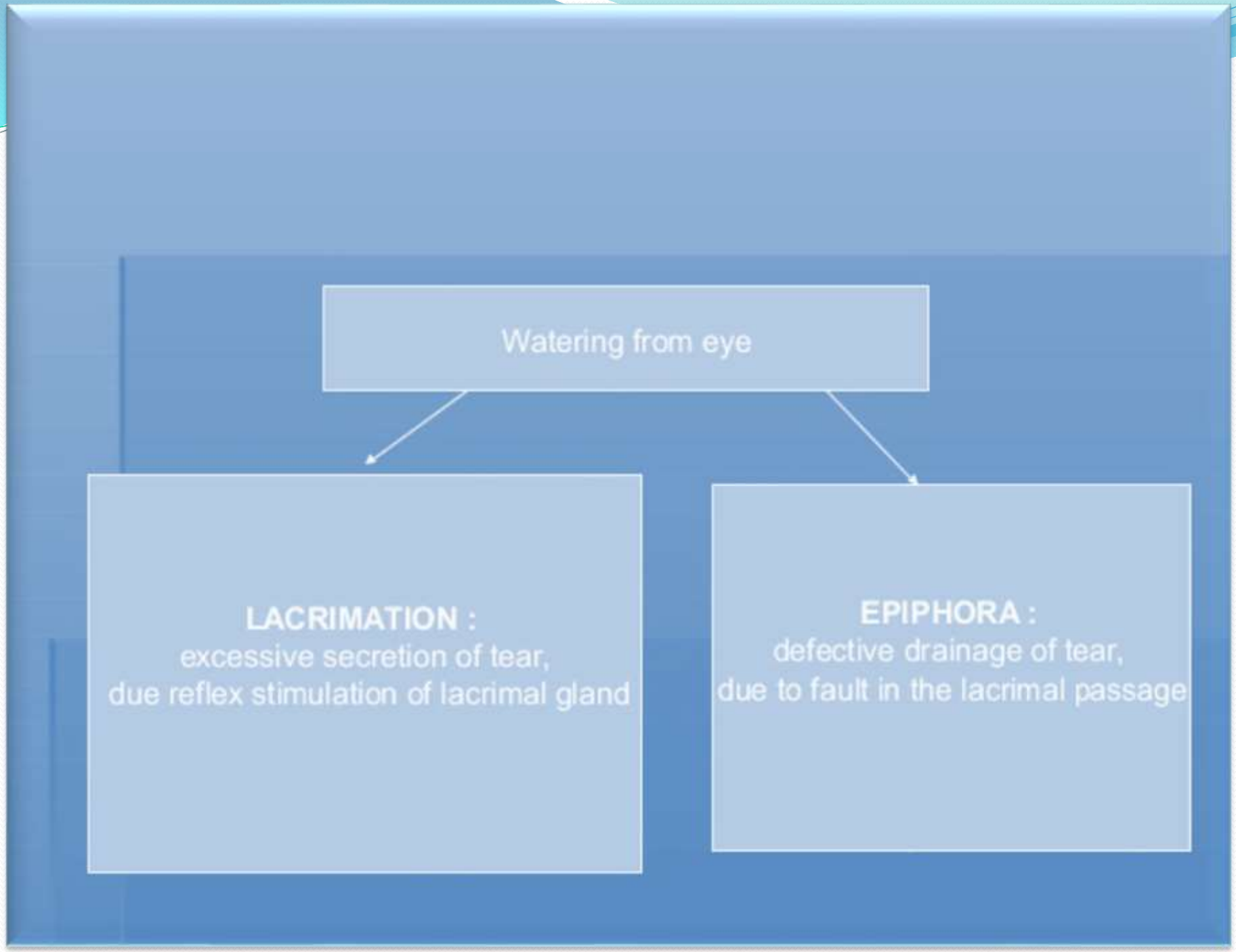



Thank You!

WATERING OF EYES

THE WATERING EYE

- watering eye is characterised by overflow of tears from conjunctival sac.
- Watering eye is mainly due to hyperlacrimation and epiphora.


Watering from eye
LACRIMATION :
excessive secretion of tear,
due reflex stimulation of lacrimal gland
EPIPHORA :
defective drainage of tear,
due to fault in the lacrimal passage

Lacrimation

Cause are :

1. Psychic stimulation as in weeping or laughing
2. Irritation of the cornea or conjunctiva, by dust , fumes, chemicals. Foreign body, inflammation. Etc
3. In coughing, sneezing, vomiting
4. Exposure to bright light
5. Corneal ulcer, abration
6. Different type of keratitis
7. Trichiasis , ectropion

Epiphora(DOWN POUR)

- Obstruction to the outflow of normally secreted tears.
- Epiphora may be due to physiological (lacrimal pump failure) or anatomical(mechanical obstruction) cause.

