The Lacrimal System

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KEYWORDS

• Lacrimal system • Epiphora (tearing) • Nasolacrimal duct obstruction
• Dacryocystocele • Tear duct probe

KEY POINTS

- Normal tear production may not be noticed until after a few weeks of life.
- Nasolacrimal duct obstruction (NLDO) is common in neonates (6% of all newborns).
- Most NLDOs spontaneously resolve with conservative management (70% by 6 months and 90% by 12 months of age).
- Surgical intervention for NLDO is in general straightforward and has a high success rate.
- Most pediatric ophthalmologists can perform a simple probing in the office if the infant is referred by 12 months of age. General anesthesia is required for children who fail a simple probing or who are referred at an older age (>12 months).

DEFINITION AND ANATOMY

1. The lacrimal system consists of the following structures (**Fig. 1**):
   a. The lacrimal gland is a bilobed exocrine gland arising from the epithelial cells of the superotemporal conjunctiva, located in the lacrimal gland fossa of the frontal bone. The 2 lobes, the lacrimal and the orbital lobes, contain ducts that secrete the aqueous portion of the tear film and are separated anatomically by the lateral horn of the levator aponeurosis, with the palpebral lobe located more distally. The palpebral lobe can often be visualized with eversion of the upper eyelid. Although the lacrimal gland receives both parasympathetic and sympathetic innervation, the secretion of tears is largely an action of parasympathetic innervation.[1]
   b. The accessory lacrimal glands of Krause and Wolfring are located within the conjunctival fornices and contribute approximately 10% of the tear secretion.
   c. The puncta are located on the upper and lower eyelids in the nasal corner at the junction of the pars ciliaris (lateral five-sixths containing lashes) and the pars lacrimalis (medial nonciliated one-sixth) and rest slightly inverted against the globe. The puncta serve as the exit point for tears from the conjunctival sac.[2]

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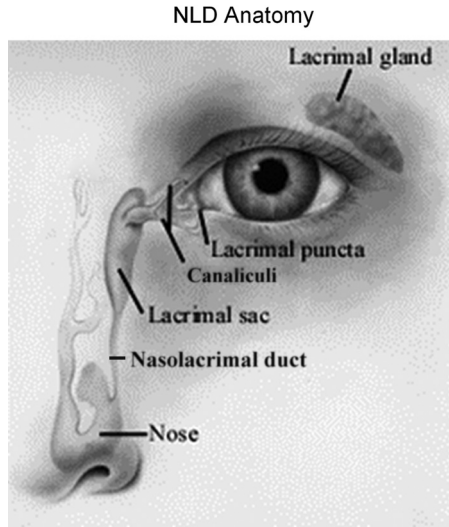

Fig. 1. Lacrimal system anatomy.

d. The ampulla extends vertically from each puncta about 2 mm.[2]
e. The canaliculi run medially about 90° from each ampulla approximately 8 mm and meet to form the common canaliculus, which opens into the lacrimal sac. Some individuals may have canaliculi that each open separately into the lacrimal sac. The valve of Rosenmuller, which is a mucosal flap separating the common canaliculus from the lacrimal sac, prevents tear reflux back into the canaliculi.[2]
f. The lacrimal sac runs vertically approximately 10 to 12 mm, with its superior portion extending above the common canaliculus. The lacrimal sac is lined with stratified columnar epithelium and lies in the lacrimal sac fossa.[2]
g. The nasolacrimal duct is also lined by stratified columnar epithelium and extends about 12 to 18 mm inferiorly and slightly laterally and posteriorly from the lacrimal sac. The duct empties into the inferior nasal meatus, with proper directional flow facilitated by the valve of Hasner, a mucosal flap separating the nasolacrimal duct from the nasal cavity.[2] The tears drain into the nose, and for this reason, your nose runs when you cry.

2. The tear film comprises the following layers:
a. The inner mucin layer allows for an even tear film layer over the ocular surface and is secreted by the goblet cells of the conjunctival epithelium.
b. The middle aqueous layer is secreted by the main and accessory lacrimal glands.
c. The outer oily layer maintains the tear film stability by preventing evaporation of the aqueous layer and is produced by the meibomian glands.[3] Without a healthy oily tear film, the tears evaporate, and this can lead to dry eye symptoms. The eye then tries to compensate by making more watery tears.

PHYSIOLOGY AND FUNCTION

Tear drainage is complex. The tears do not merely drain by gravitational flow. In a normal lacrimal pump system, blinking controlled by the orbicularis muscle causes closure of the canaliculi, with simultaneous opening of the lacrimal sac. The result is a negative pressure system, which draws tears into the sac via the ampullas and