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Direct endoscopic probing for congenital nasolacrimal duct obstruction

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ABSTRACT

Background: The most common treatment for congenital nasolacrimal duct obstruction (CNLDO) is blind probing. However, the nasolacrimal duct cannot be observed in this procedure, reducing its accuracy. If the probing procedure allows the observation of the nasolacrimal duct, it would be more successful and safer.

Purpose: To report the results of endoscopic probing to view the lacrimal duct in cases of CNLDO 6 months post-surgery, and to evaluate the condition of the lumen, while simultaneously performing direct endoscopic probing.

Design: This is a retrospective, non-comparative case series.

Participants: The study participants were 10 children aged 14 to 74 months with CNLDO, including 3 children with bilateral obstruction.

Methods: The patients underwent direct endoscopic probing with dacryoendoscopy instead of blind probing under brief total anesthesia.

Main outcome measures: During the procedure, outcomes were assessed as the endoscope reached the nasal cavity. A successful probing outcome was defined as an absence of tearing and discharge.

Results: Twelve eyes were successfully treated by direct endoscopy while one was not. We confirmed that there were various sites of obstruction and various conditions such as edematous thickening of the mucosa of the lacrimal duct and fibrous tissue due to chronic inflammation inside the lacrimal duct, and demonstrated that the various deformations could be effectively treated by endoscopic probing. Symptoms disappeared in 92.3% of the eyes treated by endoscopy in this study; however, 38.5% of these still had occasional symptoms.

Conclusions: Direct endoscopic probing is effective and safe to treat cases of CNLDO in children.

Keywords: congenital nasolacrimal duct obstruction, dacryoendoscopy, endoscopic probing,

Introduction

Most cases of nasolacrimal duct obstruction in children are congenital; the symptoms include epiphora and eye discharge just after birth. The most common treatment is blind probing, which has a very high success rate of up to 78%–92%.[1-4] However, this procedure is typically performed blindly, and the success rate depends on the skill of the physician.[5] Two studies have investigated the factors related to cases of failed probing,[3, 5] but neither of these directly visualized the anatomy of the lacrimal duct or the site of the obstruction. Some studies have used nasal endoscopy to assist blind probing, but were unable to confirm the obstruction (i.e. the end of lacrimal duct from nasal cavity).[6- 8] Conventionally, dacryoendoscopy has been used only for observation of the lacrimal duct.[9-11] While some reports have described nasolacrimal duct obstruction through a series of observations of the lacrimal duct using dacryoendoscopy in children, the specific details are unknown.[9-11] In this study, we used dacryoendscopy to perform endoscopy-guided probing while observing the lacrimal duct in patients with congenital nasolacrimal duct obstruction (CNLDO). Finally, we discuss the utility of probing using dacryoendoscopy as a new alternative to blind probing for examining the site of obstruction and the conditions inside the lacrimal duct.

Methods

This is a retrospective, non-comparative case series. All subjects who underwent direct endoscopic probing between 2007 and 2011 in Asama General Hospital, Saku City, Japan were included in this study. We obtained approval from our Institutional Review Board approval for this study.

The diagnosis was made based on a history of epiphora and eye discharge during the first week of life and also the tear meniscus height at the time of the first consultation on the medical records. They were also diagnosed by the fluorescein disappearance test (FDT) and irrigation. If patients under 1 year of age were diagnosed with CNLDO, they were followed until they were over 1 year of age, because CNLDO patients younger than 1 year can spontaneously resolve.

We performed dacryoendoscopy using a 3 CCD imaging system (FT-203F; Fiber Tech Co. Ltd., Tokyo, Japan) with a 3,000-pixel camera that displays images on a television screen (Figure 1a). The endoscopic probe had an observation depth of 1–10 mm, a viewing angle of 60 degrees, and a probe diameter of 0.7 mm. The probe had a camera lens, fiber optic light guide cables, and a water channel bound with epoxy resin and covered in stainless steel tube, to provide sufficient strength for probing (Figure 1b). The effective endoscope length was 50 mm, and the probe had an angle of 27 degrees at 10 mm from the tip (Figure 1c).

