Endoscopic Revision After Failed Dacryocystorhinostomy

Aly SA Habl[1], Mohamed NR El Metwally[1], Ayman M Fawzy[1], Ahmed A El Zihzahi[2], Ayman E Abd El Ghaffar[1]

[1] Ophthalmology department, Faculty of Medicine, Mansoura University, Egypt.
[2] Otorhinolaryngology Department, Faculty of Medicine, Mansoura University, Egypt.

Abstract

Purpose: Assessment of the outcome of endoscopic revision of DCR. Patients and Methods: Twenty-two recurrent dacryocystitis cases who attended the Mansoura Ophthalmic Center in the period from July 2020 to June 2022 were enrolled in this study. Endoscopic DCR was performed to these cases as a revision surgery. Results: Clinical improvement from baseline after treatment was observed in all symptoms ($p < 0.001$). The success rate achieved by endoscopy was 19/22 patients (86.4%), while only 3/22 cases (13.6%) had failure. Conclusion: Endoscopic revision after failed DCR is an effective and safe procedure for treatment of recurrent dacryocystitis.

Keywords: Endoscopic Revision, Dacryocystorhinostomy.

1. Introduction

The first DCR was described in 1904 by the, Addeo Toti, by an external approach, and remained the gold standard technique until endoscopic dacryocystorhinostomy (endo-DCR) gradually gained popularity in the last 3 decades **[1]**.

External DCR is the most common surgery and the preferred method among ophthalmologists for chronic dacryocystitis. The success rate of this approach varies in different studies from 63% to 97%. Overall, there is still a failure rate of 4% to 13% in which the patients' epiphora recurs **[2]**. Anatomical variations and intranasal pathologies are the most common reasons that can cause narrowing of the nasal airway and the subsequent failure of the surgery. Other causes of failure include granulation tissue and scar formation, insufficient rhinostomy, presence of nasal polyps rhinosinusitis, inappropriate location or closure of the ostium, concha bullosa, intranasal adhesion, abnormal size of fistula, sump syndrome, previous maxillofacial trauma, enlargement of Aggernasi cells, and paradoxical or hypertrophic middle turbinate. Therefore, intranasal evaluation and the ears, nose and throat consultation and/or diagnostic nasal endoscopy can discover the intranasal pathologies that may lead to failure of DCR **[3]**.

The endoscopic DCRs can achieve similar success rates to external DCRs by two factors: 1- Maximizing bone window and complete exposure of the inside wall of lacrimal sac; 2- Ensuring anatomical overlap of the lacrimal sac and nasal mucosal flap **[4]**.

For the cases of small sac who have lacrimal sac mucosa fibrosis and mucosa scarring resulting from limited residual sac mucosa caused by previous DCRs the success rate of revision DCR is significantly reduced regardless of the surgical approaches **[5]**.

One of the most important reasons is that it is difficult to form lacrimal sac mucosal flap and nasal mucosa flap anastomosis, which causes stoma scarring and resultant surgical failure. A powered endoscopic DCR is a suitable option for revising failed DCRs in which yields good long-term results. Inserting silicone tubes through the inferior and the superior puncta significantly improved the success rate of revision DCR **[6]**. The present study aims to assess the outcome of endoscopic revision of DCR.

2. Patients and Methods

This is prospective, interventional study involved patients with recurrent epiphora after previous DCR who attended the Mansoura Ophthalmic Center in the period from July 2020 to June 2022. The study was performed in the Ophthalmology Department, Faculty of Medicine, Mansoura University. Mansoura Institutional Review Board (IRB) approval was obtained from Faculty of Medicine, Mansoura University and an informed consent was taken from all patients.

Inclusion criteria includes; patients with recurrent dacryocystitis after primary DCR, whether external or endoscopic DCR, adult age more than 18 years of both sexes. However, patients with primary dacryocystitis, suspected malignancy, bone deformity after trauma, proximal lacrimal system obstruction, and pregnancy were excluded.

Twenty-two patients of unilateral recurrent epiphora after previous DCR were enrolled in this study. Onset and duration of the disease, type of primary DCR and onset of symptoms after previous surgery were recorded.

Complete assessment was done for each patient including: Personal history; name, age, residence and occupation, history of previous medications and any drug sensitivity, date of last intervention, onset and duration of the disease, details of the previous lacrimal surgery, any nasal or sinus disease, patient's first complaint, duration of the disease and its progression.

