

I-shaped incision with mucosal flap preserving technique in endoscopic dacryocystorhinostomy

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Introduction

Epiphora due to nasolacrimal duct obstruction accounts for ~3% of all general ophthalmology visits. Endoscopic dacryocystorhinostomy (DCR) has become accepted as a suitable treatment for patients with obstructions of the lacrimal system at the level of the sac or below it. Modification of endoscopic DCR is realized by using the overlapping flaps between the lacrimal sac and nasal mucosa with the creation of a wide bony ostium by drilling out the bony borders of the lacrimal sac.

Aim

To assess the rate of patency of rhinostome after endoscopic DCR with mucosal flap preservation technique in the treatment of nasolacrimal duct obstruction.

Patients and methods

The study population was 30 patients suffering from epiphora due to obstructive lacrimal drainage disorders attending the ORL clinic who were referred from the Ophthalmology Clinic in Suez Canal University Hospital. Patients included in the study had been subjected to the following procedures: full history taking, eye and ORL examinations, diagnostic procedures (dye disappearance test – Jones test I and II), routine preoperative investigations, and endoscopic DCR with mucosal preservation flap technique surgery.

Results

Most of the patients were women (70%). The patients' age ranged from 18 to 65 years old. All patients complained of epiphora, 50% had punctual discharge, and 26.6% had lacrimal sac swelling before the operation. The success rate of the operation was 90%.

Conclusion

We conclude that the low complication and high success rate indicate that EN-DCR with a large bony ostium and large nasal mucosal flap opposed with lacrimal sac flaps can be considered as a better technique in the treatment of lacrimal system obstructions.

Keywords:

DCR, endoscopic, flaps, tear sac flaps during endoscopic dacryocystorhinostomy

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Introduction

Nasolacrimal duct obstruction (NLDO) accounts for ~3% of all general ophthalmology visits [1]. The primary causes of NLDO include acute or chronic inflammation, trauma, and congenital malformations. Patients generally present with epiphora, eyelid and lacrimal sac swelling, purulent secretion, blurred vision, and facial pain [2]. The main purpose of the treatment is to eliminate the obstruction and to establish normal tear flow [3].

The standard surgical procedure for NLDO is dacryocystorhinostomy (DCR) in which a connection is created between the nasal cavity and the lacrimal sac cavity to allow drainage of tears. There are different types of DCR such as endoscopic dacryocystorhinostomy (EN-DCR) and external DCR. During the past two decades, EN-DCR has become accepted as a suitable

treatment for patients with obstructions of the lacrimal system at the level of the sac (saccul obstruction) or below it (postsaccul obstruction) [4].

EN-DCR has had its problems like false localization of the lacrimal sac, granulation tissue formation around the stent tubes, retained bony spicules, inadequate opening of the sac and synechia between the lateral wall and the middle turbinate [5]. In this study a modification is made in the form of creating a wide bony ostium around the medial aspect of the lacrimal sac by drilling out the bony borders with an I-shaped incision in the medial wall of the sac to facilitate

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opposition of the flaps between the nasal mucosal flap and the saccal flap aiming to improve primary intention healing with little granulation tissue formation and to create large, epithelialized surgical fistula between the sac and the nasal cavity.

Patients and methods

This is a prospective clinical study in which 30 patients with NLDO, who were referred from the ophthalmology department underwent clinical assessment using history taking, clinical examination, regurgitation test, lacrimal ducts syringing and probing to establish saccal or postsaccal NLDO.

The inclusion criteria include age from 18 to 70 years, patients with NLDO, failure of medical treatment, and positive regurgitation test with failed syringing of the lacrimal sac.

The exclusion criteria include patients with canalicular ducts obstruction ascertained by probing and patients with lower lid laxity.