We performed direct endoscopic probing under general anesthesia. After dilation of the lower punctum, the endoscope probe was inserted in lower canaliculus. After it was advanced until lacrimal sac, it was rotated to the horizontal portion of the canaliculus and inserted into the lacrimal sac while the inside of the lacrimal duct was observed on the screen. During the probing, physiological saline was injected through the water channel to secure the field of vision. Once the site of obstruction was confirmed, the endoscope was advanced and was used to perforate the obstructed area. For cases in which it could not be confirmed that the probe had reached the nasal cavity, a physiological saline solution dyed with trypan blue was injected into the lacrimal duct to confirm that the solution would be aspirated from the nasal cavity.

To evaluate the postoperative course of each subject, we conducted telephone interviews that occurred 6 months after the surgery. The results were categorized into 4 groups: excellent, good, fair, and poor. The definitions for each group are as follows:

Excellent: No recurrence once the symptoms (watery eyes and eye discharge) had completely disappeared

Good: Disappearance of the symptoms (watery eyes and eye discharge) but occasional eye discharge

Fair: The symptoms (watery eyes and eye discharge) disappeared initially but recurred, similar to the preoperative condition

Poor: The symptoms did not fully improve after the procedure

Results

Probing was performed in 13 eyes, for 10 children (4 boys and 6 girls) who were 14–74 months of age (mean age, 40.7 months) and were diagnosed with CNLDO (Table 1).

Three patients had bilateral obstruction, and seven had unilateral obstruction. Two patients had previously undergone blind probing at another hospital. The site of the obstruction was confirmed in all patients, except in Case 2, where the site of the obstruction could not be confirmed in the right eye. In all cases except Cases 2 (the right eye) and 9, the site of the obstruction was perforated, and the patency of the lacrimal duct was confirmed. The sites of obstruction included the punctum, canaliculus, sac, nasolacrimal duct, and nasal ostium (Table 1).

In Case 1, the patient had an obstructed common canaliculus in the right eye (Figure 2), but thereafter had no abnormal findings up to the nasal cavity. In Case 2, there were no sites of obstruction in the right eye and the patient had stenosis of the entire nasolacrimal duct due to edema (Figure 3). In Case 3, the patient had multiple dacryoliths in the right sac (Figure 4a), obstruction in the nasolacrimal duct, partial fibrosis, and inflammation of the lacrimal duct (Figure 4b). In Case 4, the patient had a blind probing once before visiting our hospital. There was an obstruction of lower nasolacrimal duct in the right eye and fibrosis in lacrimal sac. In Case 5, the sites of obstruction were canaliculus in right eye and lacrimal duct in left eye. The patient had a chronic dacryocystitis and fibrosis in lacrimal sac in the left eye. In Case 6, preoperative findings confirmed the presence of punctal occlusions at the upper and lower lacrimal puncta, which were opened with a punctal dilator (Figure 5), and then probing was performed. In Case 7, the patient had an obstruction at nasal ostium in the left eye. In Case 8, the patient had an obstruction at the opening of the nasal cavity; Figure 6 shows the status before and after probing. In Case 9, the patient had developed fibrous tissue and erythema of the mucosa in the sac due to repeated blind probing, which indicated that this infant already had chronic dacryocystitis and that reconstruction of the lacrimal duct was, regrettably, impossible (Figure 7). In Case 10, the patient had an obstruction at nasolacrimal duct in left eye. The lacrimal duct site was normal except at the site of obstruction.

For 12 eyes in 9 children, the evaluation was “Good” (38.5%) or “Excellent”(53.8%). For only one eye in case 9, it was “Poor” (7.7%), because the patency of the lacrimal duct could not be confirmed (Table 1).