Clinical examination included; visual acuity, fundus examination and intraocular pressure assessment,

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eyelid examination, examination of the puncti (stenosis or malposition), and evaluation of tear meniscus.

The following tests were done:

1. Regurgitation test: palpation with pressure on lacrimal sac. Punctal reflux of mucopurulent material on lacrimal compression was indicative of a mucocele with a patent canalicular system, but with an obstruction either at or distal to the lower end of the lacrimal sac. In acute dacryocystitis palpation was severely painful and compression was avoided.
2. The dye disappearance test (DDT): DDT was performed to asses tear outflow. Fluorescein 2% drop was instilled in the conjunctival sac of each eye then the tear film was observed with cobalt blue filter of the slit lamp over 5 minutes. The side of inadequate tear flow retains the dye (positive test).
3. Irrigation of the upper lacrimal drainage system: It was performed after DDT to detect level of obstruction of lacrimal drainage system. After topical anesthesia, the upper punctum was dilated by Nettleship dilator. Then curved blunt tipped 23-gauge cannula with saline-filled syringe was advanced through the upper punctum, first in the vertical part of the canaliculus for 2mm, then through the horizontal part of the canaliculus while keeping lateral traction of the eye lid until hard stop is felt (reaching the medial wall of the sac). Then gentle saline irrigation was done. If saline passed into the nose and throat and, this was indicative of patent lacrimal system (positive test), but if saline failed to pass to throat with reflux of the saline it was indicative of complete obstruction of nasolacrimal duct (negative test).
4. Endoscopic examination: Nasal endoscopy was done for all patients after topical decongestion and application of anesthesia to the nasal cavity. Often, mixture of 2% lidocaine and 2.5% phenylephrine. The aim of this examination is to evaluate the site of previous osteotomy and any possible nasal pathology that may be the cause of recurrence such as closed osteotomy by granulation tissue, nasal polyp, small osteotomy, retained tube.

Preoperative Preparation:

1. Systemic evaluation for proper control of hypertension & bleeding tendency to avoid intraoperative bleeding.
2. Aspirin and nonsteroidal anti-inflammatory drugs (NSAIDs) inhibit platelet aggregation for up to 2 weeks and may lead to severe operative or postoperative bleeding with resultant cosmetic and functional sequelae. Hence NSAIDs had to be stopped two weeks before surgery. Warfarin had to be stopped one week before surgery.
3. Decongestion and shrinkage of the nasal mucosa with oxymetazoline hydrochloride (Afrin) or phenylephrine hydrochloride 2.5% nasal drops few days before endoscopic DCR surgery.
4. Cases with acute attack of dacryocystitis were treated with systemic antibiotics, frequent hot compresses till the acute attack subsided before the surgery for fear of spreading cellulitis.
5. The nose was packed with a gauze soaked with adrenaline (1:100,000) for 10 minutes before the operation.
6. In all cases, the head was elevated relative to the leg to pool the blood down away from the head.

Surgical technique:

Under general anesthesia, revision endoscopic DCR was done to all patients after detecting the cause of recurrence with surgical management.

1. All revision endoscopic DCRs were performed under general anesthesia. Nasal decongestion was performed by infiltration with 2% lidocaine and adrenaline (1/100,000).
2. U-shaped incision was performed to elevate a posteriorly based mucosal flap and expose any remaining bones over the lacrimal sac. A 15-scalpel blade was used for mucosal incisions horizontally 1 cm superior, commencing 3 mm posterior to axilla of the middle turbinate and moving forward 1 cm onto the frontal process of maxilla. The blade was then turned vertically and incision was made about two thirds of the vertical height of middle turbinate, stopping above the insertion of inferior turbinate into lateral nasal wall. The blade was then turned horizontally, and the inferior insertion commenced at the insertion of the uncinate process and brought anteriorly to meet the vertical incision. The mucosal flap was elevated using a dissector to expose and identify the junction hard frontal process of maxilla and the soft lacrimal bone. The thin lacrimal bone is 2 to 5 mm wide anterior to the insertion of the uncinate process where the dissection ended. The soft lacrimal bone was elevated and removed away from the posteroinferior region of the sac.
3. Whenever present, bony remnants covering the lacrimal sac after the previous surgery were removed using bone rongeur. These include the anterior part of uncinate process (UP), frontal process of the maxilla, and the lacrimal bone. Bone removal was carried out to create an adequate opening over the medial surface of the sac. During the removal of the hard lacrimal bone, the tip of the punch was used carefully to push the lacrimal sac away from it to expose the anteroinferior portion of the lacrimal sac.
4. Then any granulation tissue, retained tube, or adhesions were removed.
5. The inferior punctum was dilated with a punctum dilator, and a Bowman's canalicular probe was passed into the sac until seen moving behind the thin sac wall. A vertical incision was carried out in the medial wall of the sac, followed by horizontal incisions inferiorly and superiorly to create lacrimal sac flaps, in a fashion similar to an open-book using 2.4mm keratome then both anterior and posterior flaps were removed. Then syringing of lacrimal system through upper punctum by trypan blue dye was done to ensure complete opening of lacrimal sac.

