

LACRIMAL APPARATUS



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□ Lacrimal apparatus consists of-

- a) main lacrimal gland

- b) accessory lacrimal gland
- c) lacrimal passage-puncta, canaliculi,
lacrimal sac
nasolacrimal duct



- ❑ Lacrimal gland is formed from 8 cuneiform epithelial buds which grow by the end of 2nd month of fetal life from superolateral side of conjunctival sac
- ❑ Nasolacrimal sac, nasolacrimal duct and canaliculi develop from ectoderm of nasolacrimal furrow

Lacrimal gland-

main lacrimal gland is situated in fossa for lacrimal gland.

□ It is divided into two parts-

superior orbital part

inferior palpebral part

□ Orbital part is larger, consists of 2 surfaces, 2 borders, 2 extremities.

□ Palpebral part is $\frac{1}{3}$ rd the size of orbital part and situated upon the course of ducts of orbital part.

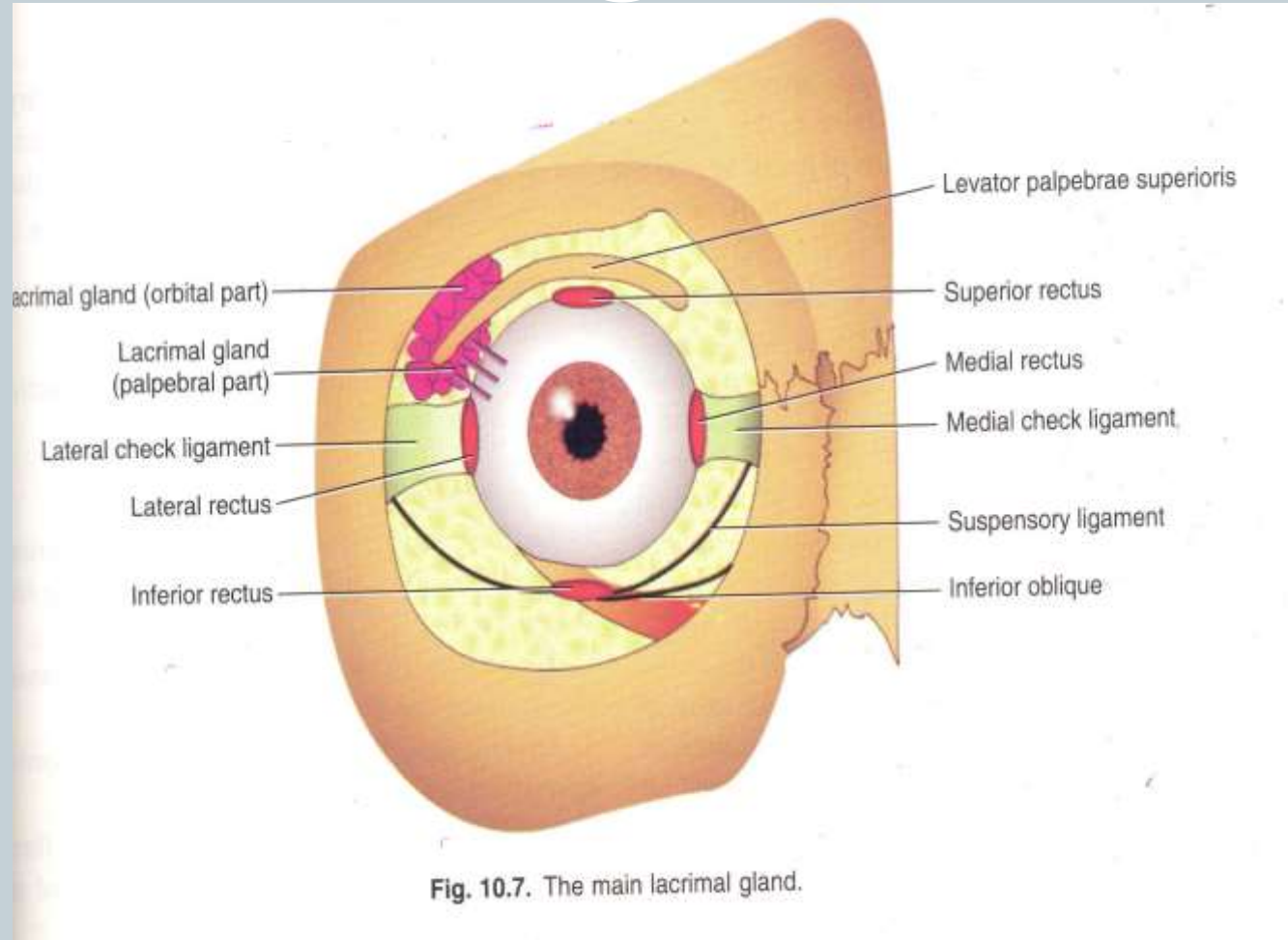


Fig. 10.7. The main lacrimal gland.

□ Ducts of lacrimal gland-

10-12 ducts pass from main lacrimal gland to open in lateral part of superior fornix. 1-2 ducts from lateral part of inferior fornix.

- All pass through the palpebral part. So excision of palpebral part accounts for excision of entire gland, as far as secretory function of the gland is concerned.

Structure of the lacrimal gland-

- Tubuloalveolar in nature
- Consists of 3 parts- glandular
- fibrovascular
- stroma
- Glandular-consists of acini and ducts, arranged in lobes and lobules, separated from each other by fibrovascular septa.
- Acini are lined by single layer of pyramidal cells which are separated from basement membrane by myoepithelial cells.