- Anatomical → complete or partial punctal canalicular or NLD obstruction

- Functional → Lacrimal pump failure due to Anatomical deformity (Laxity, orbicularis weakness)

epiphore

- Lacrimal pump failure due to
- Lower lid laxity
- Weakness of the orbicularis occuli, as in bell's palsy
- Ectropion due to other cause

Mechanical obstruction

- Punctal causes
- Canaliculi
- Lacrimal sac
- NLD

Punctal Causes

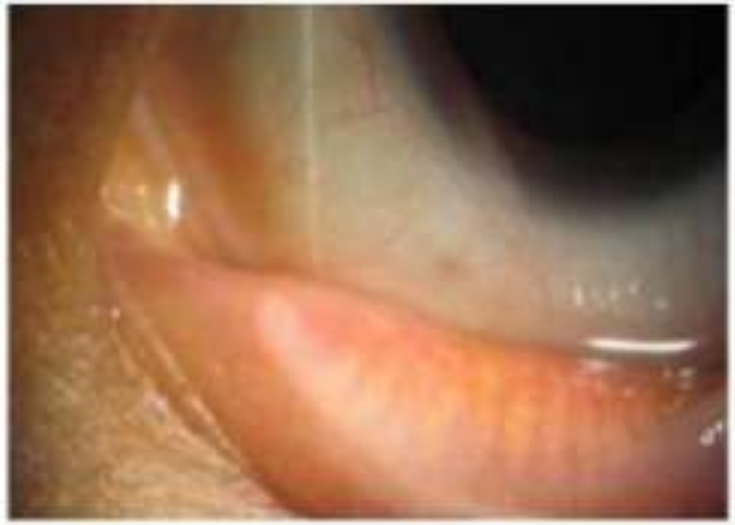
Congenital agenesis/imperforate

Acquired :

- OcclusioN
- Infection/radiation
- Systemic: phemphigoid,SJS,Burns
- Tumors

Mal position

- Medial displacement
- Medial ectropion



Canalicular

- Congenital absence/fistula
- Acquired

Intrinsic

- Canaliculitis
- Trauma/ Post radiation Trauma/ Post radiation
- Tumours

Extrinsic

- Compression by adjacent tumours

Lacrimal Sac Abnormality

- Sac inflammation
- Perilacrimal fibrosis
- Dacryolith
- Sac tumors (rare in pediatric age group)
- Adnexal tumors pressing on lacrimal sac or drainage pathway

NASOLACRIMAL DUCT OCCLUSION

Congenital:

- NLD obstruction
- Delayed opening of Hasner's valve,
- Cranio facial anomalies
- Agenesis.

Acquired:

- Primary obstruction
- Secondary obstruction: tumour, trauma

NASAL CONDITIONS

o Severe Deviated Nasal Septum or Turbinate Hypertrophy

Evaluation of watering from the eye

- History

1. Watering due to epiphore is usually unilateral and is not associated with irritation

On the other hand lacrimation is usually bilateral and associated with irritation,itching or photophobia

histroy

- Past history of bell's palsy is important, it suggest lacrimal pump failure rather than a mechanical obostruction.
- h\o of medication like, topical idoxuridine (IDU), Phospholone iodine ans systemic 5-FU (fluoro-uracil) may be cause of punctal stenosis

Clinical evaluation

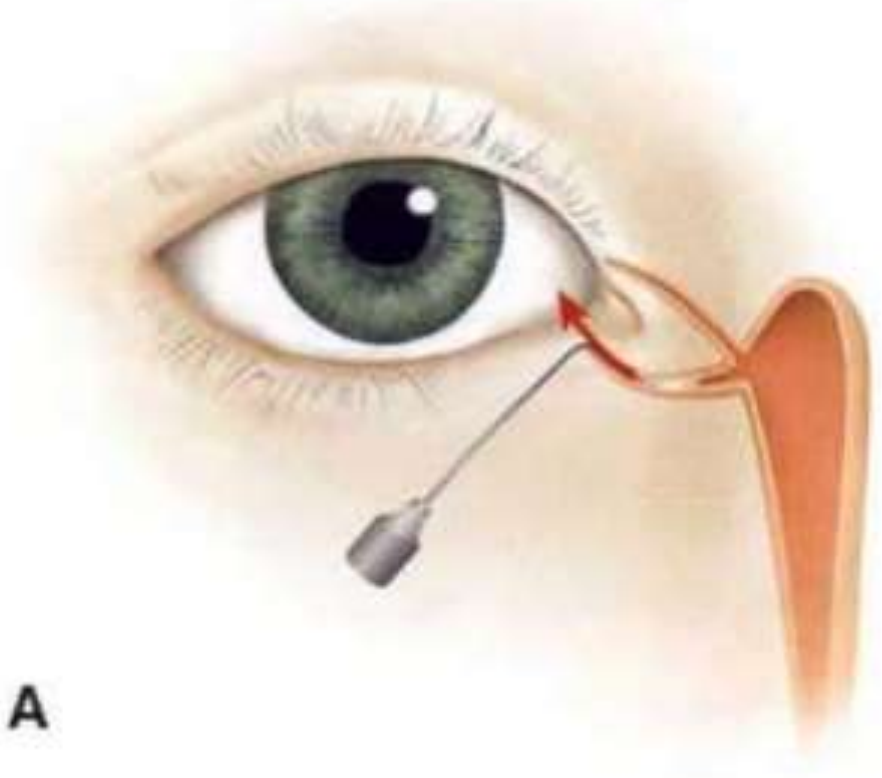
- Ocular examination with diffuse illumination using magnifiaction.
- Regurgitation test.
- Fluorescein dye disappearance test.
- Lacrimal syringing.
- Jones dye test.
- Dacryocystography.
- Radionucleotide dacryocystography(lacrimal scintillography).