A silicone stent was placed through upper, lower pucti, canaliculi and tied through the nose in all revision cases to prevent closure by the fibrous tissue.

Post operative care

The patients were discharged on the second day of surgery. One week course of systemic antibiotic was given. Antibiotic eye drops were placed in the eye for 2 weeks. Nasal decongestant was used twice a day for 2 weeks. The silicon tube was left in place for 3 months. Patients were instructed not to blow their nose in the first postoperative month to prevent inducing intra-orbital air and subcutaneous emphysema or bleeding.

Follow-up

Post operative follow up visits was done at 1, 3 weeks; 1, 3 and 6 months. Successful outcome was defined by resolution of epiphora, endoscopic examination, DDT and irrigation test.

Removal of the silicon tube

The silicon tube was removed after 3 months of the operation in 20 patients while 2patients the tube was slipped earlier. After instillation of decongestant nasal drops and application of anesthetic nasal spray, the tube was removed simply by long toothed forceps under visualization of nasal endoscopy after cutting the loop at the inner canthus.

Criteria of success

1. Resolution of symptoms of epiphora.
2. Negative regurge test.
3. Normal DDT.
4. Normal irrigation test.

All collected data and endoscopic findings were recorded, tabulated for statistical purposes and then statistically analyzed.

Statistical analysis

Statistical analyses were performed using SPSS v23 statistical software (SPSS, Inc, Chicago, Illinois). Descriptive statistics (means correlation standard deviations) were calculated for quantitative variables. Two-sided Chi-square, student-t and ANOVA test were used as appropriate for parametric data, and Mann-Whitney U and Kruskal Wallis tests were employed for non-parametric variables. The significance level was calculated and $P < 0.05$ was considered statistically significant, while $P > 0.05$ was considered statistically non-significant.

3. Results

This study involved 22 patients with failed dacryocystorhinostomy underwent endoscopic revision; they were 17 females (77.3%) and 5 males (22.7%). The ages ranged from 18 to 71 years with mean ± SD of 41.9 ± 18.3 years (table 1).

Previous external DCR was performed one time for 14 patients (63.6%) and endoscopic was performed for 6 patients (27.3%) with statistically highly significant in comparison between the two techniques, while two times external DCR was performed for 2 patients (9.09%) and no endoscopic DCR was done two times with statistically highly significant difference. The total performed DCR was external in 16 patients (72.7%) and endoscopic for 6 patients (27.3%) with statistically highly significant difference ($p < 0.001$), as shown in table (2).

Duration of appearance of symptoms after last operation ranged between 2 to 54 months (4.5 years) with mean of 9.59 ± 11 months. However, duration for revision surgery ranged from 2 - 60 months (5 years) with mean of 16.45 ± 16.36 months. In comparison between the two times showed highly significant difference ($p = 0.002$), i.e., revision surgery was delayed in most of the patients (table 3).

