CONGENITAL NASOLACRIMAL DUCT OBSTRUCTION

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DISEASE DESCRIPTION/PATHOPHYSIOLOGY:

Congenital nasolacrimal duct obstruction (NLDO) is a relatively common problem, occurring in up to 20% of infants in the first year of life.[1] Although most patients are affected in one eye, NLDO is frequently bilateral. Symptoms range from mild epiphora to frank mattering of the eyelids with a mucopurulent discharge. The site of the obstruction is most commonly at the distal end of the nasolacrimal duct (valve of Hasner). Other causes of epiphora/discharge should be ruled out (including primary congenital glaucoma, dacryocystitis, conjunctivitis, or corneal infections) prior to making the diagnosis of NLDO. Clinical findings of NLDO include increased tear lake as well as asymmetric or positive dye disappearance test. The dye disappearance test is performed by placing fluorescein dye in both eyes and waiting for 5 minutes. A positive test is either asymmetric clearing from the suspected involved eye, or failure to clear in cases of bilateral NLDO.

SIDEBAR: Anisometropia occurs at a greater rate in unilateral NLDO patients compared with bilateral NLDO patients and occurs at a greater rate than in the general pediatric population. Due to the increased risk of anisometropic amblyopia in these patients, it is important to perform a cycloplegic refraction and periodically follow patients with NLDO and anisometropia.[2]

MANAGEMENT OPTIONS

Therapeutic interventions for NLDO can be classified according to timing/location of therapy as well as intervention chosen. Infants less than 6 months are generally observed (unless additional clinical information is available which favors earlier intervention, i.e. dacryocele, recurrent dacryocystitis), with the Crigler massage (described below) being a non-invasive treatment option that parents can perform prior to surgical intervention. After 6 months of age the timing of treatment is provider dependent. Spontaneous resolution is less likely after 9 months of age and probing efficacy decreases after 15 months of age.[3] Earlier probing may obviate the need for general anesthesia, as younger infants can be safely swaddled and probed in the office. The Pediatric Eye Disease Investigator Group found that among infants aged 6 to <10 months who were observed for 6 months with Crigler massage, 66% resolved spontaneously. However, in this prospective randomized clinical trial, earlier in-office probing was as successful and less costly then observation/probing under general anesthesia (with the downside that 66% of patients would be probed in-office who would otherwise resolve spontaneously).[4]

INDICATIONS FOR SURGERY

Indications for surgical intervention are 1) clinical signs and symptoms consistent with NLDO, and 2) failure to spontaneously resolve.

NON-SURGICAL TREATMENT

a) Crigler massage:

a. Place the thumb or forefinger in the medial canthus at the level of the nasolacrimal sac and with firm pressure rub the finger down along the path

of the nasolacrimal duct. After the massage, upward pressure can be applied to empty the sac and give temporary relief of mucoid discharge.

SURGICAL DESCRIPTION

b) **Nasolacrimal Duct Probing and Irrigation:**

1. Using a nasal speculum, place intranasal oxymetazoline soaked pledgets into the involved nostril with bayonet forceps.
2. Using a punctal dilator or a large safety pin, dilate the superior or inferior punctum. Although either punctum can be used, probing through the superior canaliculus and irrigating through the inferior punctum ensures both are open while avoiding potential iatrogenic trauma to the inferior canaliculus, through which the majority of tear drainage occurs.
3. A #0 or #00 Bowman probe is placed into the punctum and passed through the canaliculus until the hard stop of the bony lacrimal fossa is felt. Following the normal anatomy (holding probe perpendicular to lid while inserting it into punctum, then rotating parallel to the lid to follow the canaliculus) can assist with insertion. Lateral traction of the lid facilitates passing the probe medially, decreasing the risk of trauma to the canaliculus. It is important to ensure the probe is resting against bone without tissue between the probe and the bony wall, as this tissue may be torn or injured during the next step. Surgeon experience is crucial as proper placement is determined with “feel” as opposed to probe position.

4. Once the probe tip abuts the bony wall, lateral traction on the eyelid is discontinued and the probe is rotated up 90 degrees until it falls inferiorly into the nasolacrimal duct. Keeping the probe on the same plane as the eyelid as it is rotated (bringing the probe over the superior orbital rim/brow) helps the distal tip drop into the nasolacrimal duct. Once in the duct, the probe is advanced into the nose. If a membranous obstruction is present, the surgeon will frequently feel the release of resistance as the probe clears the obstruction (Figure 1).
5. After removing the pledgets from the nasal cavity, the position of the probe in the nose can be confirmed by placing a second probe behind the inferior turbinate and feeling for "metal on metal" contact or by seeing the original probe moving. The second probe should directed lateral and inferior to the inferior turbinate, which can be visualized when looking into the nostril extending from the lateral wall of the nose. The direction of the second probe will be inferior and lateral almost in the direction of the earlobe.
6. After successful probing, an irrigating cannula can be placed into one of the punctum's and fluorescein stained balanced salt solution can be irrigated into the nasolacrimal duct while simultaneously suctioning using a French suction catheter through the nose. Successful suctioning of the fluorescein tinted fluid from the nose ensures a patent NLD system.

