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Modified endoscopic dacryocystorhinostomy with posterior lacrimal sac flap for nasolacrimal duct obstruction

以改良後的內窺鏡淚囊鼻腔造口術加造淚囊後瓣治療鼻淚管阻塞

Objectives. To evaluate a new technique of modified endoscopic dacryocystorhinostomy involving the creation of a large posterior flap at the lacrimal sac and to compare its success rate with that of the conventional endoscopic method of excising the entire medial lacrimal sac wall as a surgical treatment for epiphora caused by nasolacrimal duct obstruction.

Design. Retrospective, interventional, and comparative case series.

Setting. University teaching hospital, Hong Kong.

Patients and methods. Only adults with primary nasolacrimal duct obstruction were included. Consecutive endoscopic dacryocystorhinostomy was performed using two different techniques from July 1999 to June 2001. The new technique involved the creation of a large posterior flap at the medial lacrimal sac wall, reflecting it posteriorly, followed by removal of the remaining small anterior flap (the LSF group). Other patients had the entire medial lacrimal sac wall excised (the ELS group).

Main outcome measures. Surgical success was defined by free fluorescein drainage from the conjunctival sac into the rhinostomy site at least 3 months after silicone stent removal.

Results. Ninety-nine procedures were performed in 99 patients. The success rate was 89.1% (41/46) in the LSF group and 71.7% (38/53) in the ELS group. The difference between the two groups was statistically significant (Chi squared test, P=0.031).

Conclusions. Our new and modified technique of endonasal dacryocystorhinostomy has a greater success rate than conventional endonasal dacryocystorhinostomy. A large-scale prospective randomised controlled trial to further evaluate the efficacy and safety of this surgical technique is under way.

目的：利用內窺鏡手術切除整個淚囊內側壁，是傳統上醫治鼻淚管阻塞引起淚溢的一種方法。另一種治療鼻淚管阻塞的新技術，是以改良後的內窺鏡淚囊鼻腔造口術，在淚囊加造一片大後瓣來處理。本文對這種新技術加以評估，並與傳統療法的成功率作比較。

設計：一系列前瞻性、介入性，以及可比較的病例。

安排：大學教學醫院，香港。

患者及療法：對象僅限於原發性鼻淚管阻塞的成年患者，於1999年7月至2001年6月期間，以兩種不同技術順序進行內窺鏡淚囊鼻腔造口術。接受新技術醫治的病人，在淚囊內側壁加造一片大後瓣，向後反折，然後切除餘下的小前瓣（新技術組），其他病人則切除整個淚囊內側壁（傳統技術組）。

主要結果測量：在移除矽質引流條後三個月內，熒光液能順暢地從結膜囊自動流進經過造口術處理的部位，手術即可稱為成功。

結果：共有99位病人接受合共99次手術。新技術組的成功率為89.1%（41/46），傳統技術組則為71.7%（38/53）。兩組的差異達到統計上的顯著水平（卡方檢驗，P=0.031）。

結論：相比傳統的鼻內淚囊鼻腔造口術，改良後的內窺鏡淚囊鼻腔造口術的手術成功率較高。目前，一個大規模的前瞻性隨機對照試驗正在進行，進一步評估這種手術的成效和安全性。

Key words:
Dacryocystorhinostomy;
Endoscopy;
Lacrimal apparatus diseases

關鍵詞：
淚囊鼻腔造口術；
內窺鏡術；
淚器疾病

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Introduction

Although endonasal dacryocystorhinostomy was described by Caldwell[1] as early as 1893, it did not gain popularity until the development of effective endonasal illumination systems and endoscopic instrumentations in the past decade. Today, endoscopic dacryocystorhinostomy (EnDCR) can be performed using laser assistance,[2,3] radio-surgical electrodes,[4] or other mechanical means including powered burr and rongeurs.[5] Endoscopic dacryocystorhinostomy has two significant advantages over the external approach: external cutaneous scarring can be avoided, and the medial canthal ligament is not disrupted, thus preserving the normal pumping function of the nasolacrimal sac. The reported success rates of EnDCR vary from 54% to 96%,[6,7] and in general are lower than that of the external approach performed by many ophthalmologists.[8] The differences in the rate may be related to the lack of sutured apposition of the nasal and lacrimal sac mucosa, and the smaller bony ostium as compared with external dacryocystorhinostomy.[9] The benefits of mitomycin C and stenting of the rhinostomy site in EnDCR remain unclear.[10,11] Some authors have claimed that stenting may actually increase the chance of surgical failure by inducing the formation of granulation tissue at the rhinostomy site.[12]