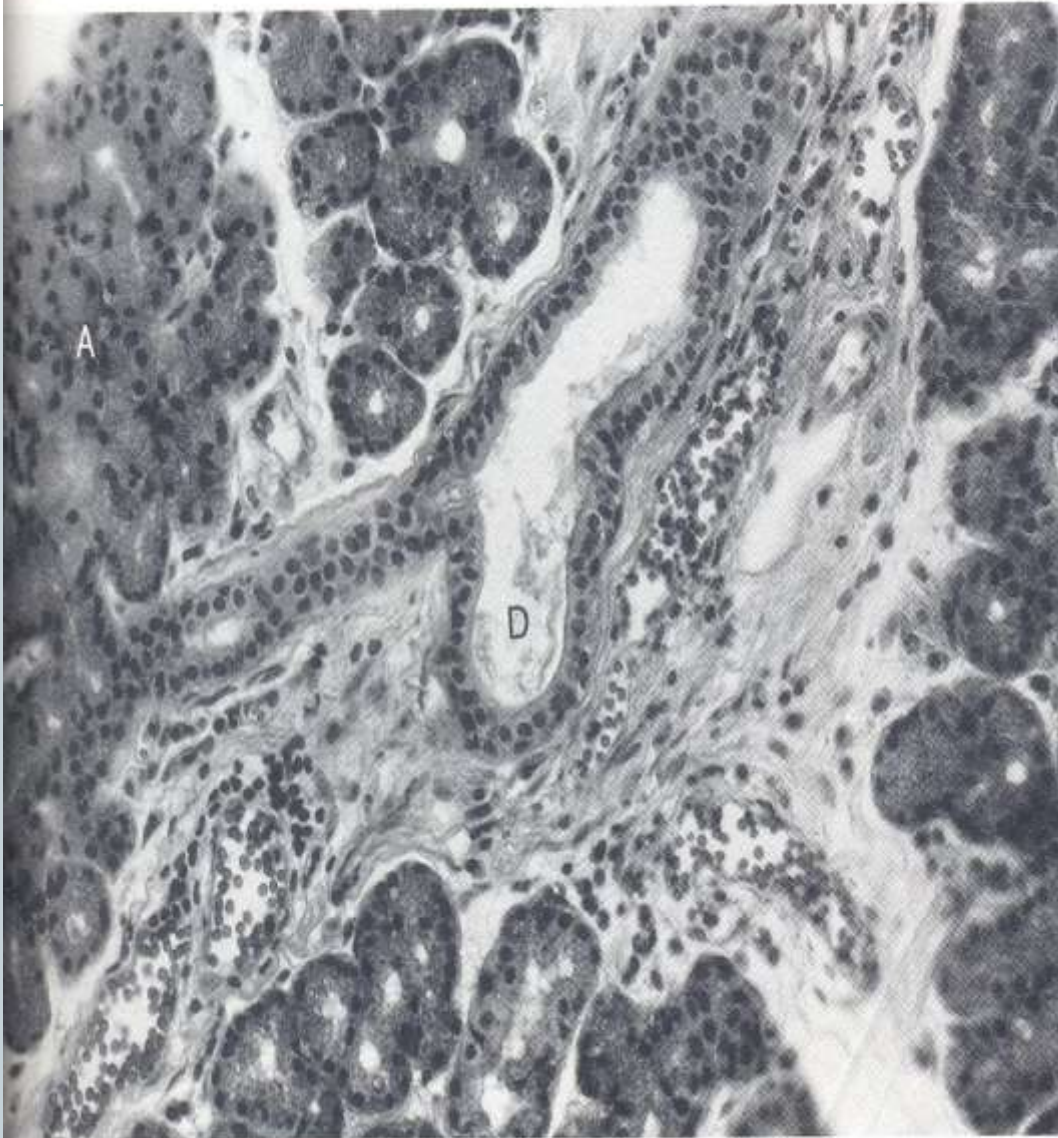
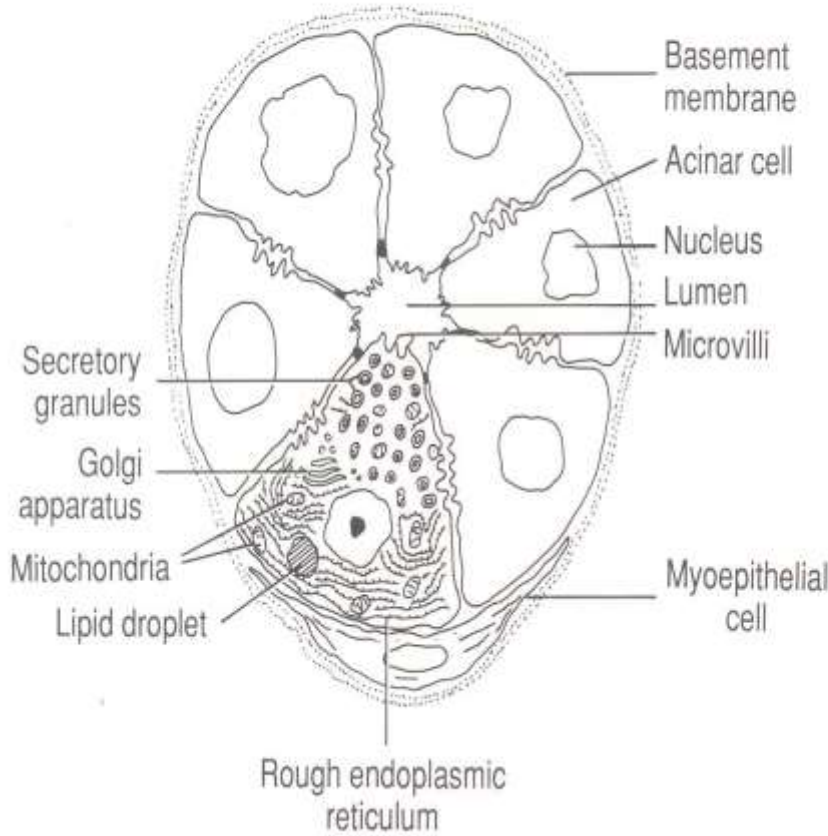
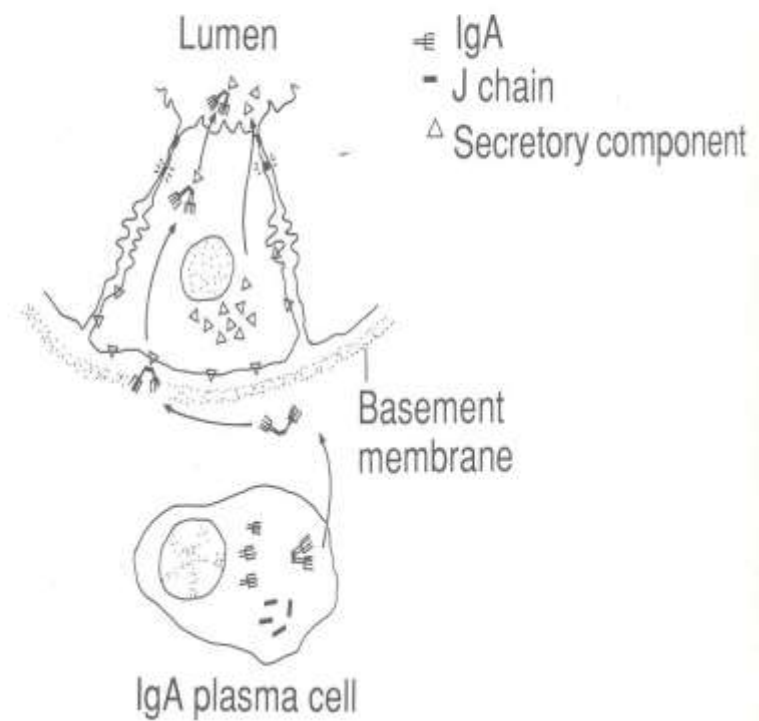


Fig. 2.57 Light micrograph of the human lacrimal gland. A = lacrimal gland acini; D = lacrimal ductule. Note the highly vascular stroma of the gland.

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(a)



(b)

- Ducts are lined by 2 layers of epithelium-
- inner cylindrical cells
- flattened outer layer of cells
- Nucleus is central
- stroma – consists of elastic tissue, lymphoid tissue, plasma cells, rich nerves and vessel terminals.
- Accessory lacrimal glands – these are
 - glands of Krause
 - glands of wolffing
 - rudimentary accessory glands

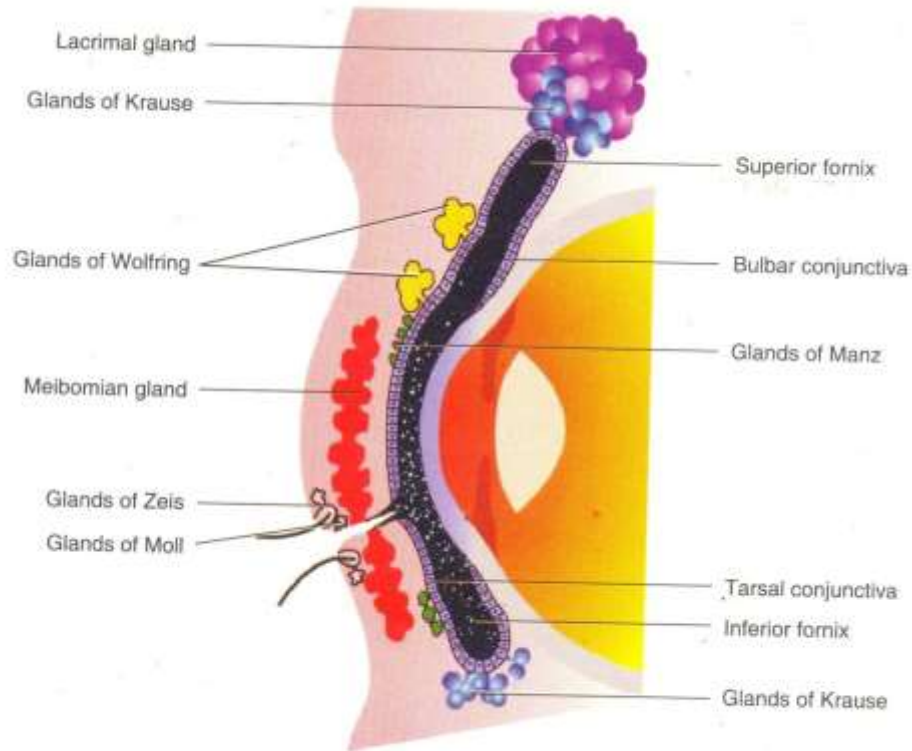


Fig. 10.1. Parts of conjunctiva and conjunctival glands.

Blood supply

- Arterial- lacrimal ar a branch of ophthalmic ar.
- Venous – lacrimal vein which joins the ophthalmic vein.
- Lymphatic drainage- they drain along the conjunctival drainage and then into preauricular lymph nodes.