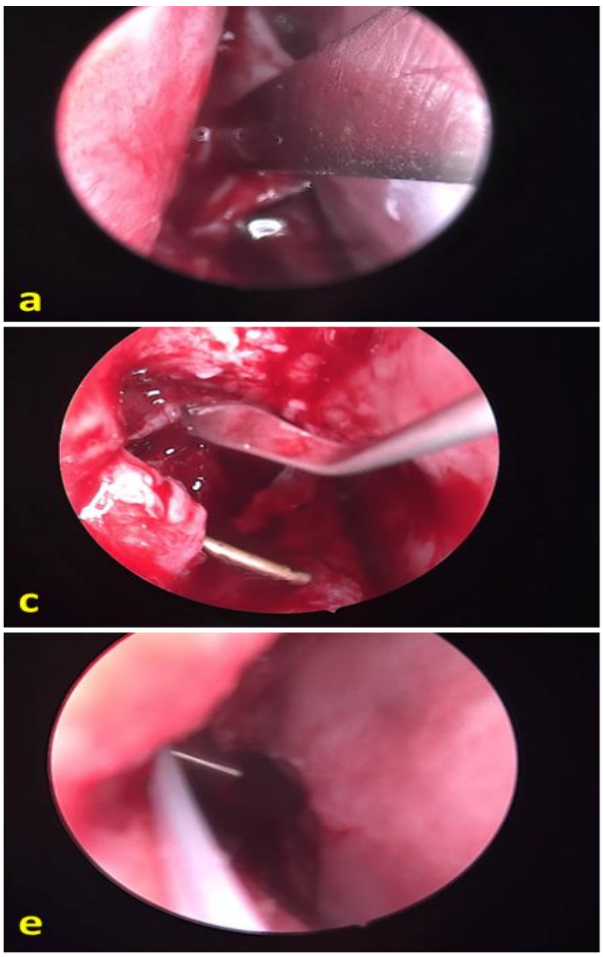
Tests performed for the studied patients at baseline. Regurge test was positive in 16 patients (72.7%) and negative in 6 patients (27.3%). Syringing failed in all patients and DDT was positive in all patients (table 4).

Clinically, there is a significant decrease all symptoms after treatment ($p < 0.001$). Preoperative epiphora was present in all cases (100%) decreased to 3 (13.6%), encysted mucocele was found in 7 patients (31.8%), all disappeared after treatment, and fistula was found in one patient (4.55%)& disappeared after treatment. There is a significant decrease all symptoms from baseline after treatment ($p < 0.001$). Regurge was positive in 16 patients (72.7%) decreased to 2 only (9.09%), syringing was negative for all patients, while it was negative in only 3 failed postoperatively and DDT was positive in 22 patients (100%) decreased to 3 patients (13.6%) as shown in table (5).

Relation between endoscopic findings and clinical presentation after treatment revealed that deviated nasal septum was found in one patient (4.55%) with positive regurge, 2 patients (9.09%) with epiphora and 2 patients (9.09%) with DDT. Granulation tissue was found in 2 patients (9.09%) with regurge, 3 patients (13.6%) with epiphora, and 3 patients (13.6%) with DDT. Obstructed osteotomy was found in one patient (4.55%) of each regurge, epiphora and DDT. Nasal polyps and narrow osteotomy were found in one patient (4.55%) represented by regurge, 2 patients (9.09%) in patients represented by epiphora or DDT. Retained tube was present in one patient (4.55%) with Epiphora and another one had DDT (table 6).

The success rate achieved by endoscopy was 19/22 patients (86.4%), while only 3/22 cases (13.6%) had failure. The cause of failure was incomplete lacrimal sac medial wall removal, granulation tissue, and retained tube in two cases performed endoscopic DCR and narrow osteotomy in one case performed external DCR as a rprimary surgery (table 7).

Postoperative complications were minimal, 17 patients (77.3%) had no complications, while only 5 patients (22.7%) had complications. They include 3 patients (13.6%) had epiphora, 4 patients (18.2%) had postoperative bleeding, 2 patients (9.09%) had slipped tube and only one patient (4.55%) had nasal infection. (table 8).



a. Incision of nasal mucosa by blade.
b. Removal of maxilla and maxillary frontal process by rongeur.
c. Lacrimal probe guided full opening of lacrimal sac using keratome.
d. Syringing with trypan blue stain to ensure complete opening of lacrimal sac.
e. Insertion of silicon tube to prevent closure by fibrous tissue.

Fig. (1): Steps of endoscopic DCR.