Recently, there has been increasing interest in modifying the way of handling lacrimal sac wall and nasal mucosa in order to improve the surgical success of EnDCR. Traditionally, the medial lacrimal sac wall is either incised alone, or is excised completely after removal of the nasal mucosa and the bone of lacrimal fossa. Tsirbas and Wormald[13,14] described a technique that might increase the chance of apposition of the nasal and lacrimal sac mucosa. The technique involved creating a C-shaped nasal mucosal flap and a large anterior lacrimal sac flap, and they reported an anatomical success rate of 95% (Fig 1).

The aims of this study are to develop a new modified EnDCR technique of handling the lacrimal sac flap, and to compare its success rate with that of the conventional method of excising the entire medial lacrimal sac wall.

Methods

Patients who received EnDCR between July 1999 and June 2001 were retrospectively identified and had their records reviewed. All surgeries were performed by two surgeons at the Department of Ophthalmology and Visual Sciences, Prince of Wales Hospital, Hong Kong. The inclusion criteria were adults with primary nasolacrimal duct obstruction and no other lacrimal disease. Patients were excluded if there was inaccessibility to their hospital files, a history of or presented with acute dacryocystitis, previous lacrimal surgery, or a follow-up period of less than 3 months after silicone stent removal.

Hospital files were reviewed for demographic information, mode of presentation, history of any lacrimal disease or surgery, details related to the EnDCR, and follow-up duration. The diagnosis of nasolacrimal duct obstruction was based on preoperative lacrimal probing, syringing results, and intra-operative findings. Postoperative findings including patency of rhinostomy site, presence or absence of free fluorescein flow into rhinostomy site from the conjunctival sac, and any surgery-related complications were gathered and analysed.

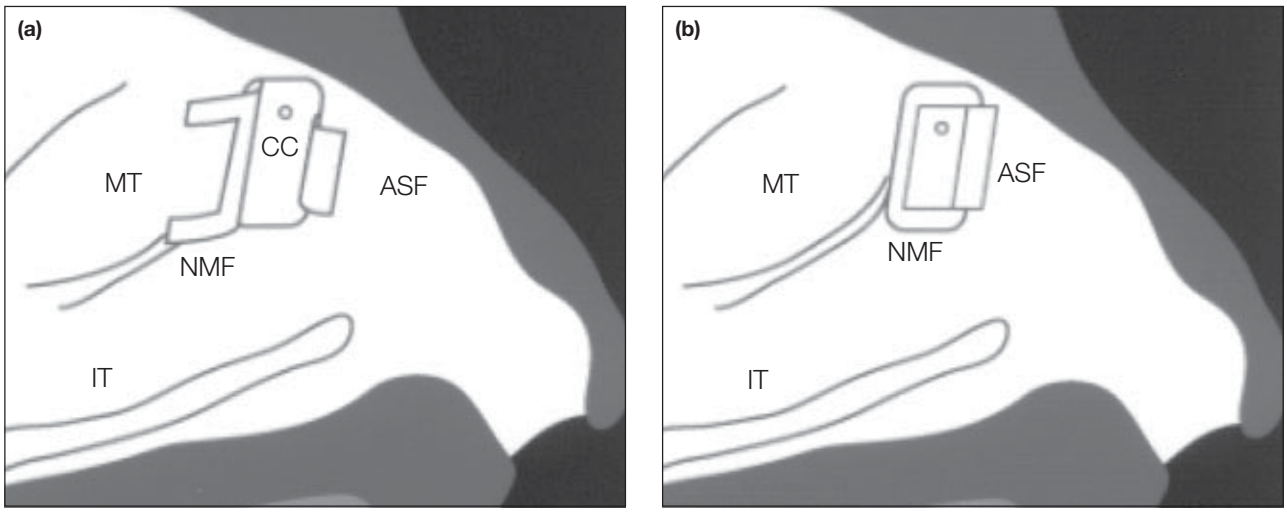

Fig 1. Creation and reflection of the C-shaped nasal mucosal flap and large anterior lacrimal sac flap
(a) Creation of C-shaped nasal mucosal flap (NMF) and large anterior lacrimal sac flap (ASF). MT: middle turbinate; IT: inferior turbinate; CC: internal opening of common canaliculus
(b) Reflection of the NMF anteriorly onto the lateral nasal wall