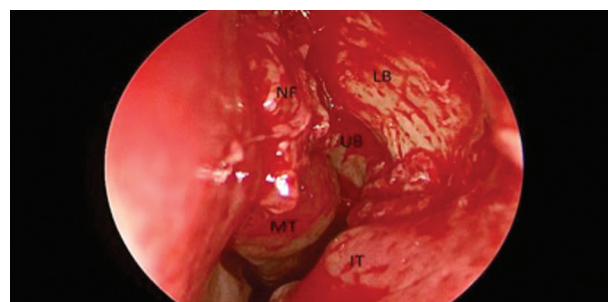
Intraoperative steps is as follows:

- (1) Patients under general anesthesia positioned semisupine at 30° angle.
- (2) Topical vasoconstriction achieved by applying cotton pledget soaked in xylometazoline 0.1% inserted above and below the middle turbinate for 10 min infiltration of 4% xylocaine with 1/100 000 adrenaline anterior to the middle turbinate medial to the lacrimal sac.
- (3) Revere-C-shaped incision started 5 mm above the insertion of the middle turbinate on the lateral nasal wall curved down anterior to the middle turbinate 8 mm in length until it stops near the inferior

turbinate at the insertion of the uncinate process (Fig. 1).

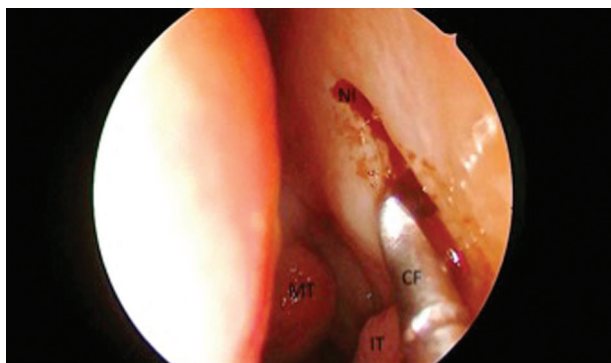
- (4) Elevation of posteriorly based nasal mucoperioosteal flap backward off the maxillary bone extended up to uncinate that process the mucosal edge was coagulated using a radiofrequency bipolar instrument (Surgimax; Ellman Inc., California, USA) (Fig. 2).
- (5) Bone covering lacrimal sac was removed using Kerrison forceps to remove the frontal process of the maxilla and microcupped forceps to remove the lacrimal bone and using a 2.5 mm DCR diamond burr to expose the lacrimal sac completely and widen the bony border and smoothen it (Figs 3 and 4).
- (6) After full exposure of the lacrimal sac, lacrimal punctual dilator is used followed by Bowman's lacrimal probe to ensure patency of the upper lacrimal canalicular system.
- (7) Sac is incised into an I-shaped incision using a keratome blade by creating two, small horizontal incisions, one in the upper limit of the sac and the other in the lower limit and both incisions

Fig. 2



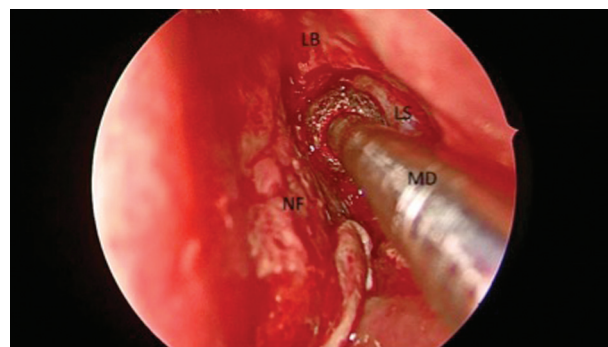
Nasal mucosal flap and exposure of lacrimal bone :freer elevator used to elevate mucosal flap covered lacrimal bone and extent posteriorly to the attachment of uncinate process. IT: inferior turbinate, LB: lacrimal bone, MT: middle turbinate, NF: nasal flap, UP: uncinate process.

Fig. 1



Nasal mucosal incision: Cottle elevator used to create nasal mucosal flap in shape of reverse-c. CF: Cottle elevator, IT: inferior turbinate, MT: middle turbinate, NI: nasal incision.