- Examination:
- eyelids: malposition ectropion lower lid laxity trichiasis
- Puncta: stenosis foreign body
- Pressure over sac area
- High marginal tear film strip
- Any conjunctival or corneal foreign body
- Orbicularis oculi muscle function
- Detection of nasal factors

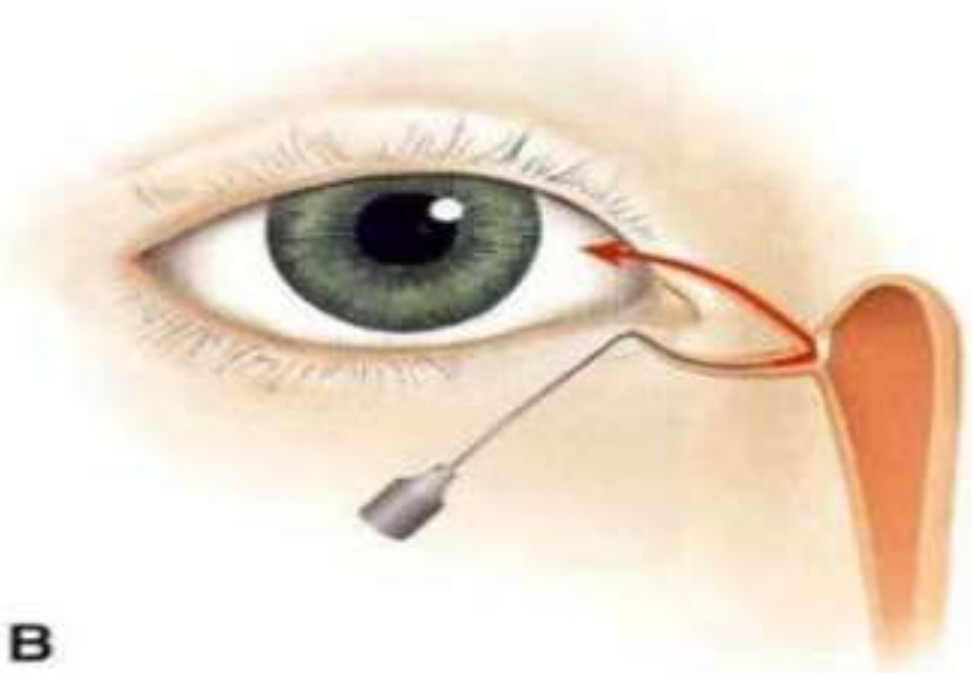
Anatomical tests

These tests helps in localization of obstruction

- Syringing / irrigation
- Diagnostic probing
- Dacryocystography