Nervous supply –

- sensory – lacrimal
- sympathetic- carotid plexes of cervical sympathetics
- Secretomotor – superior salivatory nucleus

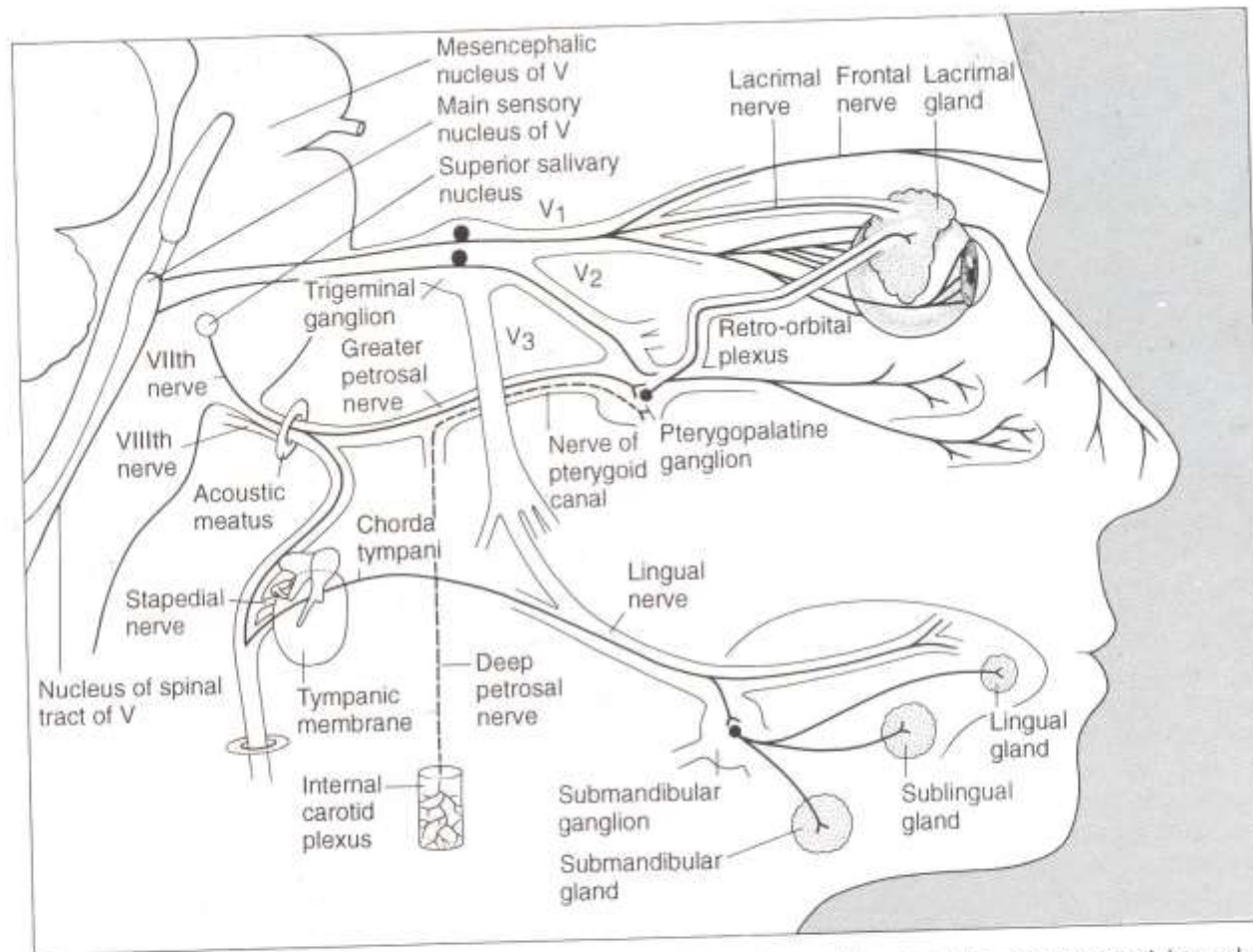
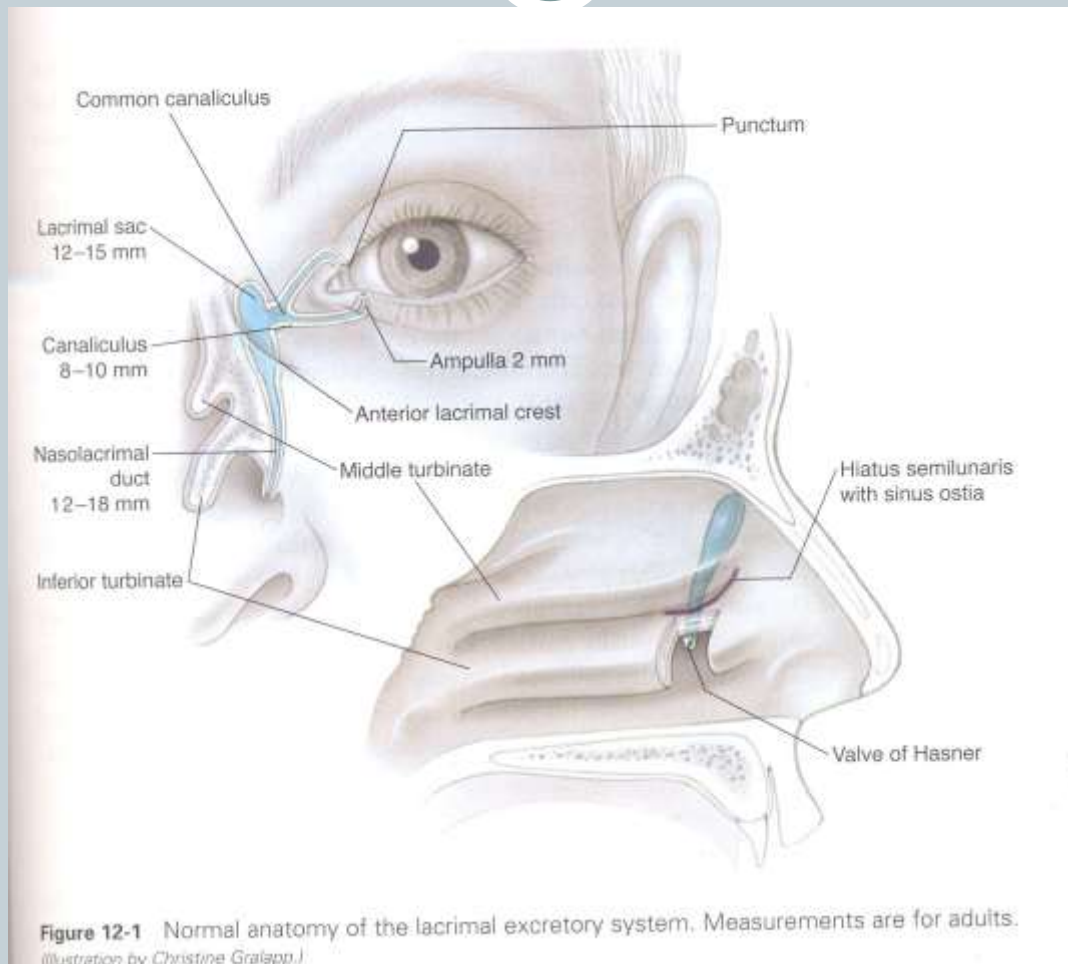


Fig. 2.62 The lacrimal reflex arc (after Kurihashi). The afferent path is formed by the first and second branches of the trigeminal nerve. The efferent path proceeds from the lacrimal nucleus, near the superior salivary nucleus, through the geniculate ganglion, the greater superficial petrosal nerve and the nerve of the foramen rotundum (where it is joined by sympathetic fibres of the deep petrosal nerve). The nerve passes to the pterygopalatine ganglion where it synapses with third order neurones which rejoin the maxillary nerve to supply the lacrimal gland via fibres which form the retro-orbital plexus of nerves. These carry parasympathetic and VIPergic nerve fibres to the gland.

- Puncta are small round openings situated on summit of elevation called papilla lacrimalis near medial end of lid margin.
- Upper punctum is 6mm and lower punctum is 6.5mm lateral from inner canthus.
- Punctum are surrounded by ring of dense fibrous tissue which keeps them patent.
- Lacrimal canaliculli – they join puncta to lacrimal sac.
- 0.5 mm in diameter.