Table (1): Age and sex distribution of the studied patients.						
	Males		Females		Significance	
Gender	No.	%	No.	%	χ^2	P
Total (n = 22)	5	22.7	17	77.3	24.12	0.000*
	Min	Max	Mean	±SD		
Age (years)	9	71	41.9	18.3		
χ^2 = Chi square, *p = highly significant, SD: standard deviation.						

Table (2): Previous DCR of the studied patients.						
Previous DCR	External		Endoscopic		Significance	
	No.	%	No.	%	χ2	P
One time	14	63.6	6	27.3	3.621	0.000*
Two times	2	9.09	0	0.00	2.167	0.001*
Total	16	72.7	6	27.3	4.712	0.000*
*P <0.001: highly significant						

Table (3): Duration of symptoms recurrence after last operation and revision surgery.				
Duration	Symptoms recurrence	Revision surgery	Significance	
			t	p
Range (months)	2 – 54	2 – 60		
Mean ±SD (months)	9.59 ± 11	16.45 ± 16.36	1.989	0.002*
*P <0.01: highly significant				

Table (4): Baseline tests performed for the studied patients.						
Test	Positive		Negative		Significance	
	No.	%	No.	%	χ^2	P
Regurge test	16	72.7	6	27.3	3.268	0.000*
Syringing#	0	0.00	22	100	N/A	N/A
DDT	22	100	0	0.00	N/A	N/A
χ^2: Chi square, *P <0.001 = highly significant, #: failed, N/A: not applicable.						

Table (5): Comparison of clinical and baseline presentation before and after treatment.						
Clinical presentation	Pre-treatment		Post-treatment		Significance	
	No.	%	No.	%	χ^2	p
Epiphora	22	100	3	13.6	37.96	0.000*
Encysted mucocele	7	31.8	0	0.00	5.245	0.000*
Fistula	1	4.545	0	0.00	2.356	0.001*
Baseline presentation						
Positive regurge	16	72.7	2	9.09	21.45	0.000*
Syringing	22	100	3	13.6	37.96	0.000*
Positive DDT	22	100	3	13.6	37.96	0.000*
*P <0.001: highly significant.						

Table (6): Relation between endoscopic findings and clinical presentation after treatment.						
Endoscopic findings	Regurge		Epiphora		DDT	
	No.	%	No.	%	No.	%
Deviated nasal septum	1	4.55	2	9.09	2	9.09
Granulation tissue	2	9.09	3	13.6	3	13.6
Obstructed osteotomy	1	4.55	1	4.55	1	4.55
Nasal polyps	1	4.55	2	9.09	2	9.09
Narrow osteotomy	1	4.55	2	9.09	2	9.09
Retained tube	0	0.00	1	4.55	1	4.55

Table (7): Postoperative outcome of the studied patients.		
Outcome	No. (22)	%
Success	19	86.4
Failed	3	13.6

Table (8): Postoperative complications of the studied patients.		
Complication	No. (22)	%
Epiphora	3	13.6
Postoperative bleeding	4	18.2
Tube slippage	2	9.09
Nasal infection	1	4.55
No complications	17	77.3

4. Discussion

When approaching revision DCR surgery, it is imperative to determine the cause of failures in order to identify which groups of patients benefit the most and least from different types of surgery. This will allow clinicians to realistically and individually predict surgical success rates and manage patient expectations. Additionally, those with an anatomical failure subtype, which is predicted to have a low redo DCR success rate, could then be offered alternative nasal lacrimal surgery [7].

This study aims for endoscopic revision of recurrent dacryocystitis after failed external or endoscopic DCR and to assess the outcome of revision endoscopic DCR.

In this study revious external DCR was performed one time for 14 patients (63.6%) and endoscopic was performed for 6 patients (27.3) while two times external DCR was performed for 2 patients (9.09%). The total performed DCR was external in 16 patients (72.7%) and endoscopic for 6 patients (27.3%).

Yu et al. [8] study, aimed to assess outcomes of endoscopic endonasal dacryocystorhinostomy (En-DCR) with a novel lacrimal ostium stent (LOS) which was performed in patients with recurrent epiphora after failed external dacryocystorhinostomy (Ex-DCR) and analyze the causes of failed Ex-DCR. In total, 29 patients were enrolled in their study, 18 and 11 were female and male, respectively, with a mean age of 41.0±13.7y (range: 18-63y). A novel LOS was used to achieve such patency, leading to full epiphora and dacryocystitis resolution in 24/29 patients (82.76%). This stent is thus well-suited to use in patients in whom Ex-DCR has failed. Effectively removing granulation tissues surrounding the ostium is also important to reducing the odds of ostium synechiae and increasing success rates. Herein, patients were subjected to outpatient follow-up endoscopic examination, revealing granulation tissue around the ostium in 12/29 cases that was removed with mucous membrane scissors and suction, with such removal being performed two times in 4 patients.