- CT/MRI

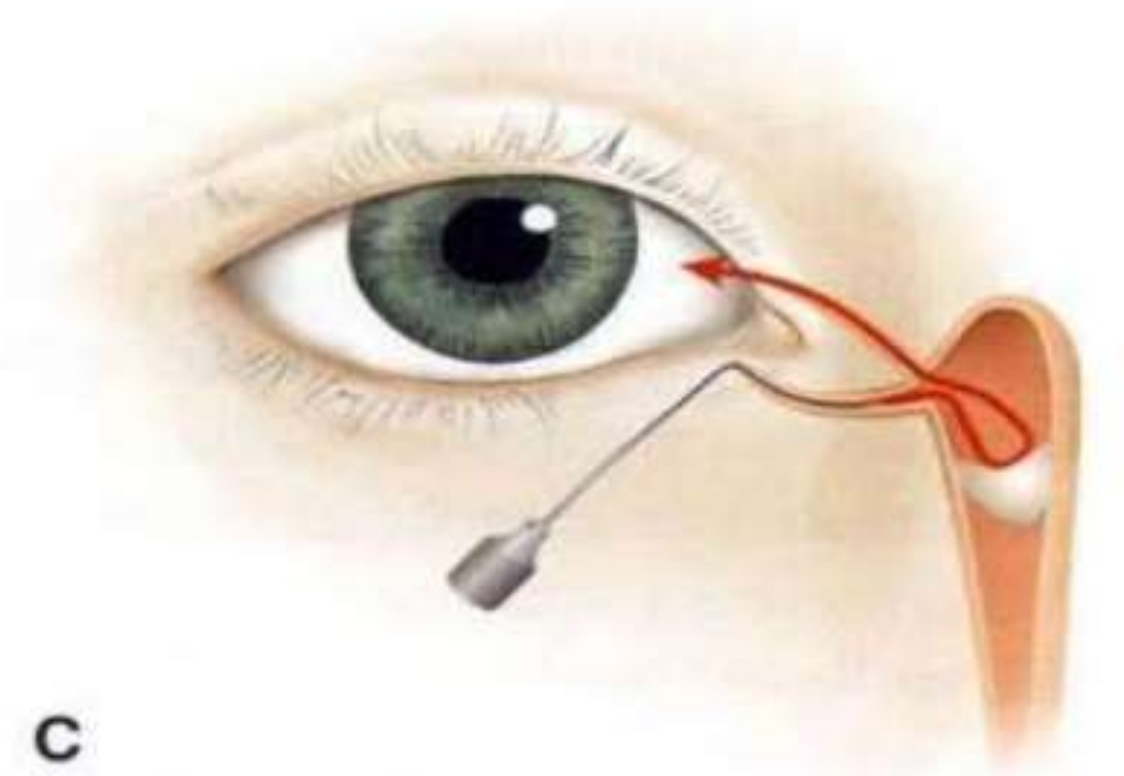


Complete canalicular obstruction. The cannula is advanced with difficulty, and irrigation fluid refluxes from the same canaliculus



Complete common canalicular obstruction. A "soft stop" is encountered at the level of the lacrimal sac, and irrigated fluid ref luxes through the opposite punctum.

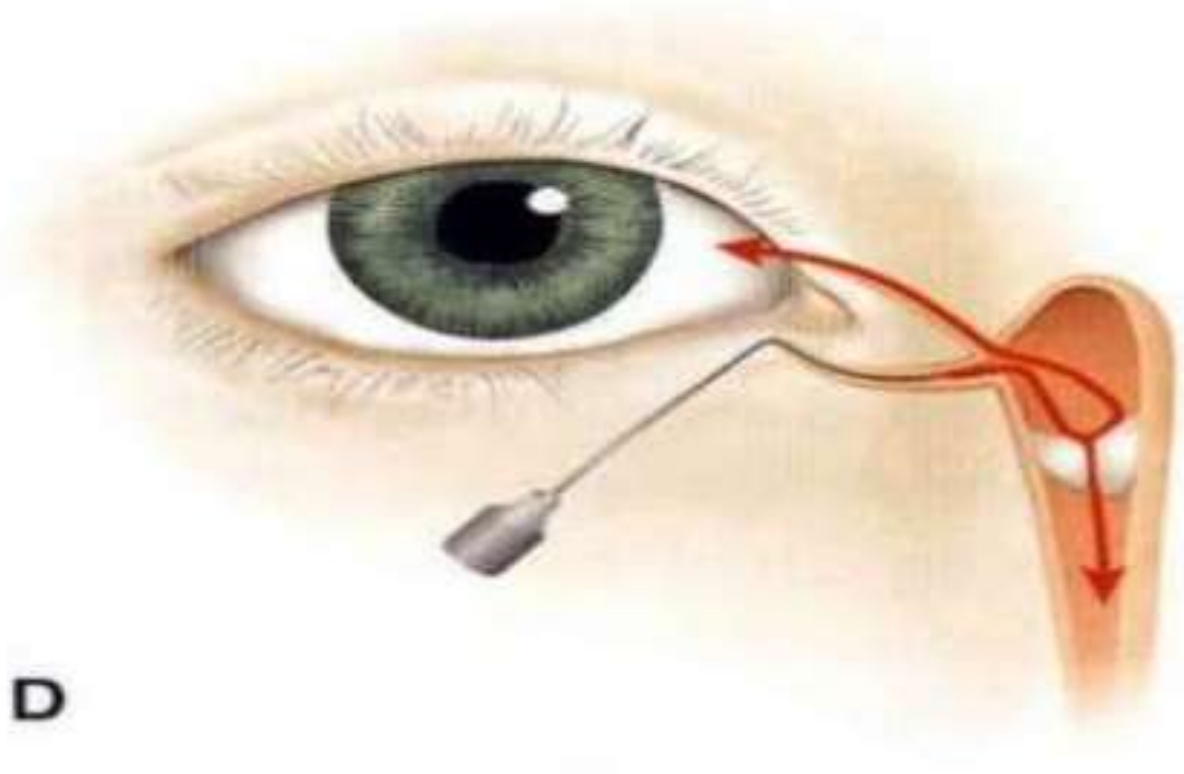
Soft stop is a spongy feeling due to canalicular obstruction



