Congenital Nasolacrimal Duct Obstruction (CNLDO)

Dr. Ramesh Murthy MD FRCS

Introduction

CNLDO is a common problem that ophthalmologists routinely face in their practice. This condition affects nearly 20% of all newborns. Most of the cases are self-resolving. It is important to understand the lacrimal drainage anatomy, embryological development and the natural course of this condition for appropriate diagnosis and management.

PATHOPHYSIOLOGY

Embryology

The development of the lacrimal drainage system begins at approximately 6 weeks of gestation. This develops along the line of the cleft between the maxillary and lateral nasal processes. Here an ectodermal fold extends into the underlying mesenchyme and forms a solid rod of cells between the medial canthus and the nasal cavity. Canalization of the ectodermal cord begins in the third month at the medial canthus. Canalization progresses towards the eyelid margin and towards the inferior meatus (Figure 1a and 1b).

Communication between the lacrimal drainage system and the nose occurs at the end of the sixth month. The lacrimal puncta opens into the lid margin during the seventh month, before the lids separate. The tear duct opening into the nose beneath the inferior turbinate does not become patent until birth or shortly after birth. Blockage of the nasolacrimal system typically occurs in

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*Fig. 1 a and b. Development of the lacrimal drainage system: An ectodermal fold develops in the mesenchyme between the lateral nasal and maxillary processes. This undergoes canalization towards the eyelid margin and the nose finally forming the NLD.*
this distal portion, where the tear duct opens into the nose. Tears are normally produced a few weeks after birth; hence nasolacrimal duct (NLD) obstruction may not be recognised until several weeks after birth.

**Causes**

Most commonly, this is due to the presence of a membrane at the level of the valve of Hasner, which is present at the nasal opening of the nasolacrimal duct. Less frequent causes include congenital atresia of the NLD, congenital lacrimal sac mucocele, congenital absence of valves, absence or atresia of canaliculi and puncta, and facial cleft anomalies.

**FREQUENCY**

While up to 20% of newborns have CNLDO, only 1-6% of infants have symptomatic obstruction. The majority of cases (up to 96%), usually resolve by the age of 1 year.²

**APPROACH**

**HISTORY**

The parents will usually give a history of the child exhibiting unilateral or bilateral tearing. Other symptoms include crusting, mucoid or mucopurulent discharge and redness. The lashes may stick together in the morning or after the child takes a nap. Tearing may be aggravated by upper respiratory tract infections or with exposure to wind or cold.

Important questions include: What is the frequency of the symptoms? Are the symptoms constant or intermittent? Is the tearing only present when the child has upper respiratory tract infection? Or is it aggravated in the cold or wind? At what age did the symptoms actually appear? If the child developed symptoms later on in life, then the problem is unlikely to be a non patent valve of Hasner.

Was the child full term and if not, what is his age adjusted for gestational dates? Are there any associated congenital anomalies, especially craniofacial anomalies such as Goldenhar’s, Crouzon’s syndrome or conditions with a hypoplastic maxilla such as Treacher-Collins syndrome? Is there a history of nasal or sinus surgery or radiation treatment to the nasal area? Is there any history of photophobia? Photophobia is indicative of possible congenital glaucoma or ocular surface disease.

**EXAMINATION**

Any obvious crusting, redness or swelling of the lids is noted. The tear meniscus may be higher in the eye with CNLDO. Lid malpositions like ectropion, entropion or epiblepharon should be observed. Any facial abnormalities should be noted. Puncta should be inspected to rule out stenosis. Corneal clarity should be evaluated and the corneal diameter measured.

Pressure over the lacrimal sac may discharge mucopurulent material into the lacrimal lake and is confirmatory. A dye disappearance test can be performed. After instilling a topical anesthetic, a drop of 2% fluorescein dye is instilled into the conjunctival cul-de-sac. Excess fluorescein is wiped away. After 5 minutes, the eyes are inspected for residual fluorescein with the cobalt blue light filter on the slit lamp opened wide. Failure to clear away the excess fluorescein is indicative of CNLDO.

**DIFFERENTIAL DIAGNOSIS**

Other causes of tearing include congenital glaucoma, lid abnormalities like entropion and epiblepharon, lash abnormalities like trichiasis and distichiasis, corneal surface abnormalities and conjunctivitis or keratitis.