There were no complications resulting from intraoperative endoscopy or general anesthesia.

Discussion

Since the late 1990s, dacryoendscopy has been used for lacrimal duct observation in Japan.[12,13] There have been several reports in Japan regarding the treatment outcomes of direct endoscopic probing in adults; these studies also used dacryoendscopy systems from Fiber Tech Co. Ltd.[14-16] However, the number of institutions that have introduced dacryoendscopy for CNLDO treatment remains small. In general, CNLDO is treated with blind probing, and it has a high success rate of 90% or above. However, in the case of patients who do not respond to the first probing, the probability that they will respond to a second probing is significantly low.[1,17-19] The reason is that a blind probing may produce false passage at the first probing. The injuries inside lacrimal duct may result in a cicatricial structure and iatrogenic obstruction. If bleeding is observed during the blind probing, which occurs in 20% of cases, it usually results in a false passage.[20] Therefore, to prevent making false passages and iatrogenic obstructions, it is important to perform the first probing successfully and to make a true passage accurately. It is clear from our study that even if skilled operators perform the first probing, the blind probing is still not accurate and reliable because of various sites of lacrimal duct. Conventionally, dacryoendoscopy has been used to observe the lacrimal duct and to select a treatment method. However, our dacryoendoscopy enabled simultaneous probing and observation of the inside of the lacrimal duct. It is an alternative procedure taking the place of the inaccurate procedure like blind probing.

In Case 2, the patient had epiphora in the right eye, but the site of the obstruction could not be determined, suggesting that some patients with CNLDO might have functional obstruction. Indeed, in Case 2, edematous thickening of the mucosa of the lacrimal duct and stenosis throughout the lumen of the lacrimal duct were observed (Figure 3). Therefore, epiphora may occur due to stenosis even if there is no specific site of obstruction. It is very dangerous to perform blind probing in such cases, and failure of blind probing may cause iatrogenic obstruction, because we believe that the lacrimal duct is not necessarily straight based on our experience of direct observation of the lumen for CNLDO . In some studies[7, 9] on nasalendoscopy assisted probing, functional obstruction cases have been reported, the cure rates of which are 55.6% and 25% respectively. If blind probing was performed repeatedly on such uncured cases, the possibility of iatrogenic obstruction would increase certainly.

In Case 9, blind probing had been repeatedly performed at until 6 years old without symptom improvement. The inside of the lacrimal duct was stiff and obstructed by fibrous tissue due to chronic inflammation; therefore, probing was impossible. If endoscopic probing had been used as the first treatment, the obstruction might have been removed, and this would not have been a refractory case. In general, the final option of treatment for CNLDO is dacryocystorhinostomy (DCR),[21-23] which has two options, external DCR and endoscopic DCR.

Endoscopic DCR is technically difficult because of the poor visualization because of small nostrils and narrowed nasal cavity. Because of this reason, external DCR is the more common procedure on the final option for CNLDO. Therefore, such a refractory case will have to have external DCR finally. The disadvantage of external DCR is invasive surgery because of osteotomy, and it may maintain the scar of a cutaneous incision on the patient’s face. Though the success rate for external DCR in children is about 88% to 96%,[22] the direct endoscopic probing may be able to save such a severe case and avoid an invasive procedure.

Endoscopic probing was performed in 10 children with CNLDO. In this study, we understand there are some limitations like retrospective study design, non-comparative nature of the study and subjective outcome measurement. However, we confirmed that probing while observing inside the lacrimal duct could accurately and safely open the obstructed lacrimal duct. Even though there were only a few cases, we noted that there were various sites of obstruction and various conditions such as edematous thickening of the mucosa of the lacrimal duct (Case 2) and fibrous tissue due to chronic inflammation inside the lacrimal duct, rather than a common deformation. We believe that endoscopic probing is the most accurate method for treating such widely varying deformations. It is, however, necessary that we increase the number of cases of endoscopic probing in order to gain more experience in the use of this technique.