Fig. 3

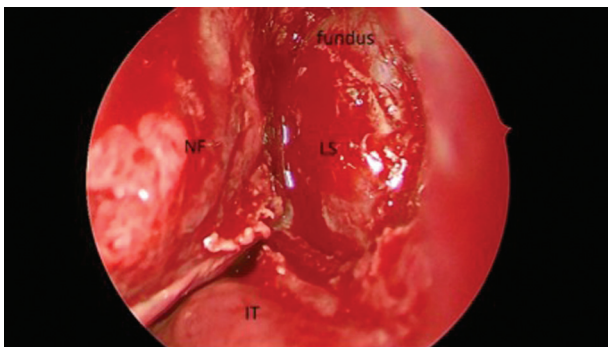


Use micro-drill: widening of bony ostium until exposure fundus of lacrimal sac superiorly, to anterior and posterior limit of lacrimal sac and to inferior turbinate inferiorly. LB: lacrimal bone, LS: lacrimal sac, MD: diamond burr of micro-drill, NF: nasal flap.

connected by a vertical incision to create an I-shaped incision (Figs 5 and 6).

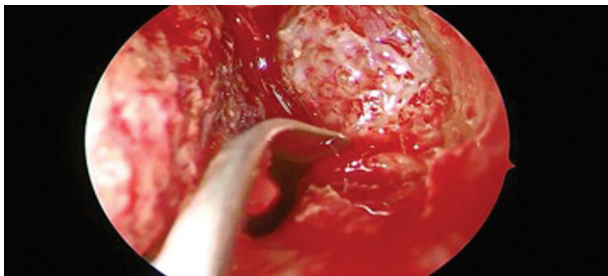
- (8) The medial wall of the lacrimal sac is fully dissected and reflected anteriorly and posteriorly, respectively, creating a large ostium into the fundus of the lacrimal sac.
- (9) The mucoperiosteal nasal flap is bisected with a microscissors into a small superior part which is used to cover the upper limit of the bone drilled out and a larger inferior part opposed against the

Fig. 4



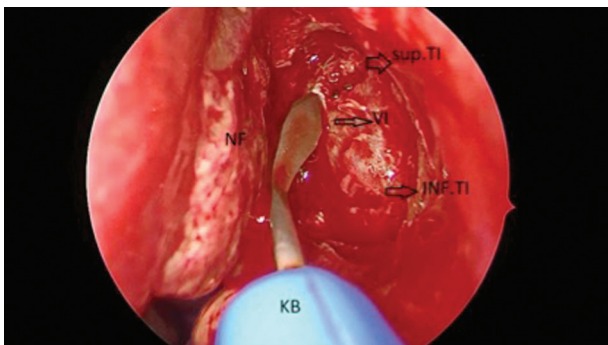
Complete exposure of lacrimal sac after using micro-drill. IT: inferior turbinate, LS: lacrimal sac, NF: nasal flap, fundus of lacrimal sac.

Fig. 5



Inferior transverse incision throw medial wall of lacrimal sac by using keratome blade.

Fig. 6



Vertical incision of I-shaped flap by using keratome blade (NF): nasal flap, (KB): keratome blade, (SUP. TI): superior transverse incision, (INF. TI): inferior transverse incision, (VI): vertical incision.

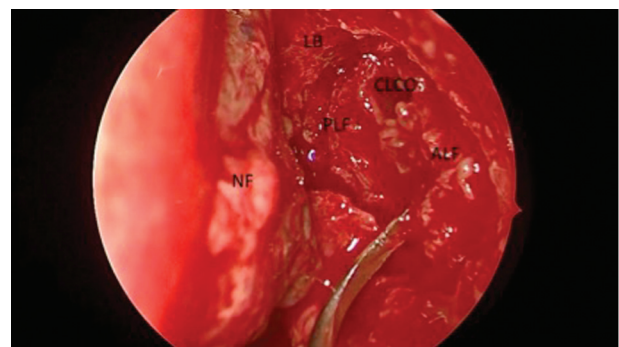
reflected posterior lacrimal sac flap and supported with a piece of gel foam. A bicanalicular silicone tube is inserted from the upper and lower puncta and secured in place by tying both lower ends into the nasal cavity (Fig. 7).