**MANAGEMENT**

1. **Observation and Massage**

   Crigler was the first to describe lacrimal sac massage.³ This is the first line of management before probing. After cutting the nails and washing the hands, the index or little finger is placed over the common canaliculus to prevent regurgitation and the finger is stroked downward firmly, to increase hydrostatic pressure within the lacrimal sac and the nasolacrimal duct (Figure 2). About 10 strokes should be performed 2-4 times daily. The aim is to increase the hydrostatic pressure to rupture any membranous obstruction. In addition, it also empties the sac of stagnant tears, which can be a source of infection. An antibiotic drop like Vanmycetin or Ciprofloxacin is prescribed if there is mucopurulent regurgitation. 80-95% of children get cured by 1 year of age by this treatment.⁴ It is a good
idea to take a swab and send for microbiological examination. The common organisms that are isolated include Hemophilus influenzae, Staphylococcus aureus, Pneumococcus and Beta haemolytic streptococcal species.

2) Probing

Considerable controversy exists about the timing of probing. Conservative management by massage can be done safely up to 1 year of age; the reason being most of the cases (96 %) will resolve within the first year of life. The success of probing falls after 1 year of age. Hence in a child 1 year of age or more, it is best to recommend probing to the parents. Success ranges between 92 % – 97 % if done before 1 year of age but beyond 1 year the success falls to 55 % – 80 %.

a) Early probing

This may be necessary if the child is very symptomatic. In addition, this is necessary in cases where any intraocular surgical intervention is necessary or there have been repeated episodes of acute dacryocystitis. Early probing prevents occurrence of fibrosis, avoids complications like infection and orbital cellulitis and suffering due to epiphora and discharge.

b) Technique

Probing is best done under sedation or general anesthesia. A cuffed endotracheal tube should be used. A decongestant nasal spray is instilled into the nasal cavity. The upper punctum is dilated using a punctum dilator. The upper canaliculus is preferred as the turn from vertical to horizontal is less acute and less traumatic. The probe is introduced vertically and the lid is pulled laterally. The probe is advanced horizontally till a hard stop is reached (Figure 3a). The lateral traction is now released. The probe is now turned 90 degrees and directed toward the NLD downward, posteriorly and laterally (Figure 3b). If the probe is in the NLD, it lies flat on the forehead, is aligned with the trochlea and is able to spring back into position if shaken. Once the membranous obstruction is bypassed, a small “pop” may be heard. Confirmation of the location can be done by direct visualisation with an endoscope or direct metal-to-metal contact using another probe. Postoperatively the child is given nasal
decongestants and topical antibiotics, advised to continue massage and reviewed after 4-6 weeks.

c) Difficult probing

This is encountered if there has been a false passage or there is a tight bony obstruction. This can be circumvented by “graduated” or “stepwise” probing (where probes of progressively increasing diameters are used) or by “reaming” (where the probe is forced in a screwing fashion to enlarge the NLD). Sometimes infracture of the inferior turbinate is required if the block is beyond the NLD.

d) Repeat probing

About 5 to 10 % of probings are unsuccessful and a repeat probing can be performed anytime, preferably after 6 weeks, if symptoms persist. It is successful especially where the probe passed into the nose in the first instance or irrigation fluid was recovered in the nose. Prognosis for probing decreases exponentially with the increasing number of probings and the age of the patient. Rarely, is it successful after the third time or after 3 years.

3] Infracture of the inferior turbinate

If the inferior turbinate is impacted against the opening of the NLD, fracture may work by stretching open the NLD. It is infractured towards the nasal septum using the blunt end of a Freer elevator (Figure 4).

4] Nasolacrimal duct intubation

Intubation using a silk seton was described as early as 1909, by Berry. Quickert and Dryden described intubation with silicon tubing in 1970. It is recommended that after a failed second probing or when the patient is older than 18 months of age or when there is canalicular stenosis, silicone intubation should be performed. The silicon tube acts as a stent and creates a normal anatomical pathway. Silicone is well tolerated, is flexible and knots easily. Retrieval of the distal end is possible under direct visualization or using a Crawford hook, when stents with olive tips have been used (Figure 5). Performed alone, success rate has been reported to be 82.5 %, while in combination with infracture of the inferior turbinate it can be as high as 97 %. The tube can be left in place for 3 to 6 months. Complications are maximum in the first 3 months, tube prolapse being the most common. Others include punctual stretching, infection, corneal abrasion, tube dislodgement and breakage. The potential for canalicular trauma and subsequent stenosis, is probably the most important disadvantage.