□ They have 2 parts- vertical 2mm

□ horizontal 8mm

□ Between 2 parts there is slight dilatation called ampulla.

□ They pierce lacrimal fascia and join to form common canaliculus, which open onto diverticulum of lacrimal sac called lacrimal sinus of maier.

□ The point of opening into the sac lies 2.5mm from the sac's apex.

□ **Structure of lacrimal canaliculi-**

Lined by Stratified squamous epithilium.

Corium rich in elastic tissue.

Fibers of orbicularis which surround the corium are called pars lacrimalis.

□ **Lacrimal sac-**

lies in lacrimal fossa,

formed by lacrimal bone and frontal process of maxilla.

Bounded anteriorly and posteriorly by lacrimal crests.

it is enclosed by lacrimal fascia

It is 15mm in length, 5-6mm breadth, capacity of 20cmm.

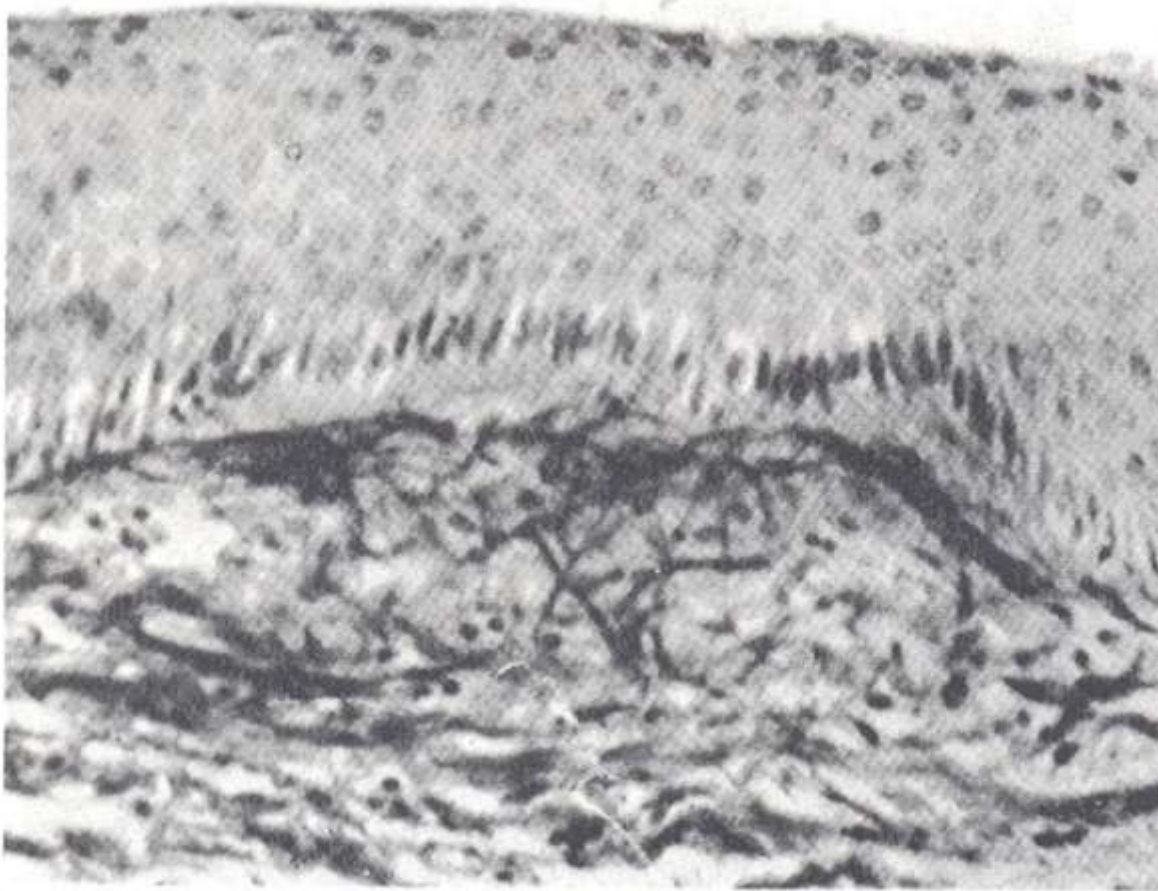


Fig. 2.65 Portion of the wall of the canalculus. Note the elastic fibres deep to the epithelium.

□ Its has 3 parts- fundus 3-5mm

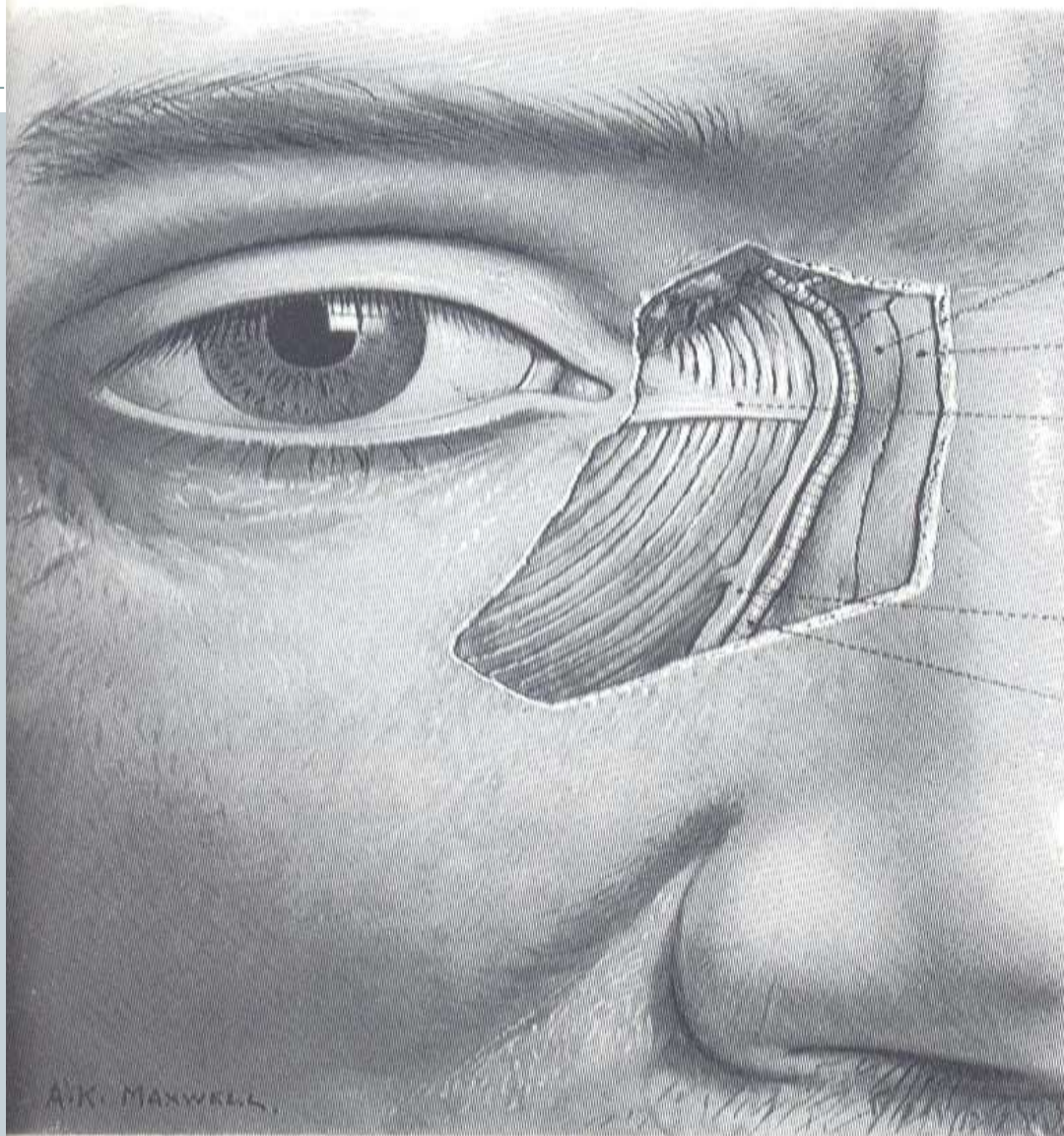
□ body 10-12mm

□ neck

□ Middle part of lateral wall of sac has diverticulum called lacrimal sinus of maier into which the common canaliculi open.