Postoperative care

No nasal pack is needed only nasal decongestant drops used for 3 successive days.

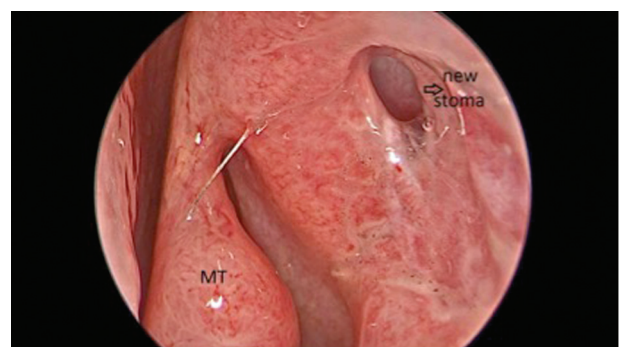
- (1) Antibiotic–steroid eye drops was used three times a day for 2 weeks.
- (2) Massage with fingers over the sac area every 3 h from the second postoperative day.
- (3) Oral broad-spectrum antibiotics for 7 days.
- (4) Analgesics were given when required.
- (5) Follow-up schedule on third day, 1 week, 1, 3, and 6 months postoperatively (Fig. 8).
- (6) The silicone tube is removed 6 week post-operatively.

Fig. 7



Lacrimal sac fully opened with anterior and posterior lacrimal flap formation, and both flap reflecting anteriorly and posteriorly respectively. (NF): nasal flap, (LB): lacrimal bone, (CLCO): common canalicular opening, (ALF): anterior lacrimal flap, (PLF): posterior lacrimal flap.

Fig. 8



Post-operative views that show will formed lacrimal ostium and tears flow at 6th month post-operative (MT: Middle turbinate).

Results

The study was carried out on 30 patients; their mean age was 34 years; women represent 70% and men were 30%. All patients complained of epiphora, 50% had punctual discharge and 26.6% had lacrimal sac swelling. All patients were negative for Jones test I, but according to Jones test II, dye was obtained from the upper punctum in 66.6% of patients, indicating complete saccal or postsaccal obstruction, while the dye was obtained through the nose in 33.3% of patients, indicating partial obstruction or lacrimal pump failure (Table 1).

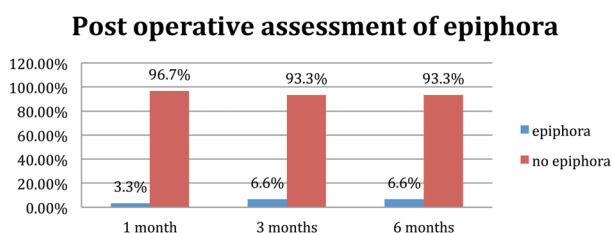
Regarding postoperative assessment of epiphora, in the first month one (3.3%) patient suffered from epiphora again, within the 3 and 6 months assessment one more patient suffered from epiphora again (6.6%) (Histograms 1 and 2).

Within the first 3 months of assessment, fluorescein dye test (FDT) with endoscopic visualization was abnormal in the one patients who suffered epiphora again (3.3%) and at the 6 months assessment the FDT was abnormal in the two patient who developed epiphora again (6.6%). Granulation tissue was seen on nasal endoscopy in one (3.3%) patient who suffered from epiphora, while adhesions between middle turbinate and site of lacrimal fistula were found in other patients (3.3%); at the 6-month assessment those patients were improved clinically.

Table 1 Shows the results of Jones test I and II in the patients

	n (%)
Preoperative	
Jones test I	
Positive	0 (0.00)
Negative	30 (100)
Jones test II	
Dye from nose	10 (33.30)
Dye from upper punctum	20 (66.60)

Histogram 1



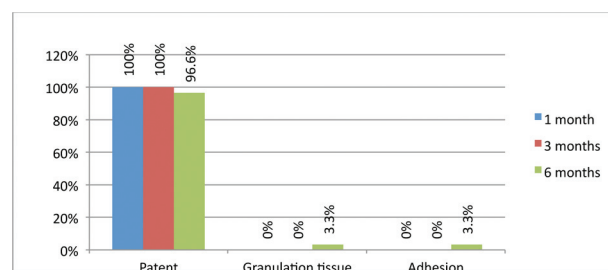
Postoperative assessment of epiphora 1, 3, and 6 months.

