Endoscopic Dacryocystorhinostomy in Children

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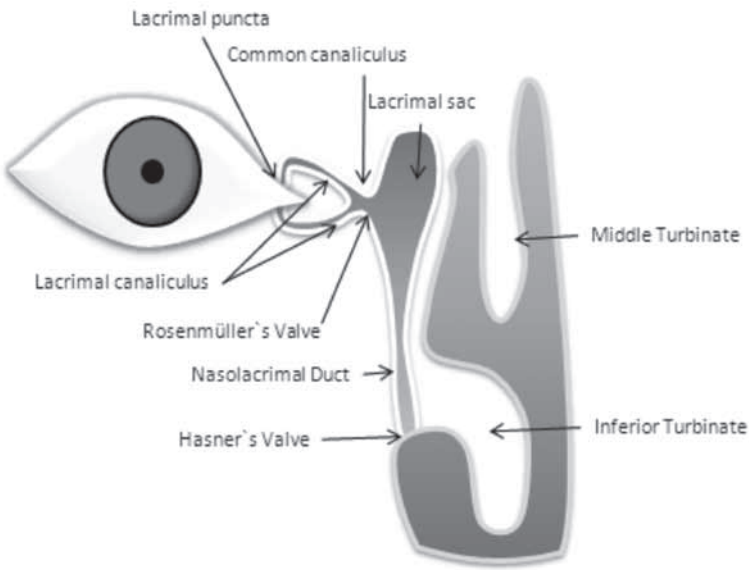
Congenital nasolacrimal duct obstruction (CNLDO) is common, presenting in from 1.2% to 30%[1,2] of newborns. However, the problem resolves spontaneously in 85%-95%[1-4] of cases during the first week of life. Only a few remain symptomatic after six months of age. If the problem is prolonged, however, it can cause serious damage to the child, including visual difficulties, low self-esteem and social rejection at school. This paper is a summary of the author's experience in that subject.

Anatomy and physiology

The lacrimal drainage system (LDS) is responsible for transporting tears from the conjunctiva to the nasal cavity (**Figure 1**). It begins near the inner canthus in two openings on the edge of the eyelid, one on the bottom and one on the top, called puncta. Puncta are continuous with upper and lower lacrimal canaliculi, which merge to form the common canaliculus, which in turn reaches a larger tube called the lacrimal sac. The lacrimal sac runs vertically, then thins and is renamed the nasolacrimal duct. The duct leads ultimately to the level of the inferior nasal meatus below the inferior turbinate.

Figure 1. Anatomy of the Lacrimal Drainage System



The epithelium covering the ducts is not a respiratory type. It is squamous, so tears do not move by ciliary movement, they move by a hydraulic pump powered by movement of the eyelids. When the eyelids are separated, the canaliculi are compressed and expand the sac, and when eyelids come together, the sac is compressed. To ensure that tears are directed to the nostril, the system has a series of valves to prevent backflow. The most important are: the lacrimal puncta, the Rosenmüller valve (located between the common canaliculus and sac) and the valve of Hasner (located at the outlet into the inferior meatus)[1,2].

Embryology

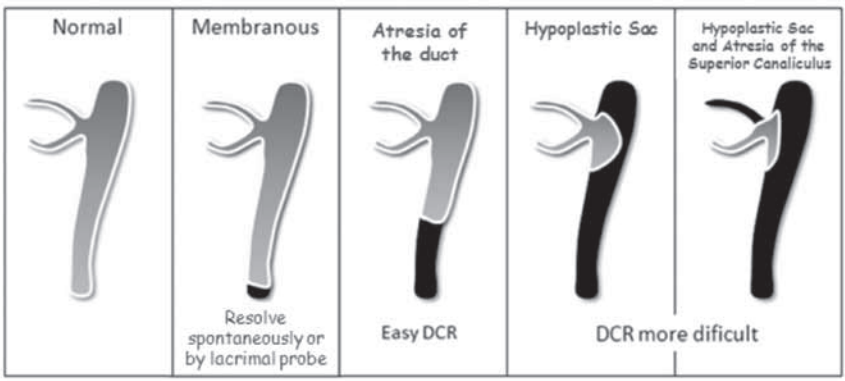
The LDS arises from the nasolacrimal groove that appears between the eye and the stomodeum (future mouth) in embryos at the sixth week. This sulcus deepens and becomes independent of the surface of the face. This pipeline begins at 12 weeks and often concludes at seven months of gestation with the channeling of the valve of Hasner.[2-7] But in some cases this channeling can fail to happen until after birth. This is referred to as congenital nasolacrimal duct obstruction (CNLDO).