□ **Relations of lacrimal sac**

Medially- related to anterior ethamoidal sinus in upper part, middle meatus in lower part.



Frontal process

Nasal bone

Medial palpebral ligament

Angular vein
Angular artery

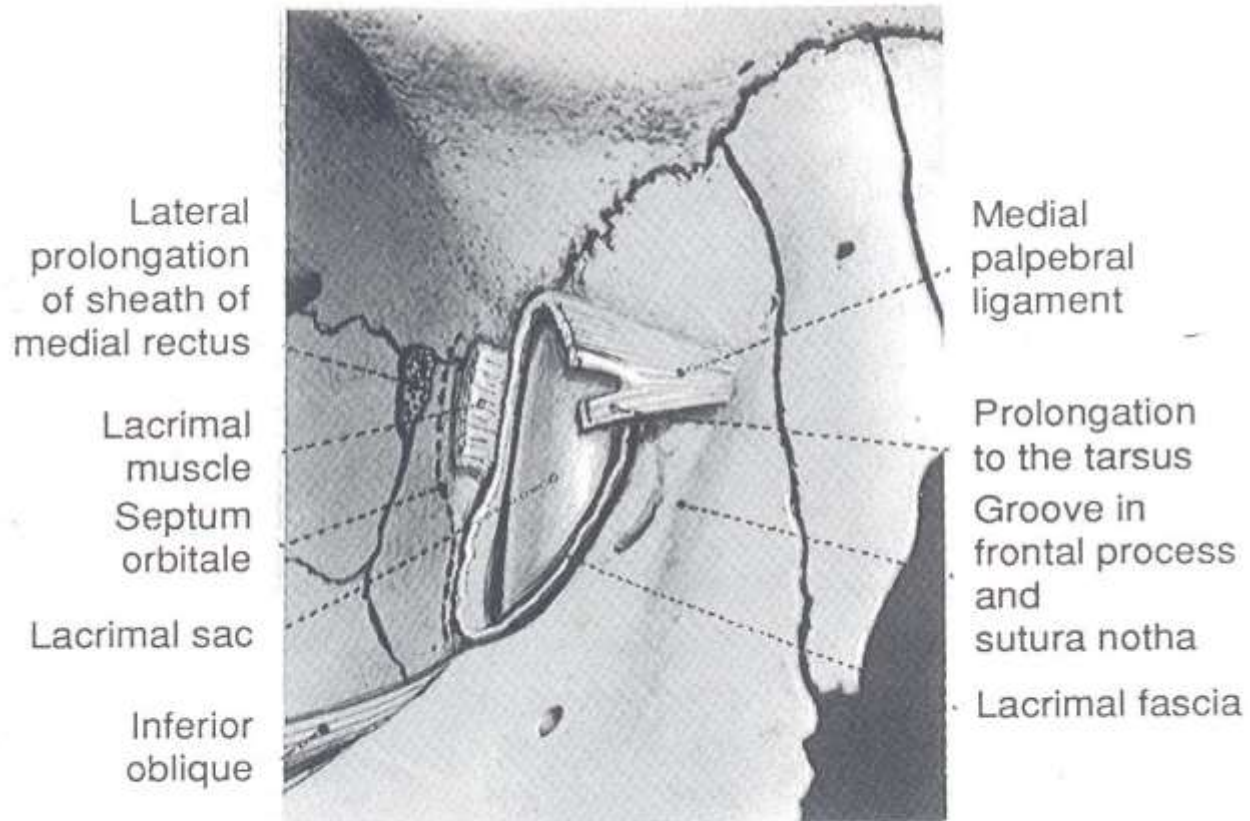


Fig. 2.67 The relations of the lacrimal sac. (Wolff's dissection.)

□ Anterolateral relations – from deep to superficial are
lacrimal fascia

lacrimal fibers of orbicularis oculi
medial palpebral ligament
palpebral fibers of orbicularis
angular vein
skin

□ Posterior relations-

lacrimal fascia
fibers of lacrimal part of orbicularis
Septum orbitale

Nasolacrimal duct

- It is 18mm in length and 3mm in diameter.
- Upper end is narrowest part and it is a continuation of neck of lacrimal sac.
- Direction is downwards, backwards and laterally.
- Externally it is represented by line joining the inner canthus to the ala of the nose.
- It consists of 2 parts- intraosseous part
12.5mm
- intranasal part 5.5mm

- Intraosseous part lies in bony lacrimal canal formed anterolaterally by maxilla and posteromedially by lacrimal bone and inferior nasal concha.
- Nasolacrimal canal lies lateral to middle meatus, produce ridge in maxillary antrum.
- Therefore lesions in maxillary sinus often cause epiphora.
- Intranasal part lies in the mucous membrane of lateral part of nose and open into inferior meatus.
- Valve of hasner situated at lower end of nasolacrimal duct and prevents entry of air into sac when air is blown out of closed nose.

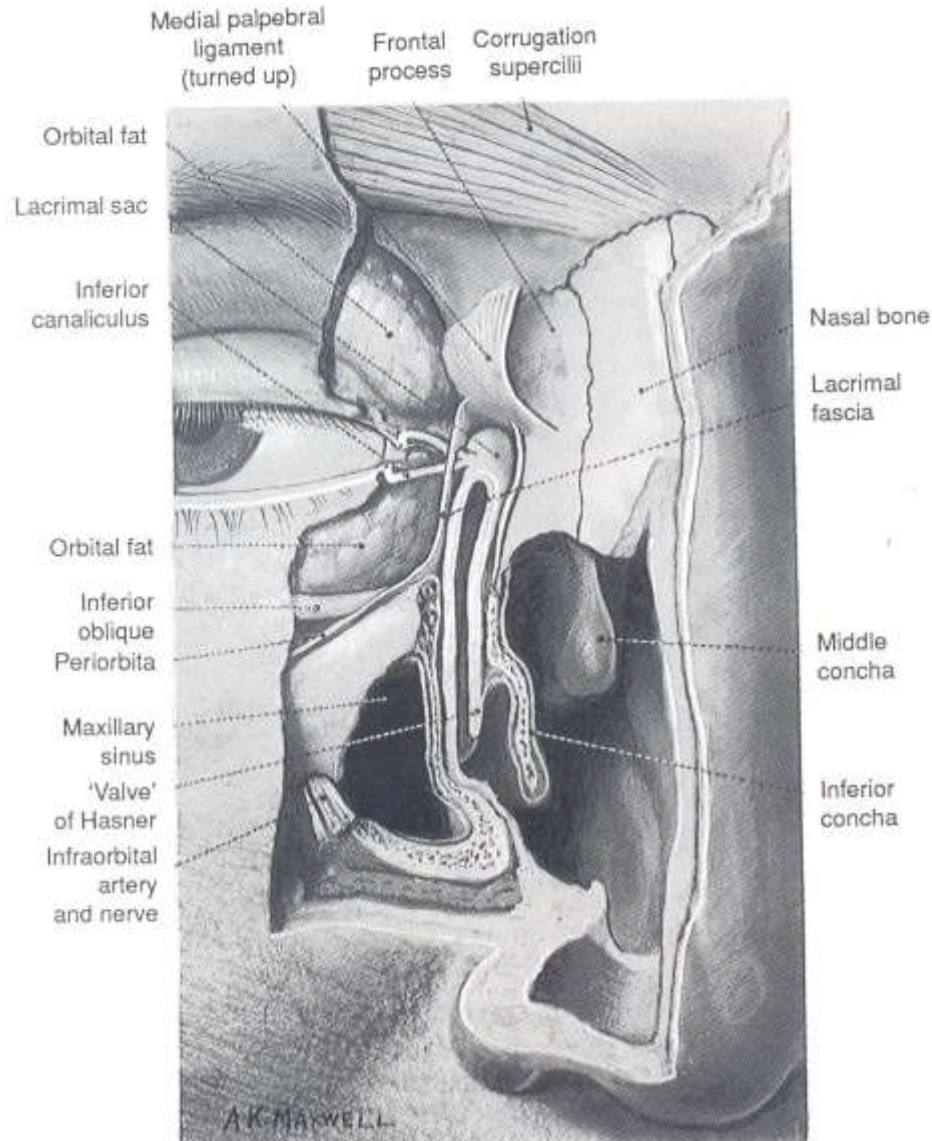


Fig. 2.68 Dissection to show the relations of the lacrimal sac and the nasolacrimal duct from the front. (Wolff's preparation.)