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Figure legends

Figure 1 a: Dacryoendscopy system, 3 CCD imaging system (FT-203F; Fiber Tech Co. Ltd., Tokyo, Japan) and a television screen. b: A section of the probe tip, which includes a camera lens (red arrow), fiber optic light guide cables (yellow arrow), and a water channel (blue arrow). Endoscope probe for a child (tip diameter, 0.7 mm). c: The effective endoscope length was 50 mm (yellow arrow), and the probe had an angle of 27 degrees at 10 mm from the tip (red arrow).

Figure 2: Case 1: right eye. An obstructed common canaliculus. Fibrous tissue occupies part of the lumen (red arrow)

Figure 3: Case 2: right eye. The mucosa on the wall of the sac had edematous thickening (red arrow), resulting in stenosis of the entire lacrimal duct (green arrow). No site of obstruction was found.

Figure 4 a: Case 3: right eye. Dacryoliths in the sac (red arrow). b: Fibrous tissue (red arrow) in the wall of the sac caused by chronic inflammation. Some bleeding (green arrow) was found.

Figure 5: Case 6. Punctal occlusion with membrane at the lower lacrimal points (red arrow).

Figure 6: Case 8. Obstruction at the opening of the nasal cavity (Right, before probing; Left, after probing).

Figure 7: Case 9. Dacryocystitis; proliferation of fibrous tissue (red arrow); inflammation of the wall of the sac.

Table 1. Clinical characteristics and past treatment of each case

Case No.	Sex	Age (mo)	OD/OS	Previous procedure	Site of obstruction	Characteristics of the lacrimal duct	Outcome after over 6 months
1	M	27	OD	Conservative treatment	Canaliculus	Normal except at the site of obstruction	Excellent
			OS	Conservative treatment	Nasolacrimal duct	Normal except at the site of obstruction	Excellent
2	M	30	OD	Conservative treatment	No obstruct	Hypertrophic mucous membrane	Good
			OS	Conservative treatment	Nasolacrimal duct	Fibrosis	Good

3	M	40	OD	Conservative treatment	Nasolacrimal duct	Lacrimal sac dacryoliths, Fibrosis, Dacryocystitis	Excellent
4	F	15	OD	Single blind probing at 4 months of age	Nasolacrimal duct	Fibrosis	Excellent
5	F	14	OD	Conservative treatment	Canaliculus	Normal except at the site of obstruction	Good
			OS	Conservative treatment	Sac, nasolacrimal duct	Dacryocystitis	Good
6	F	31	OS	Conservative treatment	Punctal occlusion, Sac	Normal except at the site of obstruction	Excellent
7	F	29	OS	Conservative	Nasal ostium	Normal except at the site of obstruction	Excellent

				treatment			
8	F	14	OD	Conservative treatment	Nasal ostium	Normal except at the site of obstruction	Good
9	M	74	OS	Several blind probing procedures	Nasolacrimal duct	Dacryocystitis, Cicatrical structure	Poor
10	F	18	OS	Conservative treatment	Nasolacrimal duct	Normal except at the site of obstruction	Excellent