5] Balloon catheter dilatation

This is a useful adjunctive procedure in cases with incomplete NLD obstructions, where probing has failed especially in children older than 13 months of age.
Fig. 6. Technique of balloon catheter intubation (using Lacricath catheters). The balloon is inflated to widen the NLD and the junction of the lacrimal sac and the NLD. Becker described this technique in 1991. After punctual dilation, probing is done. The balloon catheter is introduced through the upper punctum. The outer diameter of the balloon is 2 mm in children below 33 months of age and 3 mm in older children. The balloon length varies from 13 to 15 mm. The balloon is introduced until it is in the NLD. The balloon is now inflated to a pressure of 8 atmospheres for 90 seconds and deflated for 10 seconds (Figure 6). A repeat inflation up to 8 atmospheres is done for 60 seconds. The balloon is now retracted 5 mm, to lie at the junction of the sac and the NLD and two more inflations are performed. Complications with balloon dacryoplasty are fewer than intubation. It is minimally invasive, has more than 90% success rate and does not leave any external scars.

6] External dacryocystorhinostomy (DCR)

Indications for DCR include failed probing or intubation and cases of severe craniofacial anomalies. Anatomical considerations include anteriorly placed ethmoid cells, flatter anterior and posterior lacrimal crests, shallower lacrimal fossa, rapidly growing facial bones and the exuberant healing response. It is preferably done beyond the age of 1 year, usually by 3-4 years of age. The ostium should be at least 1 cm in diameter. Silicone stents should be used if there has been a history of acute dacryocystitis or in cases with canalicular stenosis. Failures usually occur because of anatomic obstruction by granulation tissue. Success varies between 79-96%. 

7] Endoscopic dacryocystorhinostomy

Endoscopic DCR has been performed in children with good results comparable to that obtained in adults. It can be done to avoid an external scar. Success rates of 76-88% have been reported. The advantage is concomitant sinonasal procedures can be performed.

Summary

In children less than 12 months, sac massage should be performed, unless there are strong reasons for early probing. In children reaching about 12 months of age, probing needs to be done. Infrafracture of the inferior turbinate can be attempted, if the turbinate is impacted against the lateral nasal wall. Repeat probing can be attempted in unresolved cases. If probing fails, silastic intubation can be considered. DCR is recommended where silastic intubation fails, in those with bony obstructions and those with craniofacial anomalies and is preferably done about 3 years of age.

References


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Around 1247 Bacon underwent a spiritual transformation and became a Franciscan Friar. His feverish activity, amazing credulity, superstition, and vocal contempt for those not sharing his interests displeased his superiors in the order and brought him under severe discipline. They issued an order which prevented him from publishing without prior permission.

Bacon overcame this order by writing to Pope Clement IV who he had known in Paris before his papacy. He wrote to the Pope that he had suggestions on Mathematics, Languages, Astrology and the Natural World, which he felt would help confirm the Christian Faith. The Pope’s command to be given these suggestions enabled Bacon to work secretly ignoring the order of his superiors.

Between 1266 and 1267, Bacon wrote his three main works: the Opus Majus (Major Work), the Opus Minus (Minor Work) and the Opus Tertium (Third Work).

His Opus Majus is an Encyclopaedia of all Science and deals with Mathematics, Optics, Alchemy and Astronomy. It was written to persuade the Pope of the urgent necessity and manifold utility of the reforms he proposed.

In the Opus Minus he attacked the Church. He argued that in “every town, in every village... there is an infinite corruption, beginning with the highest level.” He claimed that priests were eager to “enrich themselves indifferent to the care of souls... the monks, in their turn, are no better, and I exempt no Order.”.

He wrote many other books including “On the Marvellous Power of Art and Nature”, “On Mirrors”, “Metaphysical” and “On the Multiplication of Species”. In his Perspectiva (Optics) he proposed a model of philosophical study applying linguistic and scientific knowledge to understand Theology.

He rejected the blind following of prior authorities, both in Theological and Scientific study. His writings are a passionate tirade against ignorance He combined his attack upon the ignorance of his time with suggestions for the increase of knowledge. He set out his own new model for a system of philosophical studies that would incorporate language studies and science studies then unavailable at the Universities.

The death of Pope Clement in 1268 extinguished Bacon’s dreams of gaining for the Sciences their rightful place in the curriculum of university studies.

In 1277, Bacon was condemned to prison by his fellow Franciscans for heresy. He remained chained up in a tiny cell for almost fifteen years. During this period he managed to write only one book, Collected Study of Philosophy which though incomplete shows him to be as aggressive as ever.

Roger Bacon was released from prison just a few months before his death on 11th June, 1292. Despite his denunciation of the Church, he was buried at Greyfriars, the Franciscan Church in Oxford. After his death, his true greatness was recognized and earned him soubriquet “Doctor Mirabilis” (Wonderful Teacher).