Classification

On the basis of clinical and surgical observations, the author proposes division of CNLDO into four groups (**Figure 2**):

1. Membranous: A thin obstruction of the nasolacrimal duct; this constitutes the vast majority of cases, and is usually resolved spontaneously or by lacrimal probe.[1,6]
2. Atresia of the duct: a thick obstruction of the nasolacrimal duct in which the sac is normal or large and has no alterations of canaliculi. These cases need dacryocystorhinostomy (DCR) [1].
3. Atresia of the duct and hypoplasia of the sac. The small sac makes it difficult to do DCR
4. Atresia of the duct, hypoplasia of the sac, and atresia of the superior lacrimal canaliculi. In these cases it is often difficult to perform DCR.

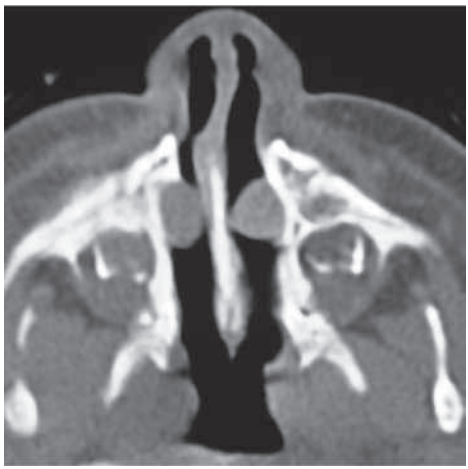
Figure 2. Types of atresia of the nasolacrimal system



Clinical

The most common finding in CNLDO is epiphora, where the eyes have excessive tears that flow down the cheeks due to the child's inability to pipe them into the nostril. The thick layer of tears in the eye causes the child to have blurred vision and often to have difficulty with reading in school. If the sac is dilated, when digital compression is done on it there may be reflux of its contents. Children may present recurrent or chronic dacryocystitis and conjunctivitis blepharus. These can cause adhesions in the LDS, making a surgical solution more difficult.[3] At times the sac is very dilated and protrudes from the back of skin between the nose and the eye. This is called external dacryocystocele.[6] Another rare presentation in newborns is congenital intranasal dacryocystocele, usually bilateral. It may lead to severe obstruction of the airway similar to that in choanal atresia (**Figure 3**).

Figure 3. Intranasal Dacryocystocele



Treatment

Usually, management of CNLDO is done by ophthalmologists. In the National Children's Hospital of Costa Rica, it is usually treated conservatively until the child is one year old. Parents are instructed in routine lacrimal massage using a Q-tip to try to push the tears into the nostril (hydrostatic massage) and in using topical antibiotic drops when there are purulent secretions. If there is no improvement at one year of age, a probe is performed under general anesthesia. This resolves most cases. If it does not work, a new probe is done and a silicon microtubule stent is inserted to remain for two to six months. If the problem continues, then it indicates dacryocystorhinostomy (DCR).

In our hospital DCR used to be done using an external approach. But since 2004 the route of choice uses an endoscopic approach involving the otolaryngologist. Its main advantage lies in avoiding facial scars in the children, because is often very difficult to hide the scar due to the absence of wrinkles.

Preoperative evaluation

The ophthalmologic service refers cases to the otolaryngologic service (ENT) when the patient is between two and six years of age, depending on several factors such as age at onset, control, the time required to perform all previous efforts, and any need to rush to prevent recurrent or chronic infection. The ENT specialist asks about epiphora, local infectious problems, and nasal problems of the child. Then the affected eye is inspected and the presence of puncta is verified, especially examining for anything torn by previous probes. The skin over the lacrimal sac is inspected, looking for lumps, swelling, or sequelae of previous infections. The sac

is pressed on to see whether there is reflux. If reflux is abundant, it indicates that the sac is large, and this is favorable to surgery. Then the nostrils are inspected. It is important to look for findings of rhinitis, septal deviation, or anything that may interfere with the surgical approach such as polyps or masses.

When eyedrops such as fluorescein dye are put in the eye, if they persist in the conjunctiva after five minutes it can be concluded that the system is actually occluded.[2] Using CT-scans, the local anatomy is reviewed to evaluate the bulk of the lacrimal bone, the position of the septum, and the absence of other malformations such as meningocele or other masses that may be compressing the nasolacrimal system. We do not do contrasted-image studies of the lacrimal system, due to various technical difficulties: lack of trained personnel available to pipe the canaliculis, the need for sedation, and time required.

The ENT service of the Children's Hospital of Costa Rica operates on all cases referred from ophthalmology, even when children have a history of canalicular stenosis in previous probes, or if they apparently have a small sac, or puncta are torn or have local chronic infection. This is because we consider that DCR is the best chance we have to solve their problem, and the possibility of worsening or complications following performance of this surgery is low. These circumstances do, however, sometimes make surgery more difficult and results more uncertain.

