Lacrimal drainage system

Anatomy

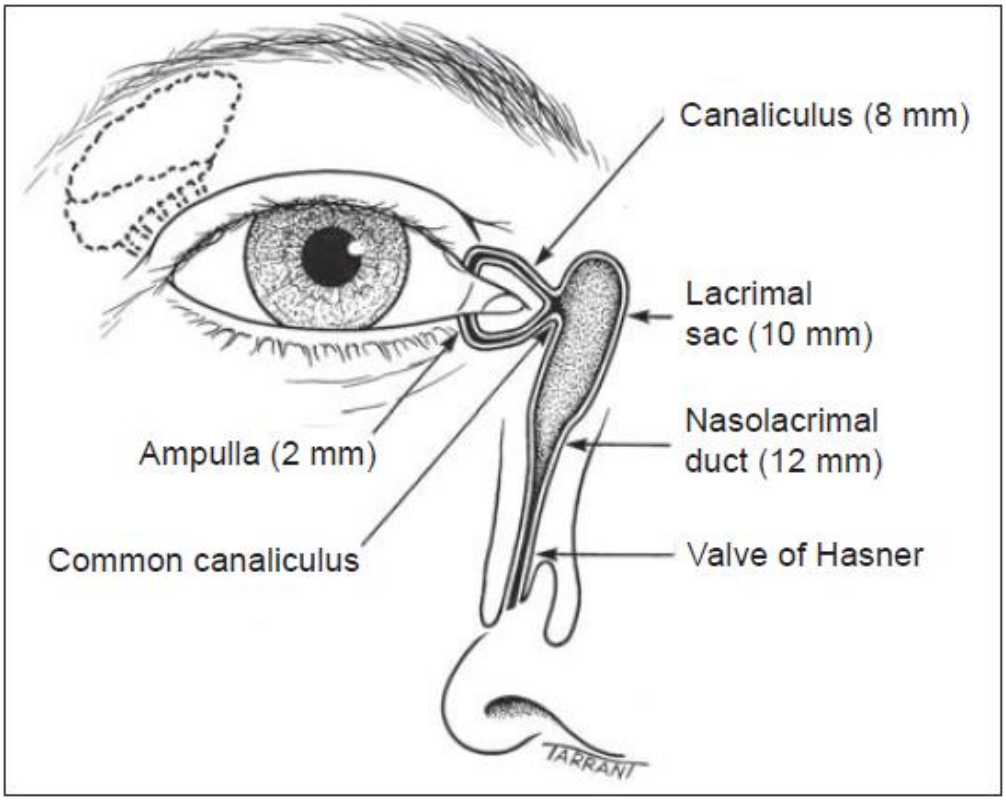
The lacrimal drainage system consists of the following structures:

1-The puncta are located near the medial end of each eyelid. Normally they face slightly posteriorly and can be inspected by everting the medial aspect of the lids.

2-The canaliculi pass vertically from the lid margin for about 2 mm **(ampullae).** They then turn medially and run horizontally for about 8 mm to reach the lacrimal sac. The superior and inferior canaliculi usually (>90%) unite to form the common canaliculus, which opens into the lateral wall of the lacrimal sac. Uncommonly, each canaliculus opens separately into the sac.

3- The lacrimal sac is about 10 mm long and lies in the lacrimal fossa between the anterior and posterior lacrimal crests. The lacrimal bone and the frontal process of the maxilla separate the lacrimal sac from the middle meatus of the nasal cavity.

4- The nasolacrimal duct is about 12mm long and is the inferior continuation of the lacrimal sac. It descends and angles slightly laterally and posteriorly to open into the inferior nasal meatus, lateral to and below the inferior turbinate. The opening of the duct is partially covered by a mucosal fold **(valve of Hasner)**.



Physiology

Tears flow along the upper and lower marginal strips, then entering the upper and lower canaliculi by a combination of capillarity and suction.

Causes of a watering eye

Epiphora is the overflow of tears at the eyelid margin; strictly, it is a sign rather than a symptom. There are two mechanisms:

• **Hypersecretion** secondary to anterior segment disease such as dry eye or inflammation. In these cases watering is associated with symptoms of the underlying cause, and treatment is usually medical.

• **Defective drainage** due to a compromised lacrimal drainage system; this may be caused by:

○ *Malposition* (e.g. ectropion) of the lacrimal puncta.

○ *Obstruction* at any point along the drainage system.