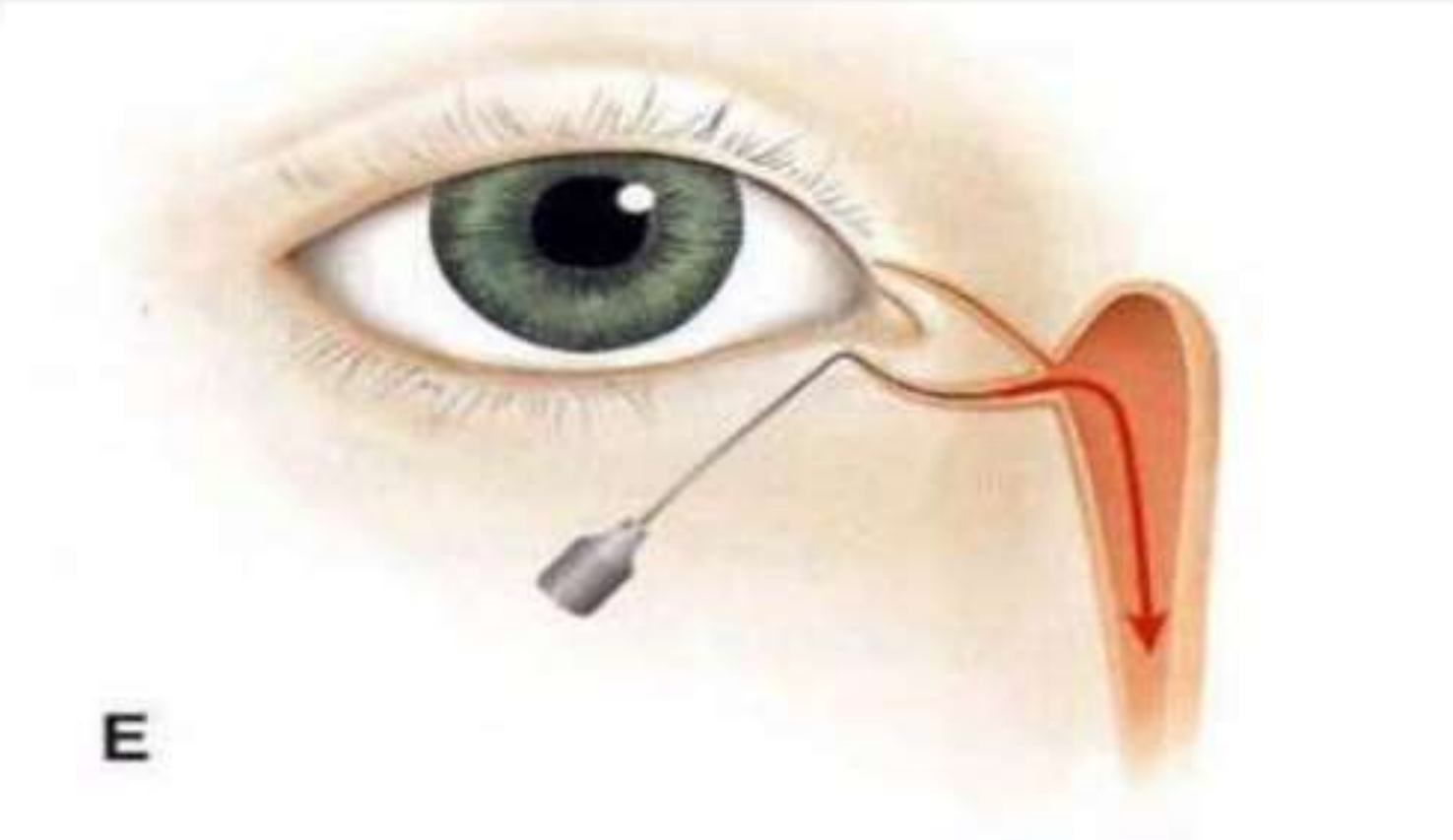
C

Complete nasolacrimal duct obstruction. The cannula is easily advanced to the medial wall of the lacrimal sac, then a "hard stop" is felt, and irrigation fluid ref luxes through the opposite punctum.

If the probe touches the medial orbital wall, this means **Hard Stop**.



Partial nasolacrimal duct obstruction. The cannula is easily placed, and irrigation fluid passes into the nose as well as refluxing through the opposite punctum.

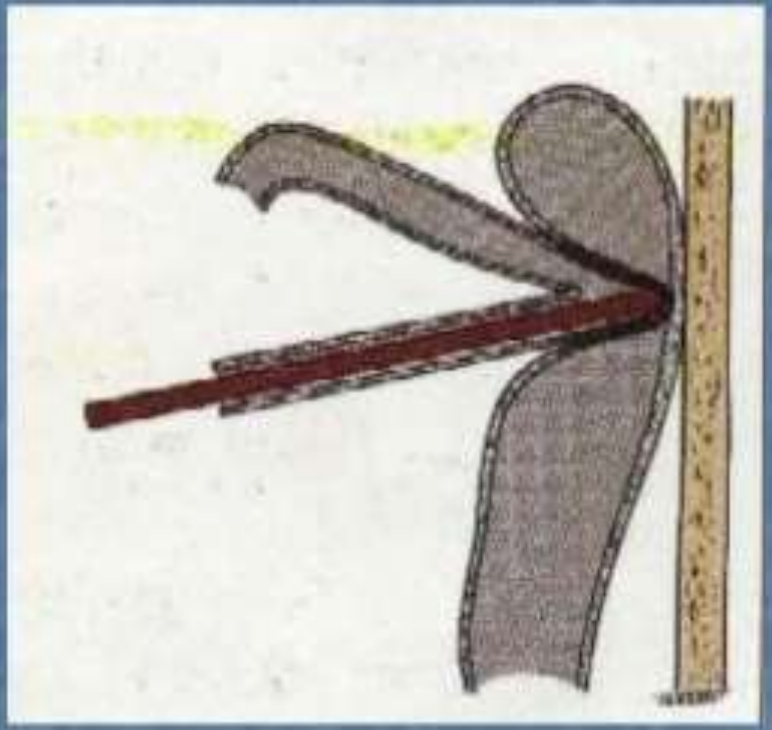


Patent la crimal drainage system. The cannula is placed with ease, and most of the irrigation fluid passes into the nose .