Structure of the lacrimal sac and nasolacrimal duct(NLD)

- Two layers of epithelium-
- Superficial non ciliated columnar epithelium and goblet cells
- Deep layer of flattened cells
- Subepithelial tissue consists of lymphocytes
- Fibro elastic tissue of canaliculli becomes continuous with the lacrimal sac.
- Plexus of vessels are well developed around nasolacrimal duct and their engorgement can lead to NLD blocked and epiphora.

Blood supply of lacrimal passage-

- Arterial- superior ,inferior palpeberal arteries, angular ar, infraorbital ar,nasal br of sphenopalatine ar.
- Venous drainage- angular vein and infraorbital vein from above and nasal vein from below.
- Lymphatics- submandibular and deep cervical glands.

Nervous supply –infra trocheolar and antero superior alveolar nerve.

Test for lacrimal gland secretion-Schirmer test

Tests for lacrimal pump

- Regurgitation test
- Florescent dye disappearance test (FDDT)
- Probing- hard stop
- soft stop
- Lacrimal syringing test- saline is pushed in lacrimal sac through lower punctum.if fluid regugitates through same punctum,it indicates obstuction in same canaticulus.
- If through upper punctum,obstuction in lacrimal sac, NLD or common canaliculus .

- The test is repeated through upper punctum , free passage of saline confirms blockage in lower canaliculus while regurgitation through the same punctum indicates block in both canaliculli.
- Jones dye test I -
 - differentiate between partial obstruction of lacrimal passages and primary hyper secretion of tears.
- Jones dye test II –
 - Performed when primary test is negative.
 - Positive test suggests epiphora due to partial obstruction.
 - Negative test indicate lacrimal pump failure.

- Dacryocystography – valuable in patients of epiphora due to mechanical obstruction as well as functional block.
- Radionucleotide dacryocystography- non invasive technique to assess the functional efficiency of lacrimal passage apparatus

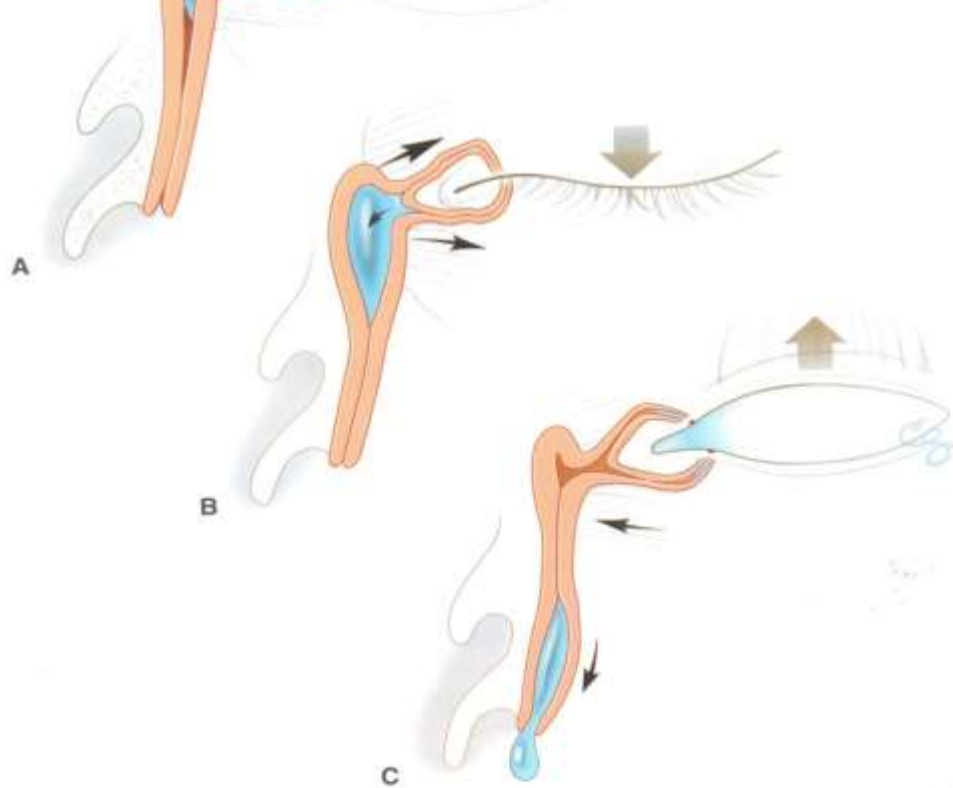


Figure 12-2 Lacrimal pump. **A**, In the relaxed state, the puncta lie in the tear lake. **B**, With eyelid closure, the orbicularis contracts. The pretarsal orbicularis squeezes and closes the canaliculi. The preseptal orbicularis, which inserts into the lacrimal sac, pulls the lacrimal sac open, creating a negative pressure that draws the tears into the sac. **C**, With eyelid opening, the orbicularis relaxes, and the elastic forces create a positive pressure in the sac that propels the tears down the duct. (Illustration by Christine Galapp.)

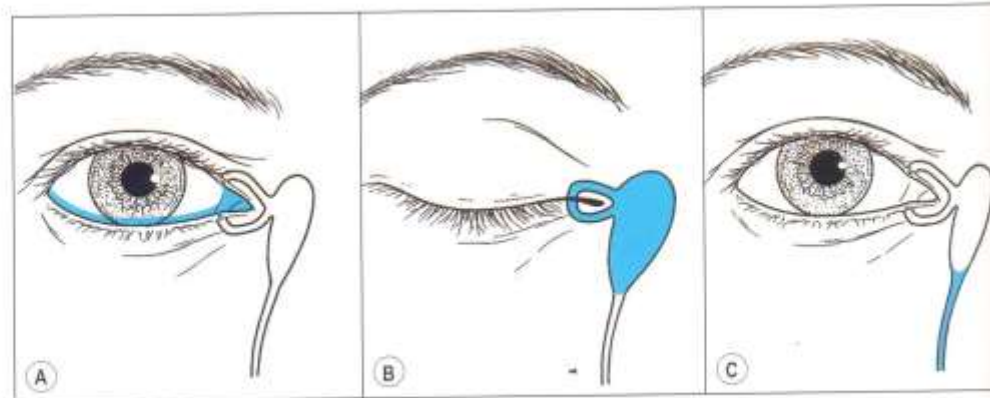
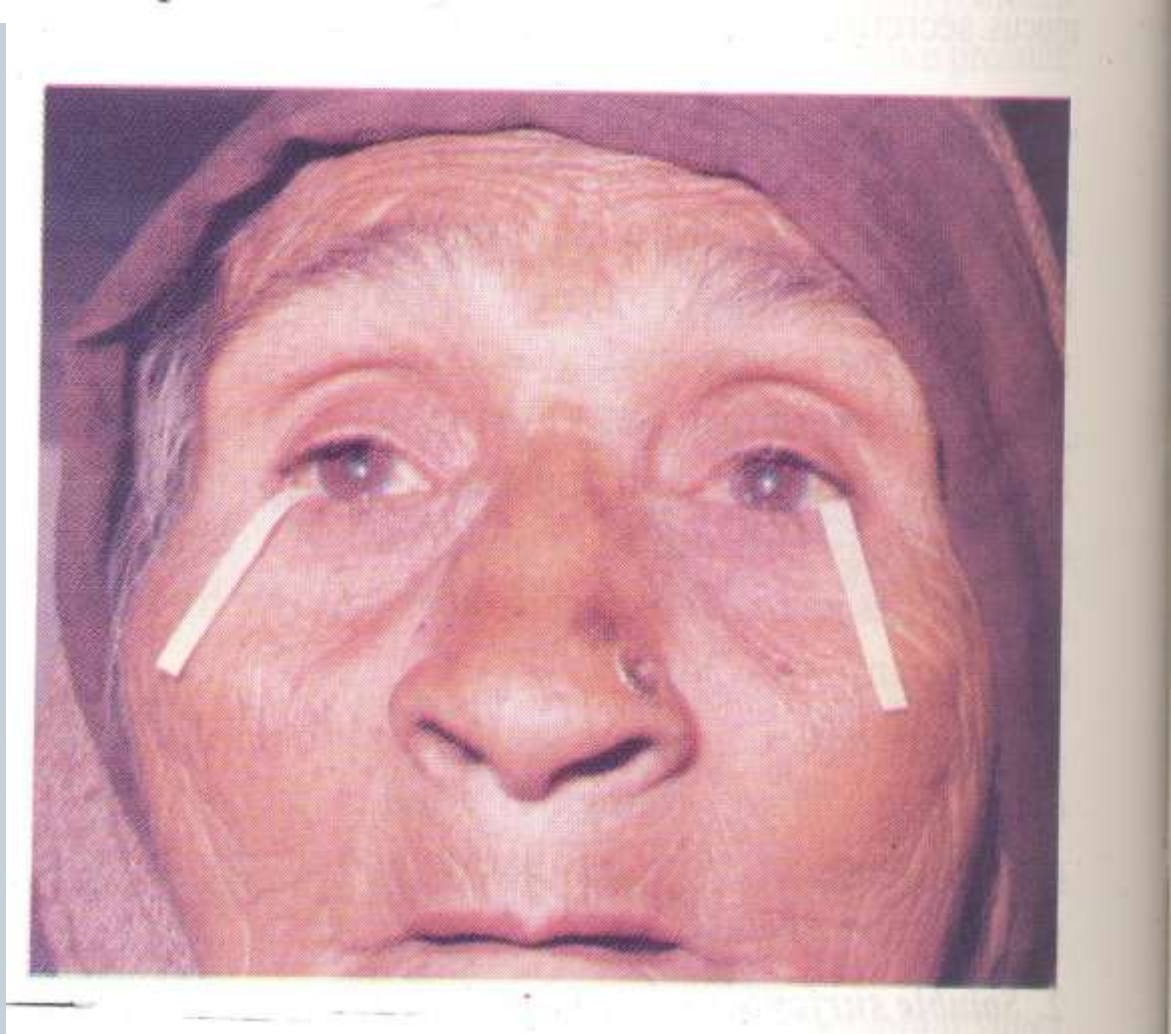