Duration of appearance of symptoms after last operation ranged between 2 to 54 months (4.5 years) with mean of 9.59 ± 11 months. However, duration for revision surgery ranged from 2 to 60 months with mean of 16.45 ± 16.36 months. This indicated that revision surgery was delayed after appearance of symptoms in most of the patients.

In a study by McMurray et al. [9] the appearance of symptoms after primary DCR surgery ranged between 15 months and 97 months (with an average of 46.9 months) but their study includes only 13 patients. The great variations of duration of appearance of symptoms in their study may be due to variation of causes of their recurrence and

variation of the initial cause of lacrimal obstruction (whether complete NLDO or partial NLDO).

The tests performed for the studied patients at baseline. Regurge test was positive in 16 patients (72.7%) and negative in 6 patients (27.3%). Syringing failed in all patients and DDT was positive in all patients.

Timlin et al. [7] uses dacryocystogram (DCG) and found that the most common DCG finding after failed DCR surgery was that of a well-sized and patent anastomosis with brisk flow of contrast into the nasal space (36%), which was followed by a narrow surgical anastomosis (31%), and completely closed anastomosis (19%). Also, McMurray et al. [9] study included 6/9 patients (66.7%) had lacrimal probing, and 3/9 patients (33.3%) had dacryocystograms.

In this study, there was a significant decrease of all symptoms after treatment ($p < 0.001$). Epiphora in all cases (100%) decreased to 3 (13.6%), encysted mucocele was found in 7 patients (31.8%), all disappeared after treatment, and fistula was found in one patient (4.55%) disappeared after treatment. There is a significant decrease all symptoms from baseline after treatment ($p < 0.001$). Regurge was positive in 16 patients (72.7%) decreased to 2 only (9.09%), syringing was negative for all patients, while it was negative in only 3 failed postoperatively and DDT was positive in 22 patients (100%) decreased to 3 patients (13.6%).

Relation between endoscopic findings and clinical presentation after treatment revealed that deviated nasal septum was found in one patient (4.55%) with regurge, 2 patients (9.09%) with epiphora and 2 patients (9.09%) with DDT. Granulation tissue was found in 2 patients (9.09%) with regurge, 3 patients (13.6%) with epiphora, and 3 patients (13.6%) with DDT. Obstructed osteotomy was found in one patient (4.55%) of each regurge, epiphora and DDT. Nasal polyps and narrow osteotomy were found in one patient (4.55%) represented by regurge, 2 patients (9.09%) in patients represented by epiphora or DDT. Retained tube was present in one patient (4.55%) with Epiphora and another one had DDT.

The success rate achieved by endoscopy was 19/22 patients (86.4%), while only 3/22 cases (13.6%) had failure. The cause of failure was incomplete lacrimal sac medial wall removal, granulation tissue, and retained tube in two cases performed endoscopic DCR and narrow osteotomy in one case performed external DCR as a revision surgery.

In agreement with our results, Yu et al. [8] revealed success rate of 24/29 cases (82.76%) by using silicone lacrimal ostium stent (LOS). The procedure has the highest percentage success rate. In the 'completely closed anastomosis' category, despite some complication, having a good success rate [7], they recommended redo-DCR surgery in the first instance. This is because only one patient with a narrow surgical anastomosis was treated with Lester Jones Tube (LJT). Furthermore, LJT requires life-long maintenance and carries a significant burden to the patient. Redo-DCR showed a reasonable success rate of 75% in a moderate number of eyes [10], and would not alter the success of subsequent LJT insertion, and is thus the recommended secondary procedure in this failure category.

