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Original Article

Effect of revision dacryocystorhinostomy under nasal endoscopy on recrudescent dacryocystitis

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Abstract: Objective: Patients with recurrent dacryocystitis are difficult to treat. We aimed to observe the role of dacryocystography in locating the site of obstruction and the effect of revision surgery in these cases of recurrent dacryocystitis. Method: We prospectively collected patients with recurrent dacryocystitis at West China Hospital of Sichuan University. Dacryocystography was performed before surgery. After revision endoscopy dacryocystorhinostomy (DCR), patients were followed-up regularly. Clinical features were recorded before and after operation, including the visual analog scale (VAS) score. Using the software of SPSS 13.0, VAS scores were compared between preoperation and postoperation by a Student's *t* test and repeated measure ANOVA. Results: Twenty patients were collected; eight cases had a history of a one-time occurrence of DCR, and 12 cases had a history of two or more occurrence of DCR. Dacryocystography could show the site with the most lacrimal obstruction. During the operation, we could resect most of the lacrimal sac medial bone wall and expose the sac successfully. Follow-up showed no relapse occurrences and only one case had a slightly tearful eye subjectively but had enough big orificium fistulae and favorable mucosal epithelialization that it was similar to other cases. The VAS scores at follow-up decreased significantly compared with preoperation ($P<0.05$). Conclusion: For patients with recurrent dacryocystitis, dacryocystography could clarify the cause and exact site of the obstruction and provide information for further treatment. Through revision endoscope DCR, patients can effectively achieve enough drainage of the lacrimal sac accompanied with a significant improvement in symptoms and no observable complications.

Keywords: Recurrent dacryocystitis, dacryocystography, dacryocystorhinostomy, nasal endoscope, visual analog scale

Introduction

Nasolacrimal duct obstruction is a major cause of chronic dacryocystitis. To rebuild tear drainage, surgery is currently the main treatment. Since the first autopsy study on dacryocystorhinostomy (DCR) via nasal endoscopy by Rice [1] in 1988, endoscopic DCR has been investigated. McDonogh *et al.* [2] performed endoscopic DCR to treat chronic dacryocystitis, which became the main therapy for the condition. Recently, the treatment of chronic dacryocystitis saw a great progress including lasers [3], endoscopic surgery [4], polymer materials [5], and other medical apparatus and instruments, but there was still the possibility of the drainage channel being obstructed again, leading to recurrence, especially for cases with a scarred ostium after the operation [6].

Revision DCR under nasal endoscopy is still available for recrudescent cases as described in previous reports [6]. Recently, we prospectively collected patients with revision surgeries of lacrimal sac obstructions by resecting most of the lacrimal sac medial wall. The study was proposed to observe the role of dacryocystography in locating the site of obstruction and the effect of revision surgery on these recurrent dacryocystitis cases by resecting most of the lacrimal sac medial wall under nasal endoscopy.

Materials and methods

Objects

This study included 20 patients who underwent surgery as a result of recrudescent dacryocystitis between January 2013 and March 2016 at