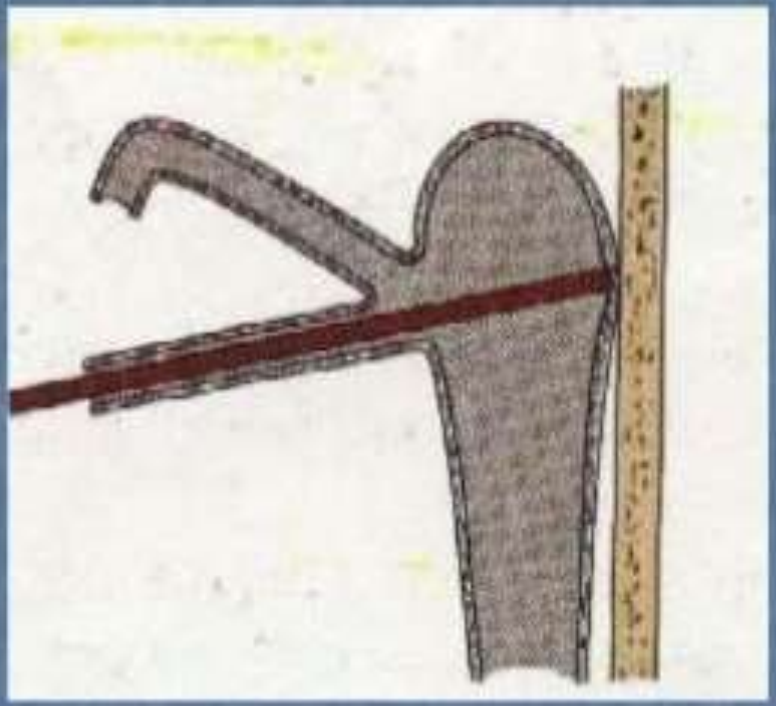
probing

- Hard stop:it comes to stop at medial wall of sac through which rigid lacrimal bone is felt...this indicates obstruction of nasolacrimal duct
- Soft stop:it comes to stop at junction of common canaliculus & lacrimal sac(lateral wall)....