Surgical technique

There are many variants in performing the procedure. Drilling equipment, LASERs and specially designed balloon-dilation catheters can be used. But here I will describe only my technique. Beginning four days pre-operatively, topical antibiotic-steroid drops and oral antibiotic and steroid are administered, with the goal to have a surgical field with minimal inflammation.

In the operating room the nostril is prepared using cotton dressings impregnated with epinephrine 1:1000, and we wait at least five minutes. Generally it is easier to perform surgery using a rigid endoscope size 2.7 mm, 11 cm in length, from 0 to 30 degrees. Under endoscopic visualization we identify the middle turbinate, the *agger nasi* and the septum. The sac is placed in front of the middle turbinate, and its volume is defined by the form of the *agger nasi*.[8]

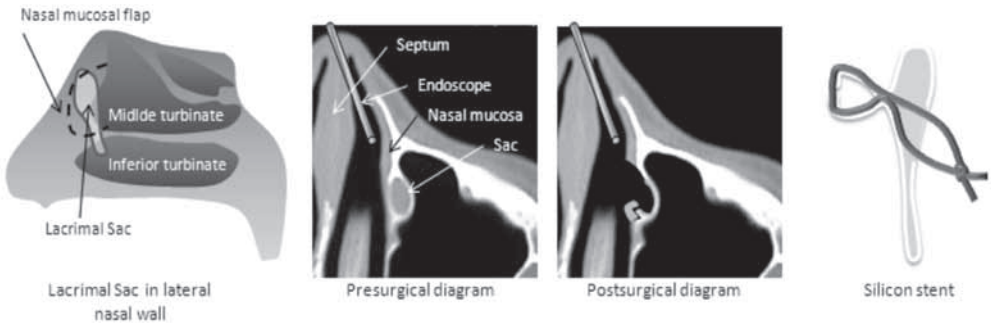
With a knife, a mucosal flap is defined on the agger nasi to the insertion of the middle turbinate, with a base at the rear. This flap is elevated using a Cottle`s dissector, and it is pulled away under the middle turbinate. Thus lacrimal bone is exposed. To remove it you can use a Kerrison forceps, drills, or a LASER, but I prefer to use a 2 mm septal chisel, first marking the bone with the chisel to remove its upper, lower and anterior limits, and then the bone is elevated and removed. Any remaining fragments are removed using ear-forceps.

Skin on the lacrimal sacs is pressed digitally to verify their movement in the surgical field, and a lacrimal probe is passed from the lacrimal puncta as far as the nasal cavity, allowing us localize the sac exactly. Then this hole is extended using a sickle knife, so that it is exposed inside the sac as long as possible. The mucosa of the medial wall of the sac can be removed using ear-forceps or a micro-shaver. Exposure of the sac should be maximized by removing the anterior and medial

wall of the bag. Once the exposure is optimal, the initial flap of nasal mucosa can be cut to minimize the bony area exposed, but the flap should not interfere with exposure of the sac.

Finally, a silicone microtubule is placed (**Figure 4**). I did not use a microtubule in my first cases where the sac was big, but after a couple of failures I now put them in, in all cases. The silicone helps maintain the sac open while connecting nasal epithelium with epithelium of the sac. Usually the silicone is left for six weeks, unless evaluation suggests stenosis of the lacrimal canaliculi, in which case it is left in for six months.

Figure 4. Surgical technique



After surgery, antibiotic-steroid drops are administrated for four days. Lubricating eyedrops and intranasal steroids are administrated for about two months or while the child has the silicone stent.

Results

Compared with births per year in Costa Rica, it is estimated that only one in 16, 000 children each year need DCR surgery in Costa Rica. Since 2004 I have performed 29 endoscopic DCRs in 26 children, averaging five per year. The children were between two and nine years old. Two of the children had Down syndrome (8%). The surgery succeeded in solving the problem after the first surgery in 24 cases (83%). Four cases have been revised, and three of those were successful. Taking into account primary cases and revisions, the rate of success is 93%. These results are similar to those reported by most authors.[1-6]

Reasons for failure can include technical errors, because of the learning curve, severe stenosis of the sac, or canalicular stenosis. There have been no serious complications that can cause postoperative consequences. It was not necessary a prior septoplasty in any case. Regarding intraoperative difficulties, is necessary to mention that sometimes passing the probe through the canaliculi is very difficult, especially if there is stenosis, so that the presence of an experienced ophthalmologist is very useful, especially in a surgeon's first cases.

Conclusion

Endoscopic dacryocystorhinostomy is a procedure that usually takes only minutes for an experienced surgical endoscopist. It is highly effective and has low surgical risk. The endoscopic approach for DCR should be chosen for patients in the pediatric population when there are resources and the appropriate experience is available.

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