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The endoscopic approach for congenital nasolacrimal duct obstruction

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Probing of the nasolacrimal duct is a common procedure in children with congenital stenosis. Although simple probing of the nasolacrimal duct is successful in a majority of patients, a number of failures occur. In those temporary intubation of the nasolacrimal duct with a silicone drain may solve the problem. We performed silicone intubation in 11 infants under nasal endoscopic control. By this improved visualization of the inferior meatus, the procedure was facilitated. In four children the probe was unable to pierce the nasal mucosa and stayed in the submucosal space. An incision of the nasal mucosa was needed before the probe could be passed into the nasal lumen. We believe that this situation, inability to pierce the nasal mucosa, may explain a number of failures of simple probing. It is therefore advisable, especially if initial probing has failed, to repeat the procedure under endoscopic control.

Keywords *nasolacrimal duct obstruction probing endoscope silicone tubes*

The nasolacrimal duct originates from an invagination of an ectodermal column between the embryonal maxillary and lateral nasal processes, around the sixth week of pregnancy. Canalization of the epithelial column starts at about the third month of pregnancy beginning at its cephalic end, with the lower end last to open.¹ Failure of the distal system to establish patency often results in a persistent membranous obstruction. The anatomy of the nasolacrimal duct shows large variation, as was demonstrated by Onodi in 1913.² In newborns the duct is not a straight canal, but rather a passage with numerous diverticula, due to the development of the ethmoidal sinuses. Sometimes the duct opens into the inferior nasal meatus by two or three orifices. When the opening of the duct ends in the lateral nasal wall, the mucosa can form a plica lacrimalis. This is called Hasner's valve. The valve is absent when the nasolacrimal canal ends directly under the attachment of the inferior turbinate³ (Figure 1).

According to the literature, the incidence of lacrimal duct obstruction may range from 6 to 73%, although only 2–4% are symptomatic.¹ The infant characteristically develops epiphora at 2–6 weeks. After 6 weeks 5–6% of those children develop signs of infection: conjunctivitis, discharge, or dacryocystitis. A purulent conjunctivitis with irreversible corneal

damage may occur and requires prompt and effective antibiotic therapy. Another complication is a mucocele of the nasolacrimal sac or duct. Congenital nasolacrimal duct mucocele, or dacryocoele, is an early and unusual manifestation of nasolacrimal duct obstruction in newborns.¹ It may occur in the neonate when fluid has become trapped within the nasolacrimal sac and distends it. 'Amniotocele' is a synonym since, in part, the fluid within the sac is derived from amniotic fluid.⁴

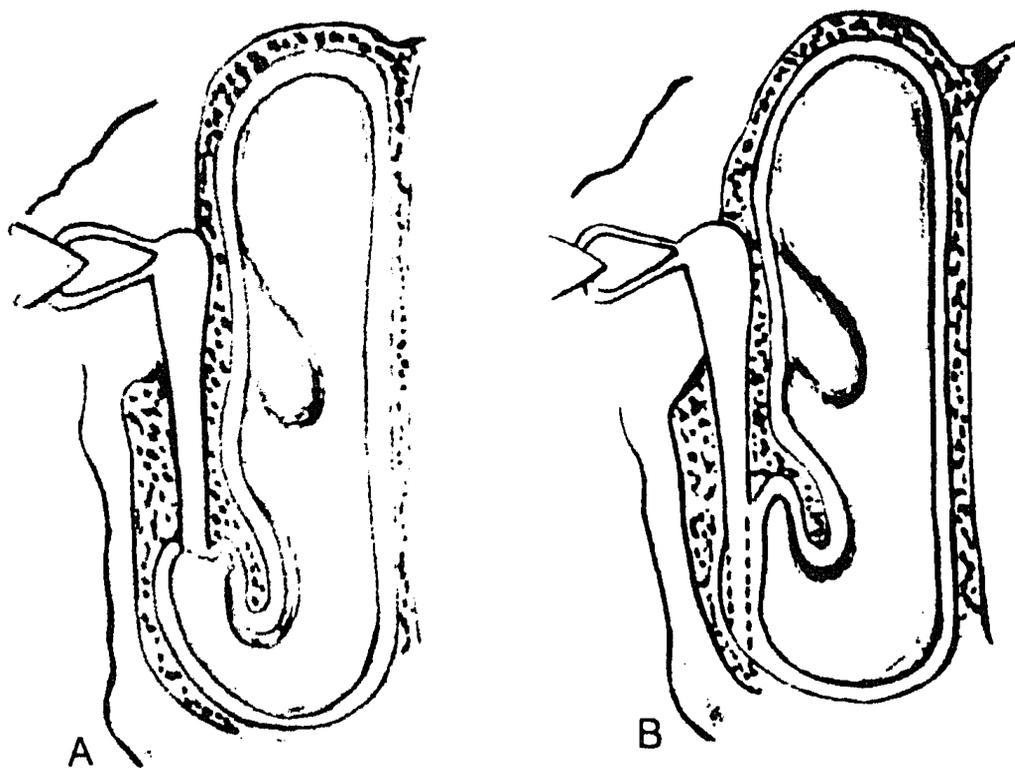
In the first weeks of life, a persistent mucous membrane across the lower end of the nasolacrimal duct can perforate spontaneously. Simple massage of the inner canthus and lacrimal sac can be helpful. When the nasolacrimal duct is still not patent after 6 months, probing of the duct is usually done.⁵ Obstruction of the nasolacrimal duct, dacryocoele, and acute dacryocystitis in neonates,⁶ are all indications to probe the nasolacrimal canal.