  it indicates common canalicular block



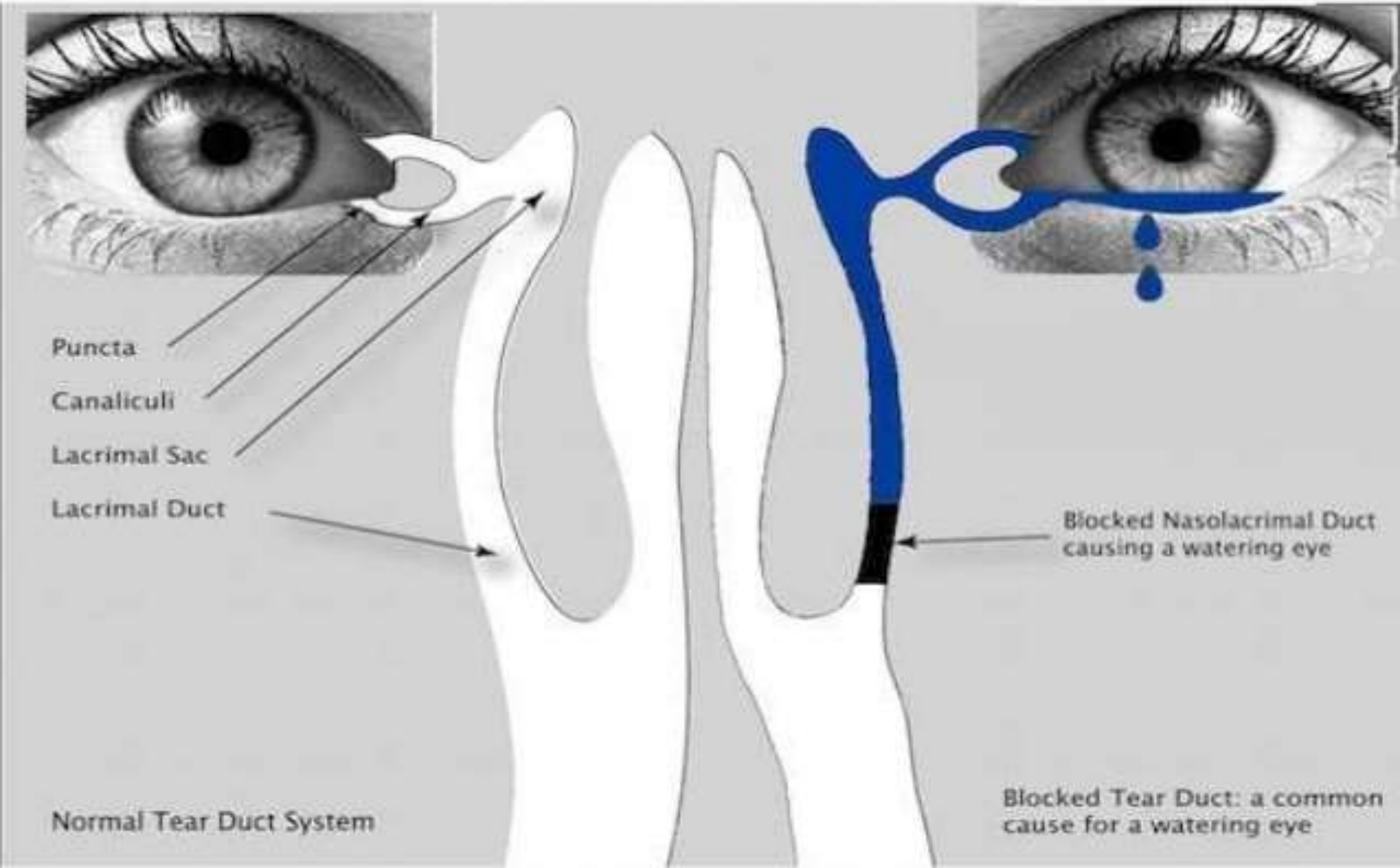
Soft Stop



Hard Stop

Contrast Dacryocystography (DCG)

- **Technique:** Plastic catheters are placed into one canaliculus in both eyes, 1ml lipidol is simultaneously injected through both catheters
- Water's view radiographs are taken, 5 minutes later, an erect oblique film is taken.
- **Results:** The site of obstruction is usually evident. Diverticula, filling defects due to stones and strictures can be diagnosed.


Puncta
Canaliculi
Lacrimal Sac
Lacrimal Duct
Blocked Nasolacrimal Duct causing a watering eye
Normal Tear Duct System
Blocked Tear Duct: a common cause for a watering eye

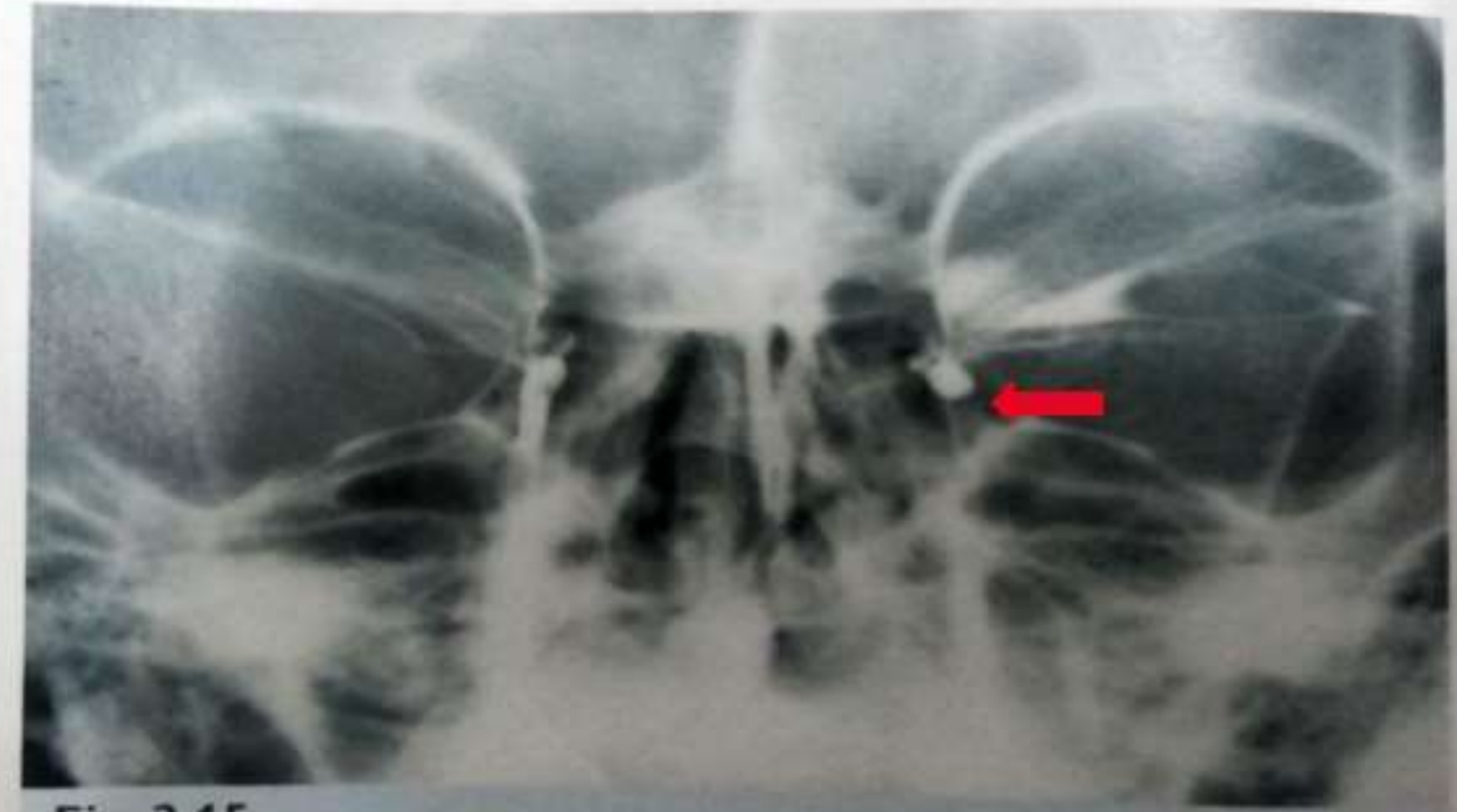


Fig. 2.15
Bilateral dacryocystogram. (**Right**) shows some irregularity of the common canaliculus, although contrast medium passes through an otherwise patent lacrimal system; (**left**) shows complete obstruction high in the sac (Courtesy of R. Welham)