The improvement in our patient was 93% (Histogram 3).

Discussion

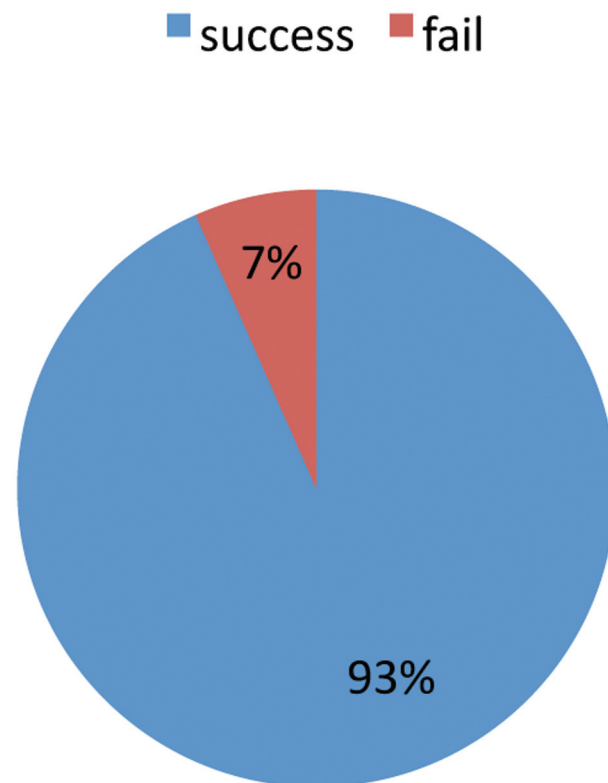
A growing clinical experience has confirmed the value of the EN-DCR technique in the management of saccal and postsaccal obstruction. Refinements in technique and instrumentation coupled with the knowledge of detailed endoscopic anatomy are largely responsible for the excellent success rates now reported, paralleling those reported with that of the conventional external technique. Tsirbas *et al.* [6] compared EN-DCR with EX-DCR and reported

Histogram 2



Morphological assessment of rhinostomy site postoperatively regarding granulation tissue, adhesions, and patency.

Histogram 3



Percent of improvement of the patient 6 months postoperatively.

the success rates to be statistically equivalent for the two techniques (93.5 vs. 95.8%).

It was noted that failure of the endoscopic techniques seemed in large part due to a poor understanding of the endoscopic anatomy, which led to poorly placed rhinostomies, and inadequate bone removal, which led to fibrosis and scarring of the intranasal ostium, unexposed common canaliculus, or subsequent sump syndrome [7].

The main difference between the presented technique in EN-DCR and previous conventional endoscopic technique is the creation of a large bony ostium by using a diamond burr and by creation of lacrimal flaps and its apposition with the adjacent nasal mucosal flaps, which is similar to the suturing technique of both flaps in the external approach, which improve the success rate of the EN-DCR and the healing process of endonasal ostium.

In this study, most of the cases were noticed to be women (70%); the disease was almost 2.5 times more common in women as compared with males. The female preponderance of alterations in the lacrimal pathways may be related to the long-term use of cosmetics, especially on the rim of the lower lid which was observed by Telang *et al.* [8]. Woog [1] also demonstrated that narrow lacrimal canal in women may contribute to the increased prevalence of NLDO in female patients.

In this study, all patients complained of epiphora before the operation and 50% of patients complained of punctal discharge. This showed accordance with the results of the study of Harvinder *et al.* [9], as all of the patients suffered from epiphora and punctal discharge.

Patients who suffered from lacrimal swelling were 26.6% in our study and that was inconsistent with Goyal and Gupta [10] as their percentage was 25%.