Surgical methods

In simple probing, a probe is introduced into the superior punctum and advanced into the nose. Sometimes a 'pop' can be heard when the membrane is ruptured.⁴ However, this technique is not uniformly successful. If this procedure fails, intubation with a silicone tube is the next step. A light metal

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Figure 1. Schematic view of the right nasolacrimal duct. (A) The canal ends directly under the attachment of the inferior turbinate. (B) The nasolacrimal duct ends in the lateral nasal wall, making the duct longer than the osseous canal containing it. [According to Boger W.P. (1994) Congenital nasolacrimal duct obstruction. In *Principles and practice of ophthalmology, clinical practice*. Albert D.M. & Jakobiec F.A. eds. pp. 2812–2826. W.B. Saunders Company, Philadelphia.] With permission.



probe glides in the hollow shaft at each end of a silicone drain. The probe is used as a guide. The first is introduced at the superior punctum and advanced through the canaliculus, the lacrimal sac and the nasolacrimal duct all the way down to the inferior meatus. Once the metal probe is located, the silicone tube is grasped and, while the probe is retracted backwards, the tube is brought out of the nose. The other probe is inserted through the inferior punctum and will follow a similar route. Both ends of the silicone tube are knotted under the inferior turbinate and left in place for 6 months.

It is not always easy to find the ends of the probe in the inferior meatus. Especially in a child with large inferior turbinates, the region of the distal end of the nasolacrimal canal is difficult to visualize, even using a speculum. Therefore, special hooked instruments are described to retrieve the probe blindly.⁷ The location of metal probes can be facilitated by connecting its proximal tip and the hook to different levels of a low ampère electrical circuit with a light bulb that glows when contact is made.⁴

Nasal endoscopes⁸ are frequently used in the diagnosis and treatment of paranasal sinus disease. They allow perfect visualization of the inferior meatus and facilitate the retrieval of the probe during silicone intubation. Moreover, direct visualization of the procedure may shed some light on the potential causes of failures. In this article we provide a possible explanation for the failures of probing and suggest how to avoid them with nasal endoscopes.

Materials and methods

During the last 12 months we have treated 11 children (seven boys, four girls), with a mean age of 21.7 months, by placing silicone drains under general anaesthesia. The mean number of former probing trials was 1.6. The inferior turbinate was displaced medially after local vasoconstriction with three

drops of adrenaline 0.01% in pantocaine 10%. A 4 mm 0° nasal endoscope was introduced, connected to a cold light source and a video system. While the ophthalmologist advanced the probes into the nose the otorhinolaryngologist studied the inferior meatus endoscopically.