Our success rate was 86.4% which was more than Timlin et al. [7] with success rate of 61% (37/61) revision operation and near to Rose and Verity [10] with success rate of 75%. Also, Yu et al. [8] had a success rate of 70%. This may be due to different cohort samples and different causes of recurrence between these studies

In patients with normal post-DCR DCG, this poor success rate is likely to reflect the fact that there may be other more proximal points of resistance to flow in the drainage system than at the nasolacrimal duct/anastomosis level. These patients typically have a high tear film, delayed fluorescein dye disappearance test and normal saline lacrimal irrigation test but delayed passage of fluorescein eye drops into the nasal space seen on endoscopy [7]. These patients are described as having a poor lacrimal pump and likely have an unidentifiable (or identifiable abnormality not amenable to surgical correction) of the eyelid, punctum, canaliculus (such as the 'atonic canaliculus syndrome') or medial canthal tendon [10]. These patients are offered Lester Jones Tube placement if symptomatic epiphora persists despite conservative management involving regular lid cleaning, hot massage, lubricants, and a 4-week course of topical steroids and chloramphenicol ointment.

Previous reports of symptomatic improvement after external redo-DCR range from 78% [13] to 85% [14] which was similar to our results. The case mix of these groups influences their success rates and makes comparison with this study's success rate challenging. Ari et al. [13], reported that redo-DCR had 78% success in patients with recurrent dacryocystitis and also Timlin et al. [7] had 75% success rate, which presumably was due to complete anastomosis obstruction. Their group of patients is higher than the cohort in our study with a complete anastomosis closure, who indeed had higher rates of success after redo-DCR (86.4%). Welham and Wulc [14], found an equivalent rate of success post redo-DCR (85%) in failed DCR cases than this study. We have clearly demonstrated that this group of patients had the highest success rate after revision DCR surgery. Indeed, these are the patients that surgeons selected are most reluctant to operate on due to low previous success.

On the other hand, Hammoudi and Tucker [15] reported significantly higher rates of operative success for patients with a large lacrimal sac opening (93%) as compared to patients in which this opening was relatively smaller (87.6%). As such, we believe that scarring and small lacrimal size were primary causes of failure in the present study.

In this study postoperative complications were minimal, 17 patients (77.3%) had no complications, while only 5 patients (22.7%) had complications. That

include 3 patients (13.6%) had epiphora, 4 patients (18.2%) had postoperative bleeding, 2 patients (9.09%) had slipped tube and only one patient (4.55%) had nasal infection.

In Yu et al. [8], in total 5/29 patients experienced recurrent epiphora following revision surgery and were considered failed cases. All the 5 patients exhibited either a scarred or small lacrimal sac visible upon review of preoperative exam results and En-DCR procedure videos. Small lacrimal sacs can markedly reduce success rates for both Ex-DCR and En-DCR procedures. Only one patient in Yu et al. [8] study cohort experienced bleeding during bone removal and hemostasis was achieved via electric coagulation in this case. Postoperative epistaxis occurred in two patients in the present study, and was controlled in the outpatient room via packing with cotton soaked in a vasoconstrictive solution.

Consistently, Hammoudi and Tucker [15] reported formation of granulation tissue and scarring as a result of prior Ex-DCR procedures can further reduce the size of the lacrimal sac.

. Timlin et al. [7] had three eyes (1.9%) of 3 patients had their lacrimal sac anastomosed to a nasal sinus rather than the nasal cavity. Unsurprisingly, all 3 patients had external approach DCR, and no tube stents were inserted in 2 cases. Nasal sinus anatomy is highly variable. In particular, agar nasi cells (large, anterior ethmoid air cells) are often encountered during DCR surgery. Entering these air cells can be misinterpreted as entering the nasal space. Haller Cells are sinuses inferior to the ethmoid air cells, which extend into the roof of the maxillary sinus. They can drain into either the anterior or posterior ethmoidal sinuses and occur in approximately 20% of people [16]. In two cases of the previous three, the lacrimal sac appeared to drain into Haller Cells. These particular findings demonstrate how a DCG can be useful in planning revision lacrimal surgery by directing the surgeon to create a new anastomosis rather than erroneously enlarging the pre-existing one [7].