After EN-DCR surgery, there is a natural tendency for the stoma to contract during the healing process. So we use a silicone tube as stent to prevent ostium contraction immediately postoperatively. The tube was removed at sixth week postoperatively for most of our patients.

Hence, the follow-up period must be adequate to accommodate completion of this healing process. Woog [1] reported that the average onset of failure was 7.5 weeks postoperatively. Therefore, the follow-up period of 6 months was observed in our study.

The procedure used in our study is based on the technique primarily described by Tsirbas *et al.* [6] which emphasizes the creation and preservation of mucosal flaps with primary juxtaposition of mucosal edges, the goal being healing by primary intention, to minimize the granulation and crusting over the exposed bone and to reduce the need for endoscopic debridement of the surgical site and their technique has been shown to present a large and stable ostium with excellent functional outcomes. They described a technique using powered instruments to create a large ostium and used an anteriorly based lacrimal sac flap covered with a nasal mucosal flap. They reported 95.7% success in 47 patients with a mean follow-up for 11 months.

In our technique, the nasal mucosal flap and bony ostium is approximated in size to that of Tsirbas *et al.* [6]. They had demonstrated that approximately two-thirds of the lacrimal sac is above the axilla of the middle turbinate. Therefore, the creation of a wide bony ostium by excess bone removal, and in order to accomplish complete sac exposure, a large amount of thick bone over the axilla of the middle turbinate and the lateral wall of the agger nasi has to be removed to cover both the everted lacrimal flaps, most of the exposed bone, and the silicone stents.

Generally, the success rates of EN-DCR reported in the literature range from 79.4 to 96%. In our study, the success rate of EN-DCR was 93.3%. Success of the surgery was defined as disappearance of symptoms, patent lacrimal passage on irrigation, normal FDT, and finally patent rhinostomy site with visible stoma on nasal endoscopy.

Our results agreed with Çukurova *et al.* [11] who reported a success rate of 92.8% in EN-DCR with the mucosal flap preserving technique. Moreover, Trimarchi *et al.* [2] using a similar technique by anastomosis of nasal mucosal and lacrimal sac flaps yielded a 91.3% success rate. In another study, Ramakrishnan *et al.* [12] found an anatomic patency of 100% and symptomatic relief of 93% in EN-DCR without stent and with mucosal flap preservation.

Also, Kansu *et al.* [13] make a comparison between EN-DCR with and without mucosal flap and the results show that the surgical success rate was 100 and 88.3%, respectively.

Our study shows that one patient (3.3%) suffered from epiphora postoperatively at first month assessment postoperatively. In the study of Goyal and Gupta the percentage was 6.8%. This can be explained by lacrimal pump failure, a condition that is diagnosed by

dacryoscintigraphy. The adoption of this technique preoperatively was expected to reduce early failure rate.

Also, we observed granulation tissue formation over stoma site in only one case, which causes partial stoma closure at third month postoperatively.

One case of adhesion was noticed after 6 months of follow-up between the middle turbinate and stoma site without affection on the drainage pathway of new endonasal stoma.

No other complications were detected in the immediate postoperative period (like hematoma, ecchymosis, or epistaxis), all the patients were discharged from the hospital at the same day of surgery.

In correlation with other study, Kansu and colleagues observed that 13.7% of the patients complained of granulation tissue over stoma and 4% of patients have adhesion by using EN-DCR without mucosal flap technique.

After finishing our work it is important to emphasize the concept of EN-DCR instead of external approach with the gain of better success rate, less complications, and better cosmetic appearance.

The modified technique used shows a high success rate with low rate of complication compared with other conventional techniques. And, all the patients have well-organized endonasal stoma that was held by primary intention with minimal crust formation.

Careful preoperative assessment is also necessary to ensure proper selection of our patients to improve the success rate of the procedure.

Conclusion

The high percentage of patency and improvement of epiphora is due to a wide bony ostium and opposing

nasal and lacrimal sac flaps that promote healing, prevent granulation and restenosis of the lacrimal sac rhinostomy opening.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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