Results

In four patients (Table 1) the probe was unable to perforate the nasal mucosa. The blunt end of the probe was protruding the mucosa to the bottom of the piriform aperture (Figure 2). Incision of the mucosa was necessary before the probe, with the silicone tube over it, appeared in the nasal lumen (Figure 3). Sometimes mucopus appeared while performing this procedure. In all infants it was possible to introduce both ends of the silicone drains in the nasolacrimal duct, through the lacrimal canals. The metal probe was withdrawn and the silicone

Table 1. Results of probing 11 patients, with age and number of former trials

Subject	Age (months)	Trials	Probe
1	15	2	<i>In situ</i>
2	25	2	<i>In situ</i>
3	24	3	<i>In situ</i>
4	14	1	Submucosal
5	26	2	<i>In situ</i>
6	31	1	<i>In situ</i>
7	39	2	Submucosal
8	14	2	<i>In situ</i>
9	8	1	Submucosal
10	14	0	<i>In situ</i>
11	29	2	Submucosal

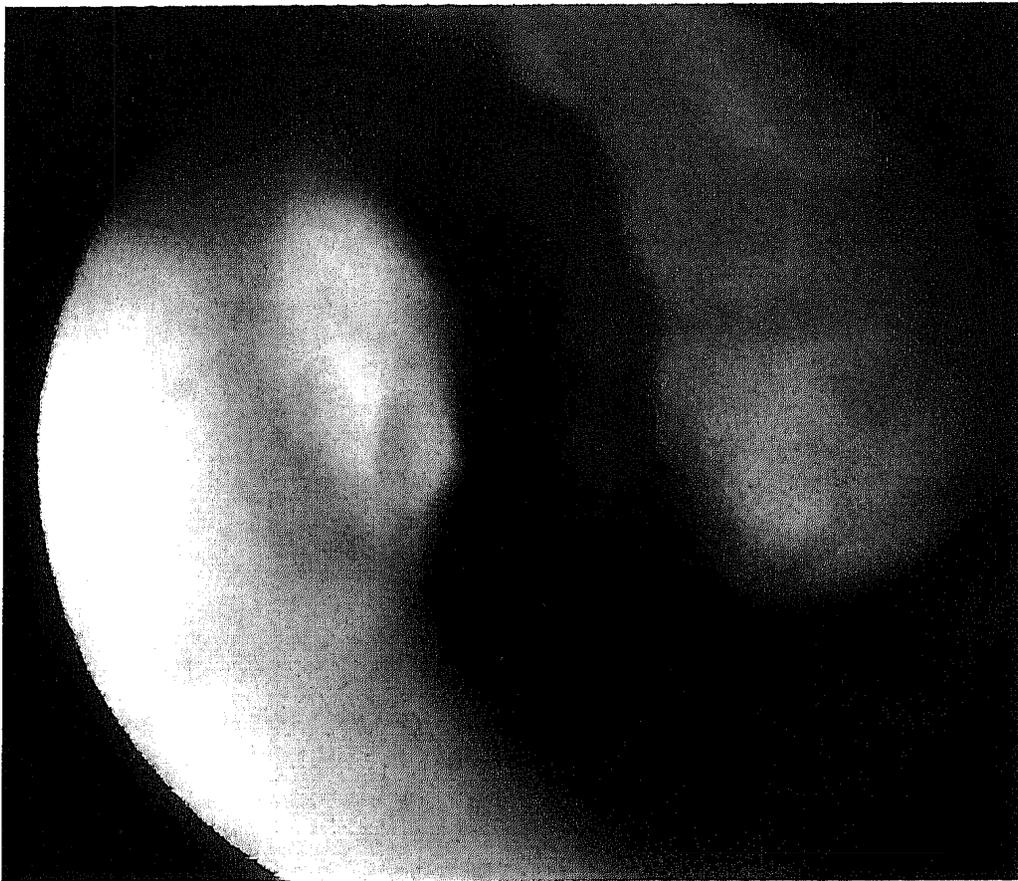


Figure 2. Endoscopic view of the right inferior nasal meatus through a 0° endoscope. The probe has not perforated the mucosa.