c) Balloon Dilation (Figure 2, Quest Medical, Inc, Allen, TX):

1. Balloon dilation can be used in both patients who failed simple probing and irrigation (although most surgeons would consider intubation in the case of previous treatment failure) as well as primary treatment during a probe where anatomic or intraoperative findings increase the likelihood of probing failure (i.e. tight NLD)

SIDEBAR: Balloon dacryoplasty has a similar efficacy to monocanicular stenting in children with congenital NLDO. The major advantage to balloon dacryoplasty is that no silicone tube is left in the lacrimal system.[5]

2. Specific directions can be found on the insert of all commercially available balloons, but the generic technique involves probing with the balloon deflated as you would in a simple probing, advancing the balloon cannula to a specific mark, and then inflating the balloon with the included pump for a specified amount of time.

SIDEBAR: In order to minimize trauma to the outflow system during removal, maximally deflate the balloon and twist the catheter counterclockwise.

d) Intubation:

1. Monocanalicular
    a. A variety of monocanalicular stents are commercially available. One common type used for NLDO is composed of a silicone stent that has on one end a self-retaining punctal plug and on the other end a metal probe. The distal end of the metal probe has a round bulbous tip.
    b. The metal probe is inserted into the punctum (either upper or lower) and passed down the NLD as described above.

c. Once the rounded tip end of the probe is in the nose, a special hook is placed under the inferior turbinate in the same manner and direction as the confirmatory probe was placed in #2 above. Keeping the opening of the hook oriented towards the septum as the hook is slid along the lateral wall of the nose can help prevent excessive damage and bleeding.

d. Once the hook is confirmed to be in the correct place as determined by "metal on metal" feel of the intranasal probe, the shaft of the intranasal probe is hooked.

e. The hook is then slid up the shaft until it engages with the rounded tip. Gently pulling back on the intranasal probe after engagement ensures the hook stays engaged with the rounded tip as the hook is pulled out of the nose. Once the probe is retrieved through the nose, the metal probe can be cut off and the punctal plug can be seated into the punctum.

f. Ritleng type stents (described below) are also available as monocanalicular stents (Figure 3, FCI Ophthamics, Pembroke, MA).

2. Bicanalicular

a. The two most common bicanalicular stents used for NLDO are the Crawford (Figure 4, FCI Ophthalmics, Pembroke, MA) and the Ritleng.

b. Crawford tubes are placed the same way as the monocanalicular stent described above, with the exception that the silicone tubing has a separate metal rounded-tipped probe on both ends.
c. One probe is placed into the superior canaliculas and retrieved, and the second probe is placed into the inferior canaliculus and retrieved. The probes are then cut off and the silicone ends are tied together. Crawford stents are also available with a dacron suture within the lumen of the silicone tubing. The ends of these can stripped and the dacron suture ends tied together. These are less traumatic to remove, as the suture knot is generally small and easily retrieved through the punctum, but takes additional time in the OR to strip the silicone tubing from the suture.
d. This tied ends can then be allowed to retract back into the nose, or sutured to the lateral nasal mucosa with a 6-0 silk suture. If sutured, it is important to ensure there is not excessive traction to avoid cheese-wiring of the punctum.
e. Ritleng probes consist of a hollow introducer probe with stylette. The introducer probe has a narrow slit along the side. The introducer probe is placed into position in the nasolacrimal system as described above with the stylette in place, and then the stylette is removed. The stent can then be fed into the hollow introducer probe and through the nasolacrimal system and retrieved through the nose. Once the guide suture is retrieved through the nose, the probe can be backed out of the

nasolacromal duct to the point where the stent narrows and can be removed from the probe through the narrow groove.

f. Ideally the stents are left for 3-6 months, but can be effective if left for shorter time periods. If the stent has been sutured into the nose, check to see if the suture is present prior to stent removal. If still present, defer removal another month or two. Removal can be performed by using topical anesthesia and rotating the stent until the knot is visible. The stent is then cut and pulled out of the nasolacrimal system.

e) Nasal Turbinate Infracture

a. Like intubation or balloon dacryoplasty, infracture of the nasal turbinate can be performed at the initial probing or reserved for cases refractive to simple probing. Infracture of the turbinate can be helpful if the tight turbinate makes retrieval of the canalicular stent.

b. Infracture can be performed by placing a periosteal elevator under the inferior turbinate and then rotating inward. Conversely, the inferior turbinate can be grasped with a hemostat and rotated.

c. Infracture turbinate can be associated with nasal bleeding. A displaced turbinate can occasionally cause nasal whistling or a dry nose.