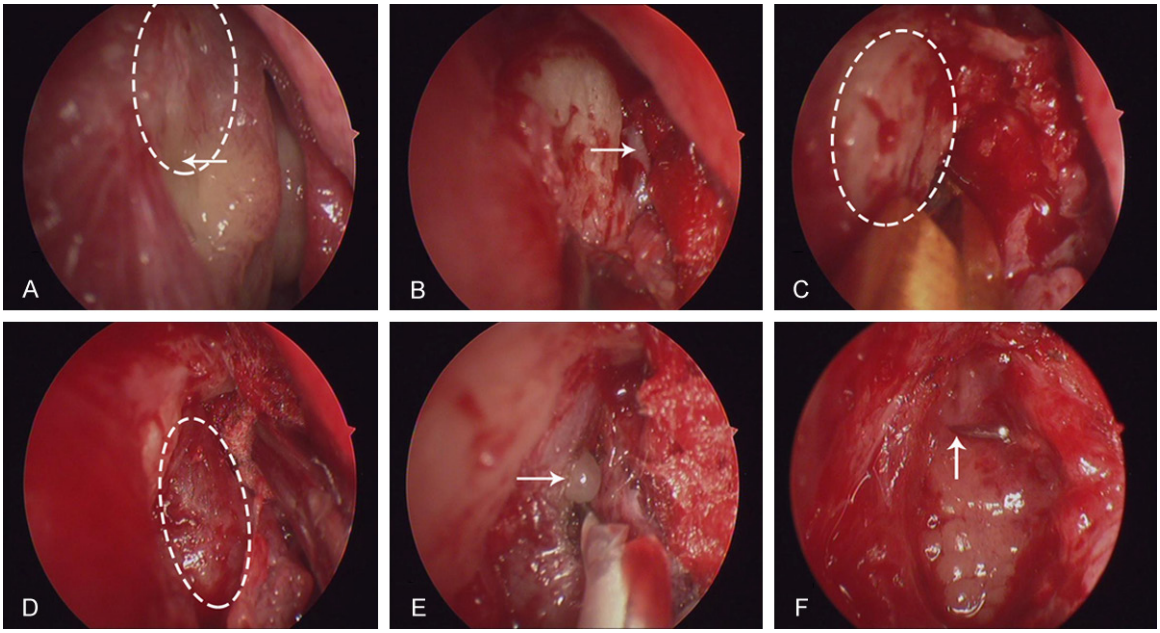

Figure 1. Surgical steps. A. The projection of lacrimal sac (outlined with a broken line) in the lateral nasal walls. Cicatrization (white arrow) in surgical surface led to obstruction of the anastomotic stoma. B. Turning up the mucous membrane (white arrow) to expose the frontal process of the maxilla. C. Removing part of the medial bone wall of the lacrimal sac by bone rongeur, including part of the maxillary frontal processes (outlined with a broken line). D. Exposing the medial wall of the lacrimal sac (outlined with a broken line) thoroughly. E. Sticky purulence (white arrow) would outflow from the lacrimal sac usually when the middle wall of lacrimal sac was incised. F. The probe was manipulated out from the lacrimal canaliculus to the Rosenmuller's valve (white arrow). Rosenmuller's valve was viewed under nasal endoscopy.

West China Hospital of Sichuan University. All patients had at least a one-time occurrence of DCR before being enrolled in the study. All patients had undergone a previous assessment of the site of the obstruction by dacryocystography. Patients, whose lacrimal sac could not be inserted by a probe, or who had the obstruction site at the canaliculus as shown by dacryocystography, were excluded. The ethics committee of West China Hospital approved this study and all patients gave informed written consent.

Effect evaluation

A visual analog scale (VAS) was used to evaluate disease severity and the effect of surgery based on the question "Are you plagued by dacryocystitis?" [7]. Preoperative and postoperative VAS scores were collected at preoperation, and 1, 3, and 6 months after operation. Then, the scores were compared, and the effect was evaluated.

Revision surgical steps

General anesthesia was administered intravenously to reduce patient discomfort. Adrenaline cotton swabs were used to shrink the nasal mucosa after disinfection, and then the landmarks in the nasal cavity, including the middle turbinate and agger nasi cells, were identified, as well as the projection of the lacrimal sac on the lateral nasal wall (**Figure 1A**). Diorthosis of a deviated nasal septum would be performed to enlarge the surgical field if the deviated septum affected surgical field remarkably. First, we removed the nasal mucosa around the lacrimal sac scar that had been formed by the previous operation. Then, the mucous membrane flap was turned up to the uncinate process. The lacrimal sac scar and the maxillary frontal processes were visible (**Figure 1B**). The mucosal flap was placed into the olfactory cleft. The medial bone wall of the lacrimal sac was removed thoroughly with a bone rongeur or abrasive drill (**Figure 1C**). The maxillary frontal processes in front of the agger nasi cells and part of the lacrimal bone were removed if necessary (**Figure 1D**). A lacrimal sac probe was inserted into the lacrimal sac through the upper or lower lacrimal puncta to indicate the residual lacrimal sac cavity. Usually, a large quantity of sticky purulent discharge was observed in the lacrimal sac when the medial part of the lacrimal