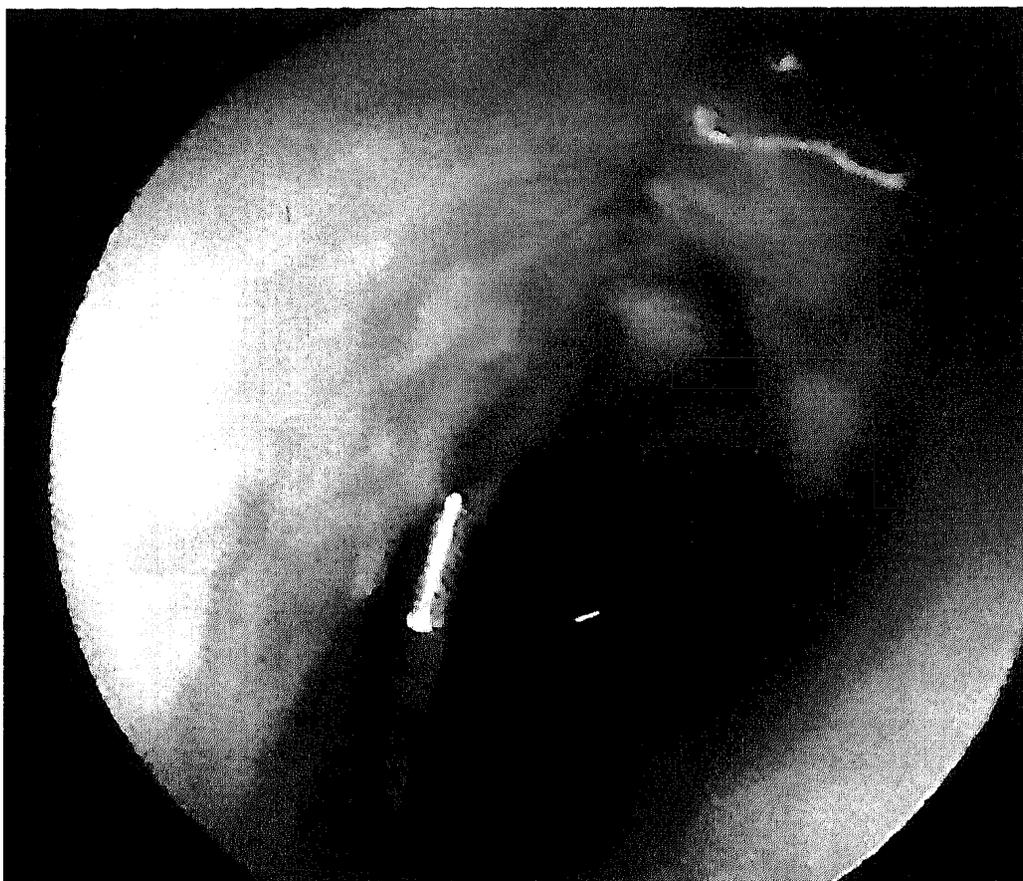


Figure 3. Endoscopic view of the same meatus as Figure 1, after the mucosa has been incised. The metal probe with silicone tube is visible under the inferior turbinate.

drain was knotted under the inferior meatus, where it was left in place for approximately 9 months.

Discussion

The success of initial probing is approximately 80%.⁴ Most ophthalmologists prefer repeated probing to silicone tube insertion, unless the child is 1 year old or has severe symptoms.⁵ The small anatomical dimensions of the newborn nose and poor illumination make investigation difficult. In the past, different techniques were proposed to retrieve a probe in the nasolacrimal

canal under the inferior turbinate. A nice example is that of the closed electrical circuit.⁴ The superior visualization provided by nasal endoscopy has rendered these techniques obsolete.

In our study we used a 4 mm endoscope, although 2.7 mm endoscopes are available. In 36% of our patients we clearly identified submucosal probing of the distal end of the nasolacrimal canal as the most plausible cause of failure accounted with initial blind probing. In those infants we had to incise the mucosa before the probe could pierce it and appear in the nasal lumen. If one considers the anatomy of the duct, it appears that the location of the orifice will determine whether

or not a false route will be created. If the nasolacrimal canal ends immediately under the attachment of the inferior turbinate, probing will be easy.³ If, however, the nasolacrimal duct is longer than the osseous canal containing it, with the orifice in the lateral nasal wall, the probe will not exert its pressure at the orifice. In that case a submucosal false route is created down to the bottom of the cribriform aperture (Figure 1).

A number of failures of simple probing of the nasolacrimal duct are probably due to the fact that the surgeon erroneously believed that he perforated the mucosa, while only a false route was made. Therefore, we conclude that in probing the nasolacrimal duct the inferior meatus should be checked endoscopically, especially when previous probing failed to solve the problem.

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