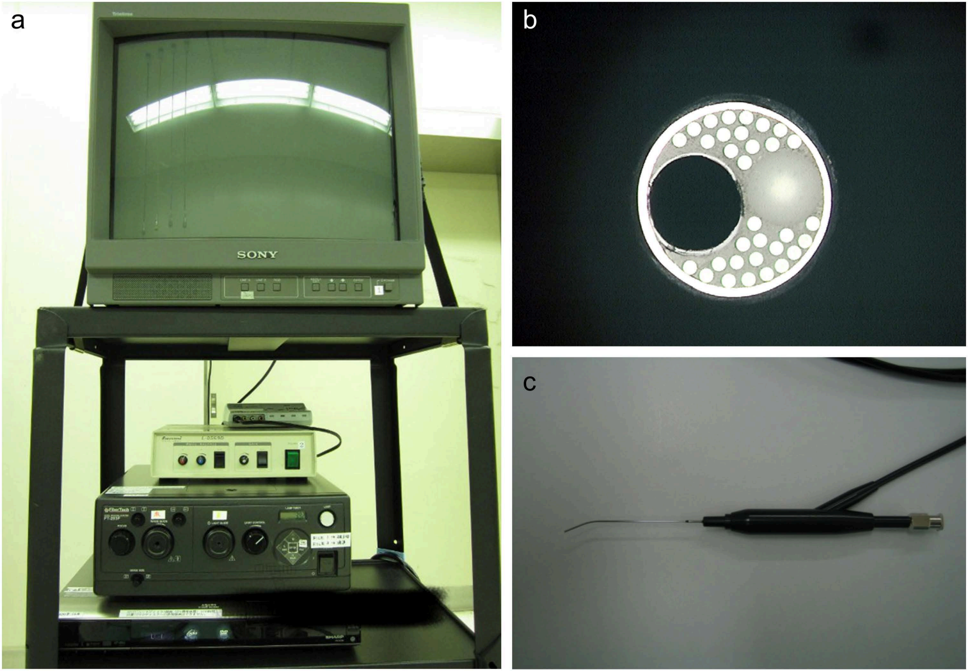
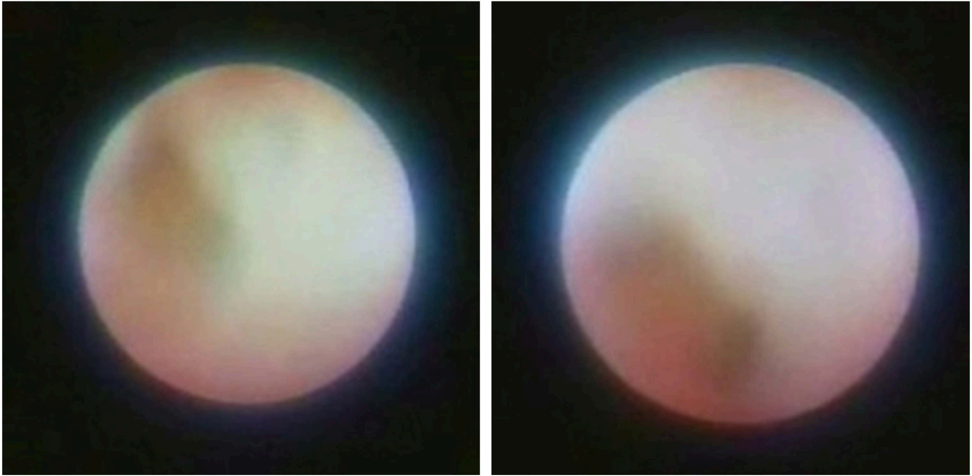


Figure 1



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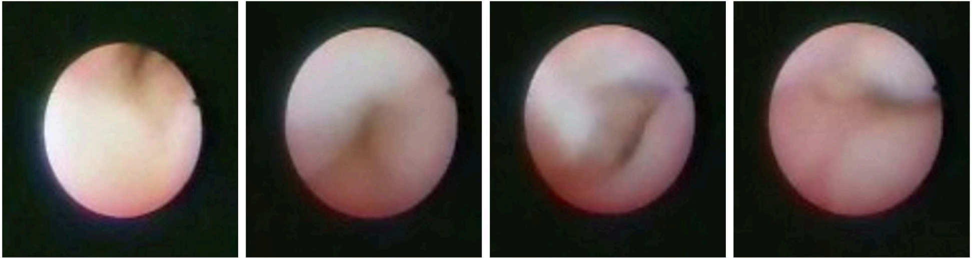