Study limitation

The small number of patients in this study (22 cases) and lack of a control group may limit the outcome findings and interferes with statistical analysis and complications. Further studies in a large cohort are recommended in the future strategies. In the statistical analysis of this study, we neglected age relation to revision. Patients younger than 30 years had higher odds of revision; however, the small sample size within this age category limits generalizability about this finding as reported in previous studies [17]. We were unable to review medical records to verify billed procedure codes. Because physician choice determined stent placement or surgical approach, we cannot determine if severity of canalicular or nasolacrimal disease biased management. Short duration of follow up (6 months) in our study may affect the accuracy of results and outcome of the operation, thus needs longer duration of follow up.

In conclusion: Endoscopic revision of DCR has a high success rate, deals directly with the cause of recurrence with minimal comlications.

References

Herzallah IR, Marglani OA, Muathen SH, Obaid AA. Endoscopic and radiologic findings in failed dacryocystorhinostomy: Teaching pearls for success. American journal of rhinology allergy, 2019; 33: 247-255.

Ali MJ, Naik MN, Honavar SG. External dacryocystorhinostomy: Tips and tricks. Oman journal of ophthalmology, 2012; 5: 191.

Ghasemi H, Asl SA, Yarmohammadi ME, Jafari F, Izadi P. External Dacryo-cystorhinostomy; Success Rate and Causes of Failure in Endoscopic and Pathologic Evaluations. Iranian journal of pathology, 2017; 12: 189.

Wu S, Xu T, Fan B, Xiao D. Endoscopic dacryocystorhinostomy with an otologic T-type ventilation tube in repeated revision cases. BMC ophthalmology, 2017; 17: 138.

Takahashi Y, Nakamura Y, Kakizaki H. Dacryoendoscopic findings in the lacrimal passage in failed dacryocystorhinostomy. Ophthalmic Plastic Reconstructive Surgery, 2013; 29: 373-375.

Choussy O, Retout A, Marie J, Cozlean A, Dehesdin D. Endoscopic revision of external dacryocystorhinostomy failure. Rhinology, 2010; 48: 104-107.

Timlin HM, Kang S, Jiang K, Ezra DG. Recurrent epiphora after dacryocystorhinostomy surgery: Structural abnormalities identified with dacryocystography and long-term outcomes of revision surgery: Success rates of further surgery following failed dacryocystorhinostomy surgery. BMC Ophthalmol. 2021; 21(1): 117.

Yu B, Tu YH, Zhou GM, Shi JL, Wu ED, Wu WC. Management of chronic dacryocystitis cases after failed external dacryocystorhinostomy using endoscopic technique with a novel lacrimal ostium stent. Int J Ophthalmol. 2022; 15(3):413-419.

McMurray CJ, McNab AA, Selva D. Late failure of dacryocystorhinostomy. Ophthalmic Plast Reconstr Surg. 2011 Mar-Apr;27(2):99-101. doi: 10.1097/IOP.0b013e3181d35267.

Rose GE, Verity DH. Functional nasolacrimal duct obstruction -- a nonexistent condition. Exp Rev Ophthalmol. 2011; 6:603–610.

Ragab SM, Elsherif HS, Shehata EM, Younes A, Gamea AM. Mitomycin C-enhanced revision endoscopic dacryocystorhinostomy: a prospective randomized controlled trial. Otolaryngol Head Neck Surg. 2012; 147(5): 937–942.

Roozitalab MH, Amirahmadi M, Namazi MR. Results of the application of intraoperative mitomycin C in dacryocystorhinostomy. Eur J Ophthalmol. 2004;14(6):461–463.

Ari S, Kürşat Cingü A, Sahin A, Gün R, Kiniş V, Caça I. Outcomes of revision external

dacryocystorhinostomy and nasal intubation by bi-canalicular silicone tubing under endonasal endoscopic guidance. Int J Ophthalmol. 2012; 5(2):238–241.
Welham RA, Wulc AE. Management of unsuccessful lacrimal surgery. Br J Ophthalmol. 1987;71(2):152–157.
Hammoudi DS, Tucker NA. Factors associated with outcome of endonasal dacryocystorhinostomy. Ophthalmic Plast Reconstr Surg. 2011; 27(4): 266–269.
Earwaker J. Anatomic variants in sinonasal CT. Radiographics. 1993; 13(2): 381–415.
Eftekhari K, Kozin ED, VanderBeek BL. Revision Surgery After Dacryocysto-rhinostomy in a National Cohort. JAMA Ophthalmology. 2018; 136(1): 94-95.