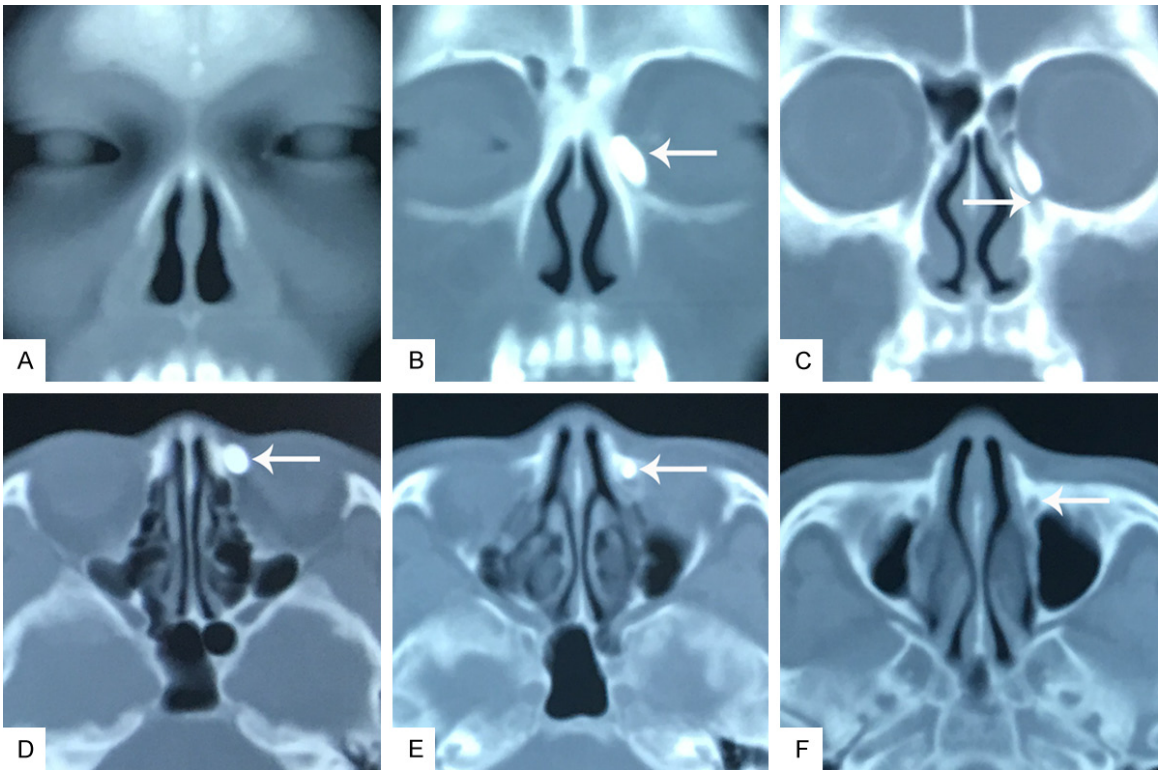

Figure 2. Dacryocystography was used to assess the obstruction site. (A-C) The coronal CT scan showed the retention of Omnipaque (contrast media containing iohexol) in the fundus (A) and body (B, arrow) of the nasolacrimal sac (NSL) while not in the nasolacrimal duct (NSD, arrow) (C). (D-F) The axial CT showed the retention of omnipaque in the fundus (D, arrow) and body (E, arrow) of the nasolacrimal sac (NSL) while not in the nasolacrimal duct (NSD) (F, arrow).

sac was incised (**Figure 1E**). A mucosal forceps was used to remove the medial part of the lacrimal sac enough to drain the secretion or tear. Rosenmuller's valve was then viewed under nasal endoscopy (**Figure 1F**). After stanching, resorbable material (Nasopore, Polyganics, Stryker, Groningen, The Netherlands) was placed into the residual cavity of the lacrimal sac. The mucosal flap was trimmed and reset to cover the lateral nasal wall. Nasopore was used to compress the mucosa to the surgical surface.

Perioperative management and follow-up

An antibiotic was administered to prevent infection for 3 days after the operation. Regular follow-up and lacrimal duct flushing were performed. Salt water was used to irrigate the nasal cavity to promote drainage after the second week post operation. An intranasal corticosteroid spray was used continuously for three months. To avoid secondary damage and reduce the cicatrization of the surgical surface, we carefully cleaned the nasal cavity.