○ *Lacrimal pump failure*, which may occur secondarily to lower lid laxity or weakness of the orbicularis muscle (e.g. facial nerve palsy).

Evaluation of Epiphora

Clinical examination

The main parts of clinical examination are **(1) General *External* examination (2) Slit lamp examination** and **(3) Lacrimal irrigation**

(1) GENERAL EXTERNAL EXAMINATION

1- Eyelids for evidence of ectropion, trichiasis, eversion of lower punctum and lower lid laxity.

2- The lacrimal sac should be palpated. Punctal reflux of mucopurulent material on compression is indicative of a mucocele (a dilated mucus-filled sac) with a patent canalicular system, but with an obstruction either at or distal to the lower end of the lacrimal sac. In acute dacryocystitis palpation is painful and should be avoided. Rarely, palpation of the sac will reveal a stone or tumour.

(2) SLIT LAMP EXAMINATION

1-The puncta for stenosis ,malposition and Punctal obstruction by an eyelash or a fold of redundant conjunctiva (conjunctivochalasis).

2- The marginal tear strip of both eyes should be examined because many patients with watering do not have obvious overflow of tears but merely show a high marginal tear strip.

3- A large caruncle displacing the punctum away from the globe.

4-A pouting punctum is typical of canaliculitis.

5-Fluorescein disappearance test

Is performed by instilling fluorescein drops into both conjunctival fornices; normally, little or no dye remains after 5 minutes. Prolonged retention is indicative of inadequate lacrimal drainage

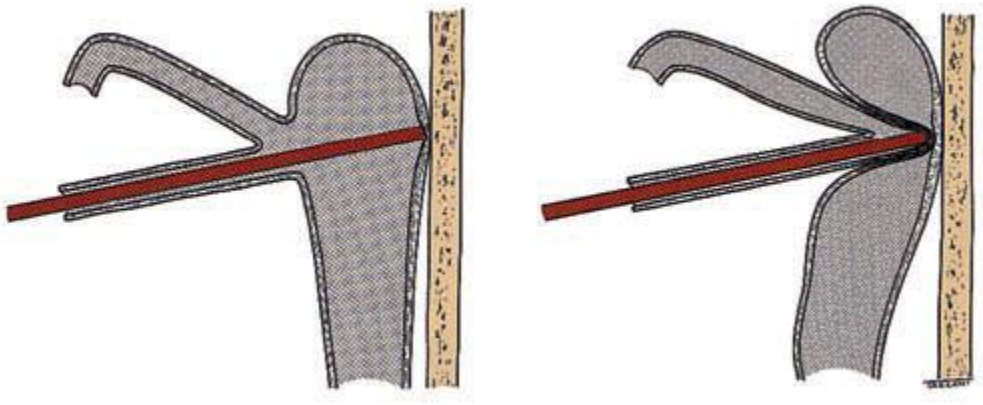
(3) Lacrimal irrigation

A drop of topical anaesthetic is instilled into the conjunctival sac and a straight lacrimal cannula on a 3 ml saline-filled syringe is inserted into the lower punctum, advanced a few millimetres, following the contour of the canaliculus, an attempt is made to touch the medial wall of the lacrimal sac and the lacrimal bone.The cannula can come either to ***hard stop*** or to ***soft stop***.

Hard stop occurs if the cannula enters the lacrimal sac, coming to a stop at the medial wall of the sac, through which can be felt the rigid lacrimal bone. This excludes complete obstruction of the canalicular system. If saline passes into the nose and throat, when it will be tasted by the patient, a patent lacrimal system is present. Failure of saline to reach the throat is indicative of total obstruction of the nasolacrimal

Soft stop is a spongy feeling as the cannula presses the soft tissue of the common canaliculus and the lateral wall against the medial wall of the sac and the lacrimal bone behind it. This indicates that the lacrimal sac was not entered due to an obstruction of canalicular system.

Hard stop soft stop



Others tests

1-Jones dye testing Dye testing is indicated only in patients with suspected partial obstruction of the drainage system (i.e. Epiphora is present, but there is no punctal abnormality and the patient tastes saline in his or her throat on irrigation). They are done by using fluorescein dye.

2- Contrast dacryocystography involves the injection of radio-opaque contrast medium into the canaliculi followed by the capture of magnified images. Indications include confirmation of the precise site of lacrimal drainage obstruction.

3- ***Nuclear lacrimal scintigraphy*** assesses tear drainage under physiological conditions , by labelling the tears with a radioactive substance and tracking their progress.