Fig. 2.2 Physiology of the lacrimal drainage system



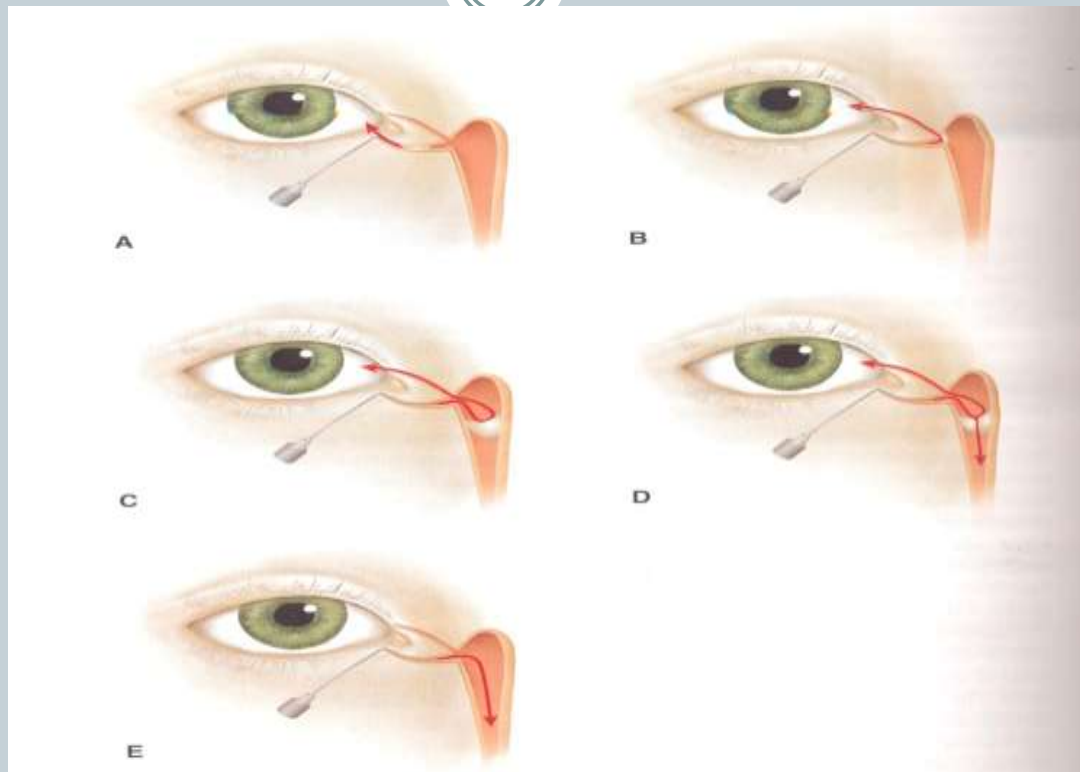


Figure 13-7 Lacrimal drainage system irrigation. **A**, Complete canalicular obstruction. The cannula is advanced with difficulty, and irrigation fluid refluxes from the same canaliculus. **B**, Complete common canalicular obstruction. A "soft stop" is encountered at the level of the lacrimal sac, and irrigated fluid refluxes through the opposite punctum. **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 refluxes through the opposite punctum. Often, the refluxed fluid contains mucus and/or pus. With an intact valve of Rosenmüller, lacrimal sac distension without reflux of irrigation fluid may be encountered. **D**, Partial nasolacrimal duct obstruction. The cannula is easily placed, and irrigation fluid passes into the nose as well as refluxing through the opposite punctum. **E**, Patent lacrimal drainage system. The cannula is placed with ease, and most of the irrigation fluid passes into the nose. (Illustration by Cyndie C. H. Woolley)