3. **Dacryocele (nasal endoscopy):** Dacryocele occurs when both a distal and proximal obstruction prevents any outflow of secretions from the nasolacrimal sac/duct. This usually occurs when a NLDO results in distention of the

nasolacrimal sac, which occludes the common canaliculus and prevents retrograde reflux. If not treated with probing, dacryoceles can either resolve spontaneously or become infected/inflamed within a few weeks. Once infected, systemic antibiotics are typically used for a few days followed by decompression/probing. A nasal mucocele (bulging of the nasal mucosa into the nose) can be treated at the time of probing with nasal endoscopy for removal of the nasal cyst.

Sidebar: Dacryoceles can be associated with life threatening respiratory complications in neonates, who are obligate nasal breathers. Parents should be queried about shortness of breath with feeding in infants with dacryoceles.

POST-OPERATIVE CARE

Symptoms typically resolve within a week or two following successful probing. Topical antibiotic/steroid can be used for 3-4 days following probing to decrease inflammation. Intranasal oxymetazoline spray can be used for a few days following probing as well to help with minor bleeding and swelling. Transient bacteremia can occur following any intranasal procedure, so patients at increased risk (i.e. congenital heart defects) may require prophylactic systemic antibiotics.[4]

PROGNOSIS

Simple probing and irrigation is successful in 90% of patients.[7] Complications are rare, but can include iatrogenic trauma to the canaliculi or false passage into the nose. Other complications with bicanalicular stenting are early displacement and corneal abrasion.

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Figure Legends

Figure 1: Probe in Nasolacrimal Duct. Note the probe exits the nasolacrimal duct at the level of the inferior nasal meatus.

Figure 2: Balloon Dacryoplasty set includes a probe with a balloon on the end and a device to inflate the balloon in the nasolacrimal system.

Figure 3: Ritleng Monocanalicular Stent

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Figure 4: Crawford bicanalicular stent includes a ball on the end of the stent that is hooked under the inferior turbinate.

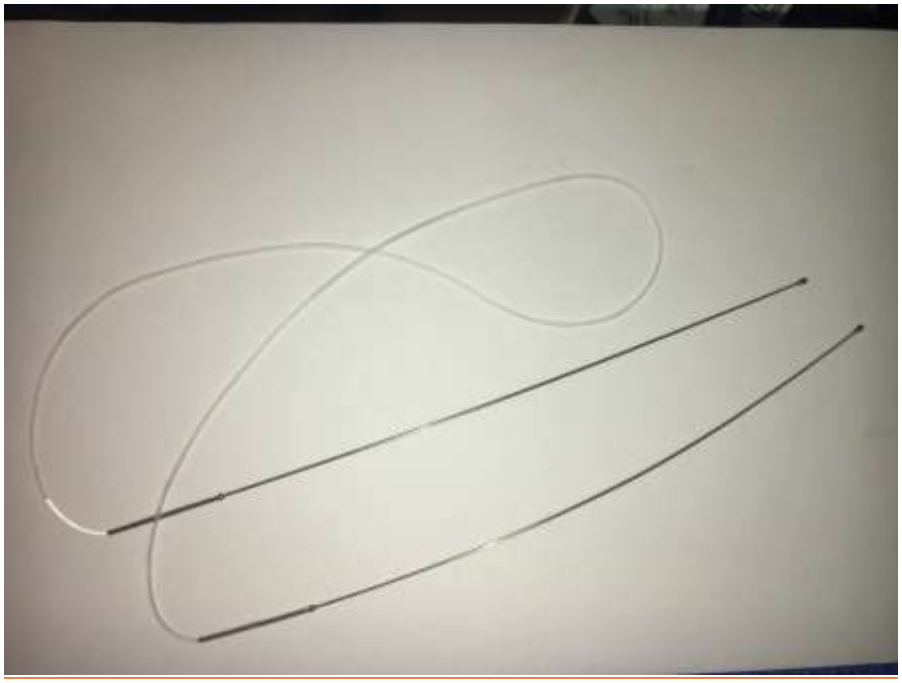

Figure 4

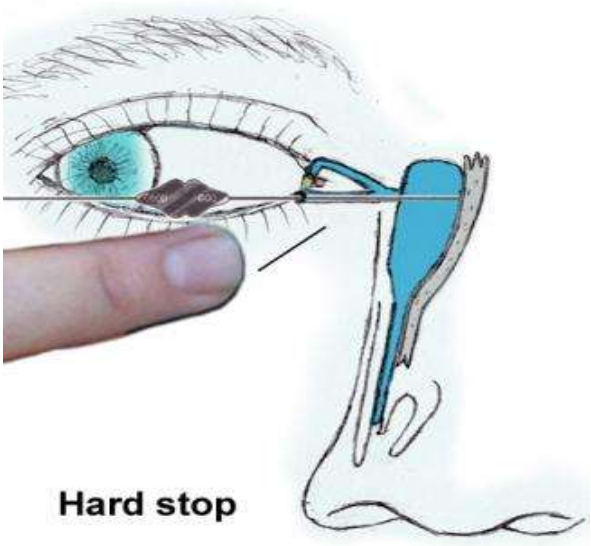

Figure 1

Figure 3