Statistical methods

A student's *t* test was conducted to compare the influence of recurrence on the quality of life. A repeated measure ANOVA was performed using SPSS 13.0 (SPSS, Inc., Chicago, IL, USA) to analyze the effect of the operation. $P<0.05$ was considered to be statistically significant.

Results

The patients consisted of 7 males and 13 females aged from 18 to 69 years, with an average age of 48±9 years. Eight cases had a history of a one-time occurrence of DCR, and 12 cases had a history of two or more occurrences of DCR. A total of 20 sides were recorded. The most common complaint was epiphora (80%), followed by chronic dacryocystitis (60%). All patients have the most common site of lacrimal obstruction at the nasolacrimal duct according to dacryocystography (**Figure 2**). For all patients, the medial bones of the lacrimal sac were removed and the residual lacrimal sacs were successfully exposed during the operation.

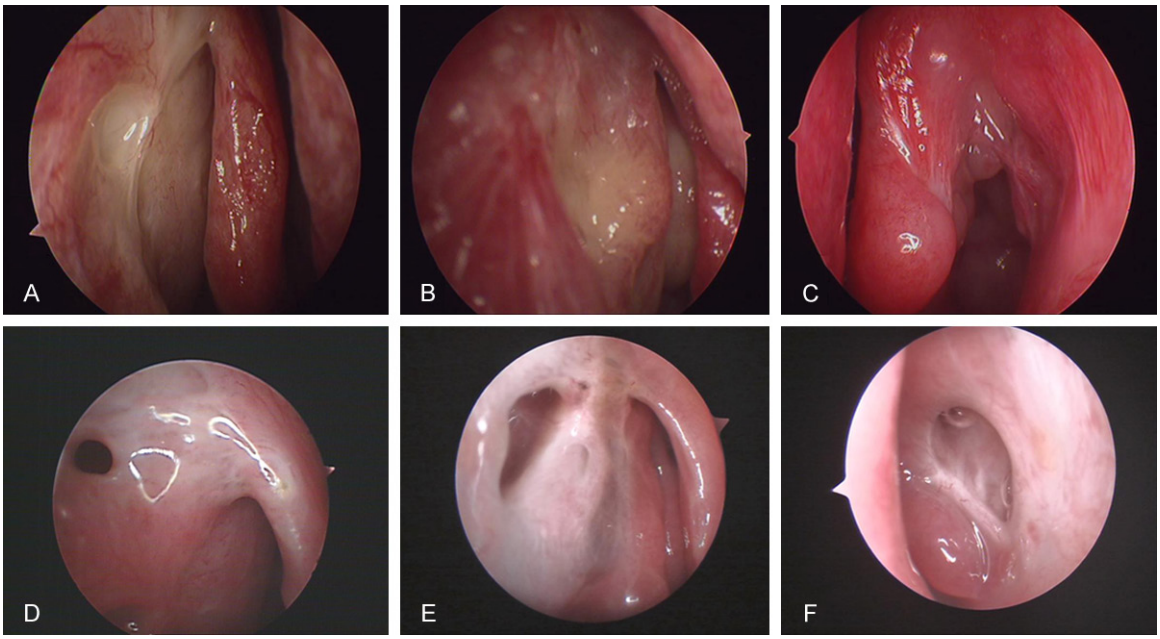

Figure 3. Representative results showed patients achieved the desired drainage with good epithelialization after revision DCR, compared with cicatrization in the anastomotic stoma as a result of the previous one to three DCR. (A-C) Obvious obstructive cicatrization in anastomotic stoma that have undergone once (A), twice (B) and triple (C) DCR. (D-F) Desired drainage with good epithelialization in the anastomotic stoma related to the response in patients in (A-C), respectively.

Table 1. Preoperative and postoperative VAS scores

History	Preoperative	One month	Three months	Six months	*P* value
One DCR	7.07±0.70	0.71±0.11	0.79±0.07	0.81±0.11	<0.001$
Over 2 DCR	8.32±0.81*	0.61±0.20	0.67±0.14	0.69±0.15#	<0.001$
Total	7.78±0.98	0.66±0.17	0.72±0.14	0.73±0.15	<0.001$

VAS, Visual analog scale; DCR, dacryocystorhinostomy; *Vs Once DCR P=0.006, #Vs Once DCR P=0.038; $Vs preoperative, P<0.001.