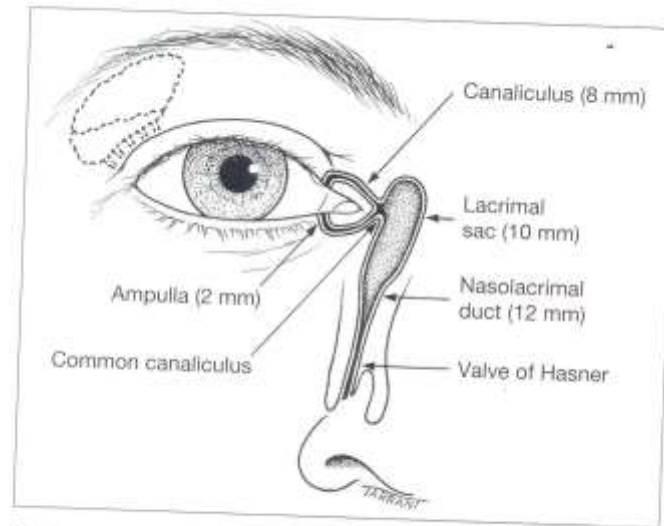


Fig. 2.1 Anatomy of the lacrimal drainage system

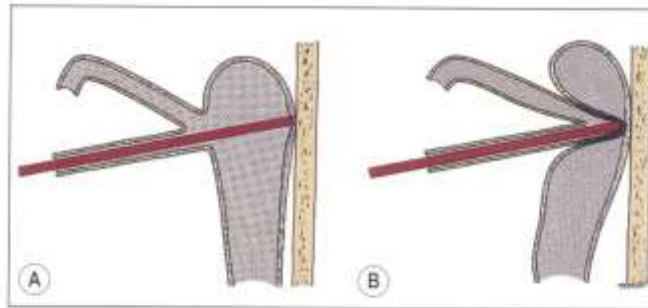


Fig. 2.6 Possible results of probing. **(A)** Hard stop; **(B)** soft stop

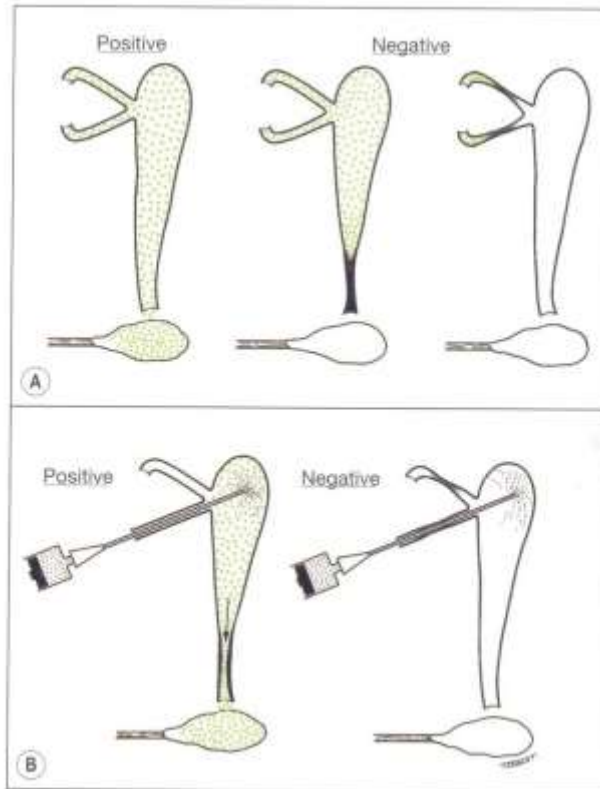


Fig. 2.7 Jones dye testing. (A) Primary; (B) secondary.

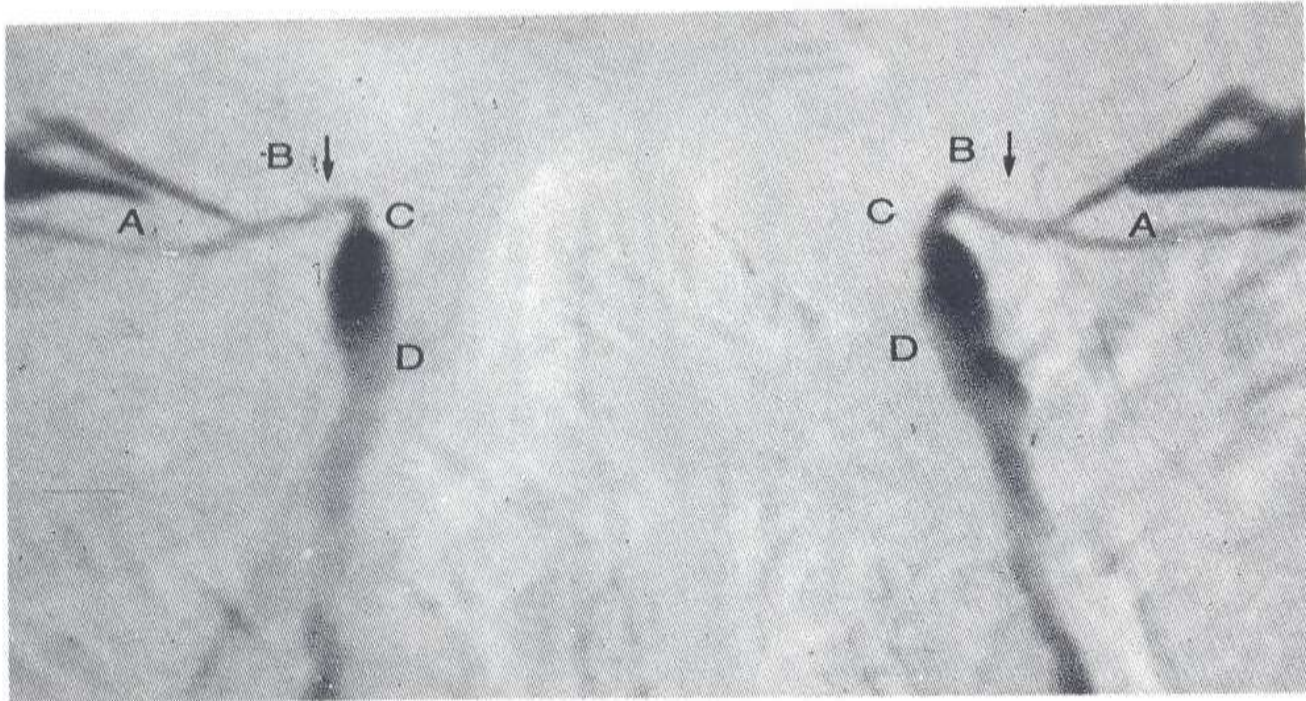


Fig. 2.70 Dacryocystogram demonstrating the nasolacrimal system using a subtraction technique. A = common canaliculi; B (arrow) = common canaliculus; C = upper pole of the lacrimal sac; D = nasolacrimal duct. (Courtesy of Dr Glyn Lloyd.)

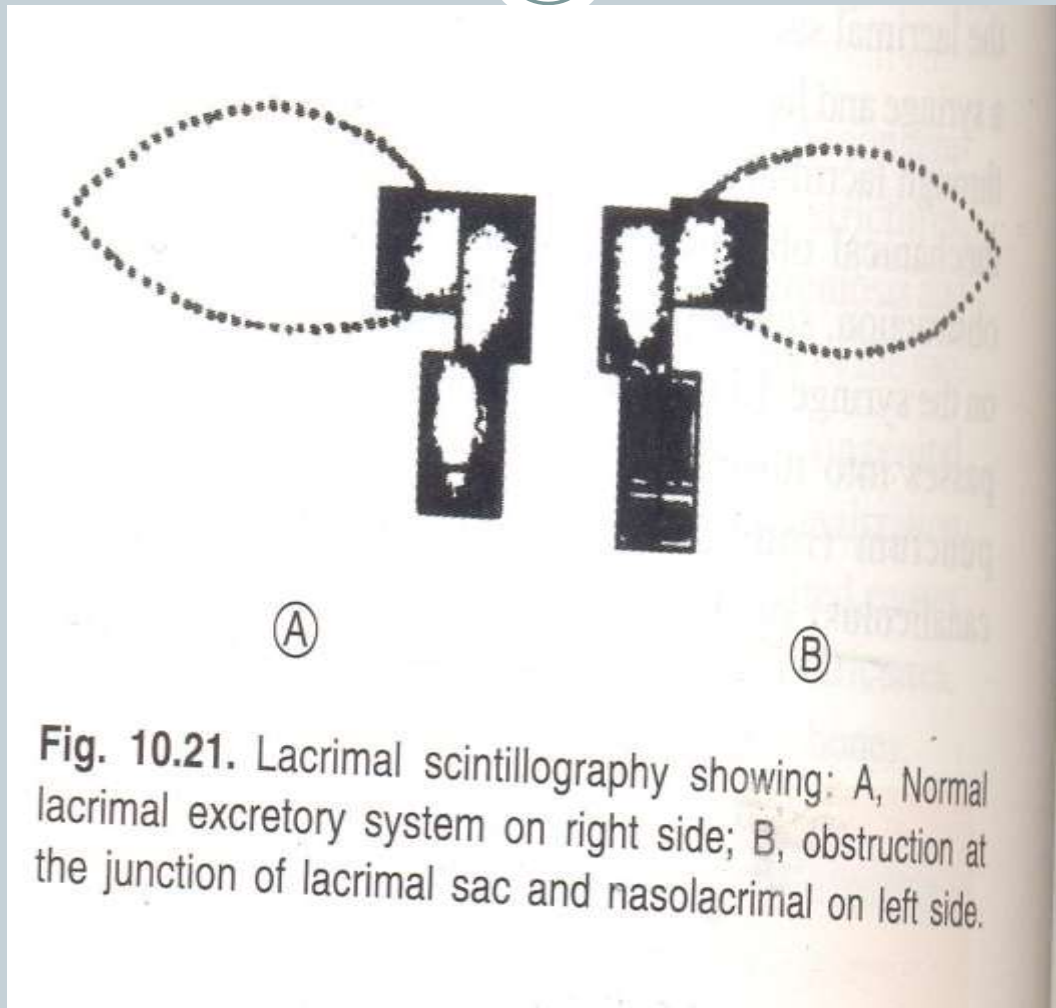


Fig. 10.21. Lacrimal scintillography showing: A, Normal lacrimal excretory system on right side; B, obstruction at the junction of lacrimal sac and nasolacrimal on left side.



THANK YOU