4- CT and MRI

Occasionally employed in the assessment of lacrimal obstruction, for instance in the investigation of paranasal sinus or suspected lacrimal sac pathology.

5- Internal nasal examination

Assessment of the nasal cavity, especially with endoscopy, can be invaluable in the detection of obstructions such as nasal polyps or a deviated septum.

Acquired nasolacrimal duct obstruction

Causes

- Idiopathic stenosis – by far the most common.
- Naso-orbital trauma, including nasal and sinus surgery.
- Granulomatous disease such as Wegener granulomatosis and sarcoidosis.
- Infiltration by nasopharyngeal tumours.

Treatment

- Conventional (external approach) or Endoscopic dacryocystorhinostomy (DCR) for complete obstruction.
- Probing and intubation, stent insertion and balloon dacryocystoplasty for partial obstruction.

Congenital nasolacrimal duct obstruction

The lower end of the nasolacrimal duct, in the region of the valve of Hasner, is the last portion of the lacrimal drainage system to canalize, with complete patency most commonly occurring soon after birth.

Clinical features

Presentation is within a few weeks of birth, with epiphora.

Examination: gentle pressure over the lacrimal sac may cause mucopurulent reflux.

Differential diagnosis includes other congenital causes of a watering eye, such as punctal atresia; it is important to exclude congenital glaucoma, chronic conjunctivitis (e.g. chlamydial), keratitis and uveitis.

Treatment

1- Massage of the lacrimal sac increases the hydrostatic pressure and may rupture the membranous obstruction. To perform this manoeuvre, The index finger is initially placed over the common canaliculus to block reflux through the puncta and then massaged firmly downwards. Ten strokes are applied four times a day. Massage should be accompanied by lid hygiene; topical antibiotics should be reserved for superadded bacterial conjunctivitis.

2- Probing of the lacrimal system to manually overcome the obstructive membrane at the Hasner valve should be delayed until the age of 12 months because spontaneous canalization occurs in about 95%of the cases. Probing performed within the first 1–2 years of life has a very high success rate, but thereafter the efficacy decreases. The procedure should be carried out under a general anaesthetic. After probing, the lacrimal system is irrigated with saline. If saline can be recovered by aspiration from the pharynx, successful probing is confirmed. Postoperative steroid-antibiotic drops are used q.i.d. for up to 3 weeks. If, after 6 weeks, there is no improvement, repeat probing can be arranged. Nasal endoscopic monitoring of probing is recommended, especially for repeat procedures, to detect anatomical abnormalities and ensure correct probe alignment

Results are usually excellent and 90% of children are cured by the first probing and 6% by the second. Failure is usually the result of abnormal anatomy, which can usually be recognized by difficulty in passing the probe and subsequent non-patency of the drainage system on irrigation. If symptoms persist despite one to two technically satisfactory probings, temporary intubation with fine silastic tubes with or without balloon dilatation of the nasolacrimal duct may affect a cure. Patients who fail to respond to such measures can be treated later with dacryocystorhinostomy (DCR), provided the obstruction is distal to the lacrimal sac.

Congenital dacryocele (amniontocele)

Is a collection of amniotic fluid or mucus in the lacrimal sac caused by an imperforate Hasner valve.

Presentation is perinatal

Signs A bluish cystic swelling at or below the medial canthus, accompanied by epiphora . It should not be mistaken for an encephalocele which is characterized by a pulsatile swelling above the medial canthal tendon

Treatment is initially conservative but, if this fails probing should not be delayed.

Dacryocystitis

Infection of the lacrimal sac is usually secondary to obstruction of the nasolacrimal duct. It may be acute or chronic and is most commonly staphylococcal or streptococcal

Acute dacryocystitis

Presentation is with the subacute onset of pain in the medial canthal area, associated with epiphora
Signs: very tender tense red swelling at the medial canthus that may be associated with preseptal cellulitis . Abscess formation may occur
Treatment
1- Initial treatment involves the application of local warm compresses and oral antibiotics such as flucloxacillin or co-amoxiclav; ***irrigation and probing should not be performed***
2- Incision and drainage may be considered if pus points and an abscess is about to drain spontaneously.
3- DCR is usually necessary after the acute infection has been controlled.

Chronic dacryocystitis

Presentation is with epiphora, which may be associated with a chronic or recurrent unilateral conjunctivitis.
Signs: A painless swelling at the inner canthus caused by a mucocele and pressure over the sac results in reflux of mucopurulent material through the canaliculi.
Treatment involves DCR.