CT/MRI

- Epiphora foll. Trauma with NLD obst.
  R/o orb. Rim/ max. #
- Infant with cystic mass at med. Can.
  Amniocele v/s meningocele
- Suspected malignancy

Functional tests

- To access functioning of lacrimal apparatus under physiologic conditions
- Performed only when there is no evidence of obstruction in anatomical tests

- Flourescein dye disappearance test
- Scintigraphy
- Jones dye test I

Fluorescein dye disappearance test

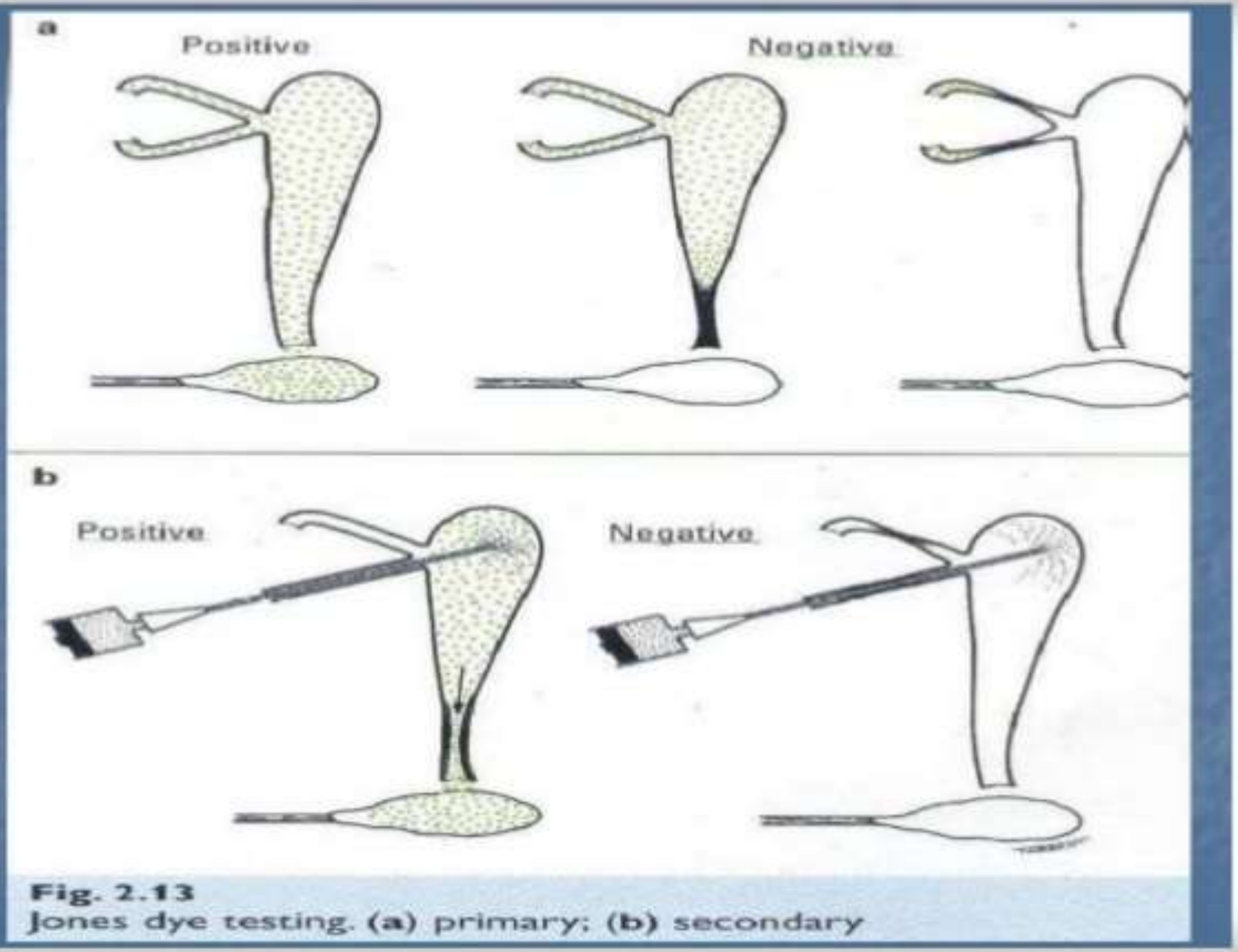


Fig. 2.13
Jones dye testing. **(a)** primary; **(b)** secondary

Lacrimal scintillography

- Scintillography is used to assess the lacrimal drainage system under physiological conditions.
- **Technique:** Tchnetium-99 is delivered by a micropipette to the inferior conjunctival sac. The tracer is imaged using a gamma camera.


Thank You!