All patients had good drainage three months after operation, as indicated by lacrimal sac flushing via the lacrimal puncta. One patient appeared to have a hypertrophy scar in the surgical surface at the first-month visit, then mitomycin C (a single 3-min 0.01% MMC) [8, 9] was applied to the hypertrophy scar to inhibit cicatrization. Only this patient with a hyperplastic scar reported a mild tearful eye at the third-month visit but had a big anastomotic stoma. After more than 6 months of follow-up, all cases had effective drainage without any complaints of epiphora and had the desired epithelialization of anastomotic stoma (**Figure 3**). No complications including xerophthalmia were reported after six-months of follow-up.

Patients with a history of more than two occurrence of DCR had higher VAS scores compared with one-time occurrence DRC patients, but all scores were significantly decreased after the revision surgery and until to six months of follow-up (**Table 1**).

Discussion

In our study, the site of obstruction was assessed by dacryocystography previously. It may help to clarify the cause and exact site of obstruction and provide information for further treatment, especially an operation [10]. The most common site of lacrimal obstruction was at the nasolacrimal duct. Most patients have symptoms of epiphora and chronic dacryocystitis after a previously failed DCR. The complete success rate of revision endonasal DCR in our study was comparable to that described in a previous report [6]. As reported previously, endonasal DCR was a greatly developed technique under the help of rigid nasal endoscopes [11]. The success rate for endoscopic endonasal DCR appears comparable to the external approach, especially for treatment of nasolacrimal duct obstruction, with a number of advantages over an external approach including

direct visualization of nasal anatomy, avoidance of cutaneous scar, and preservation of medial canthal tendon and pump function [7, 12, 13].

Though the advantage of endonasal DCR was obvious, relapse may occur in this therapy and needs further investigation. The possible reasons for relapse are as follows: granulation hyperplasia of wounds; scar contracture; inflammation and lack of experience [14]. Recurrence of disease increases the economic burden of patients and can significantly affect the quality of life and personal appearance [7]. The VAS score of patients who had DCR more than once is higher than that of the patient who had DCR only once. However, after our revision surgery, the symptoms were completely improved with no complications reported by these patients. The VAS score of patients decreased significantly from the first follow-up after revision surgery, and the VAS score remained lower than one through six months of follow up. These findings indicated that revision surgery could remarkably relieve the symptoms of patients who had undergone several DCR.

Based on our experience of endoscope DCR, some key tips were critical in obtaining satisfied results. First, dacryocystography would clarify the cause and exact site of the obstruction and provide information for further treatment. If the obstruction site was located at the canaliculus, single surgery to open the lacrimal sac without solving the drainage from the canaliculus to the sac would be doomed to failure. An objective dacryocystography would be an excellent method to determine the surgical approach. Additionally, removing the maxillary frontal processes in front of the agger nasi cells during the revision DCR was another key point. Without sufficient bone removal, it would lead to difficulty in exposing the residual lacrimal sac [15, 16], as indicated in **Figure 3C**. Furthermore, placing biodegraded resorbable material into the residual lacrimal sac cavity was another key to providing gentle mechanical support [17]. It separated mucosal surfaces by keeping opposing mucosal tissues separated during the critical, early post-surgery days and then prevented the formation of post-surgical adhesions in the anastomotic stoma. Moreover, resetting the trimmed mucosal flap to the exposed lateral nasal bone was also extremely important because it would provide the basis of epithelization of the bone surface to reduce scarring possibilities. As reported by Wormald, fashioning a U-shaped flap over the ostial meatus resulted in 95% patency, purportedly leading to primary intention healing without granulation [15]. Therefore, familiar lacrimal sac anatomy, right incision and resorbable material combined together to result in a successful DCR.

In summary, we found that dacryocystography could clarify the cause and exact site of the obstruction and provide information for further treatment for chronic dacryocystitis patients with repeated DCR. Resecting most of the lacrimal sac medial wall could effectively solve the problem of lacrimal sac drainage and markedly ameliorate the patients' symptoms. Our study indicated that skilled revision endonasal DCR could help to avoid a facial scar and complications and reduce recrudesce. However, the surgical methods still need further follow-up and more cases should be included in future investigations.

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Disclosure of conflict of interest

None.

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