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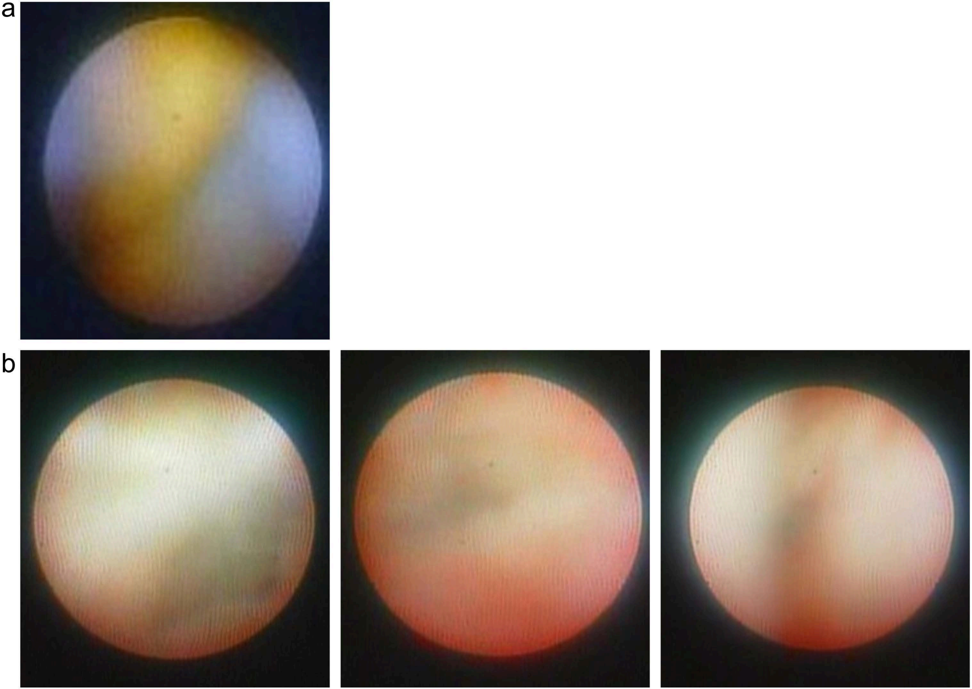

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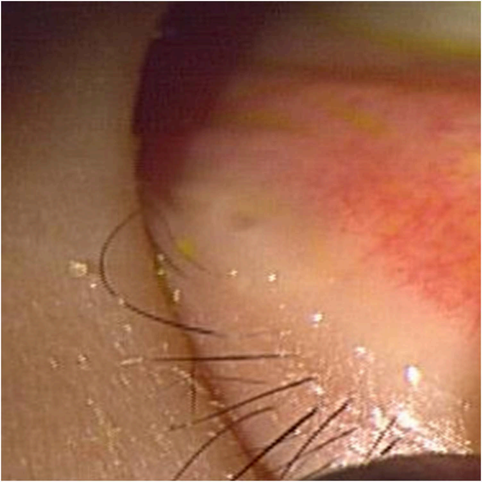

Figure 5

Figure 6

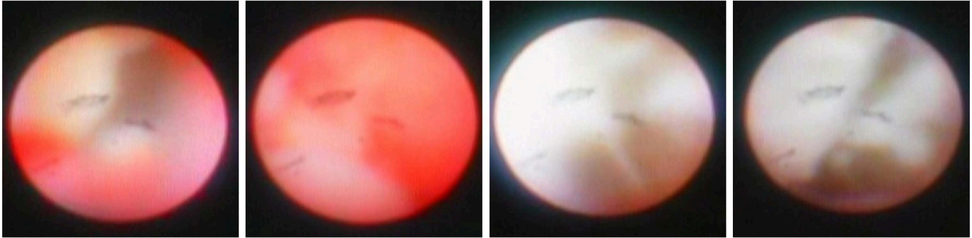

Figure 7