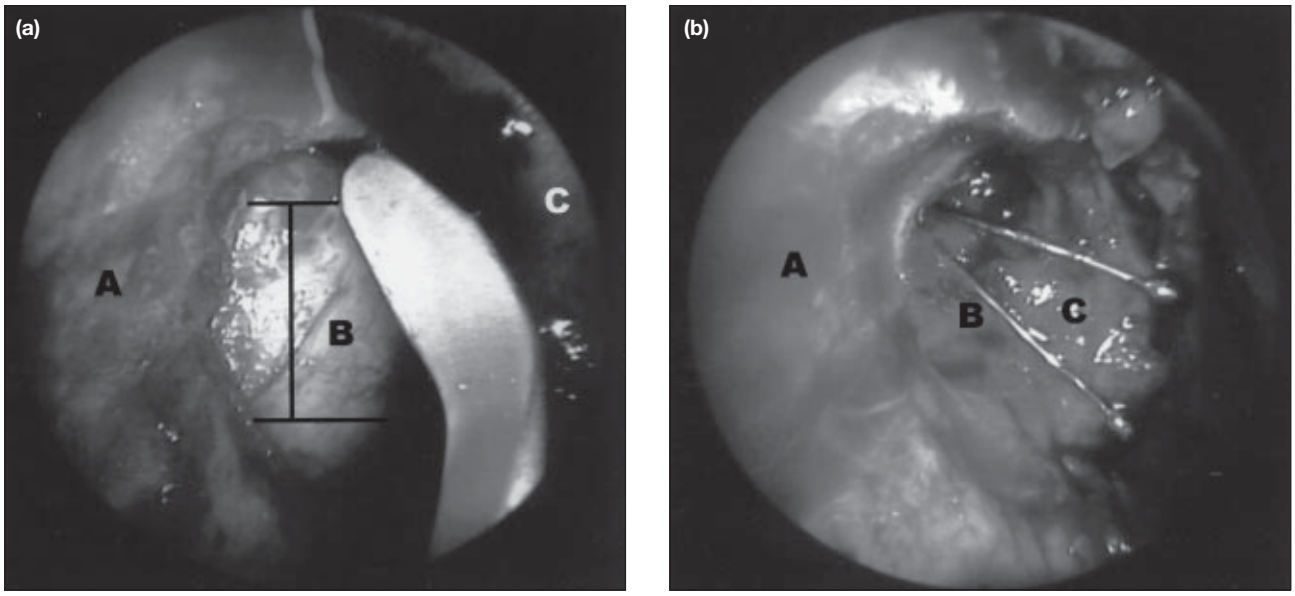

Fig 2. Surgical technique of creating posterior lacrimal sac flap
(a) Removal of lacrimal fossa bone showing underlying medial lacrimal sac wall. A: frontal process of right maxillary bone; B: medial lacrimal sac wall; C: middle turbinate. Solid line indicates the line of incision of the medial lacrimal sac wall
(b) Creation of a large posterior lacrimal sac flap. A: frontal process of right maxillary bone; B: bicanalicular silicone intubation; C: posterior lacrimal sac flap

Surgical technique of creating posterior lacrimal sac flap

The nasal mucosa was decongested with ribbon gauze soaked with 5% cocaine and 1:10 000 adrenaline (1:1 dilution). The lateral nasal mucosa anterior to the middle turbinate was injected with local anaesthetic (2% xylocaine with 1:80 000 adrenaline). For surgery under local anaesthesia, a regional anterior ethmoidal nerve block (3 mL of 2% xylocaine with 1:200 000 adrenaline) was added. 0° and 30° Storz endoscopes (Storz, California, US) equipped with three-chip cameras were used during the surgery. The location of the lacrimal sac was identified by inserting a 25-gauze fibre-optic light probe used in vitreoretinal surgery (Bausch and Lomb, New York, US) through one of the canaliculi into the lacrimal sac, and then observing the transmitted light with the nasoendoscope. A vertical incision of nasal mucosa was made just anterior to the maxillary line by a crescent knife used for cataract surgery (Alcon, Texas, US). The incision began at the level of the head of the middle turbinate to the level of the inferior end of the middle turbinate. A nasal mucosal flap was lifted with a Freer elevator and then excised completely with straight Blakesley forceps. The underlying bone of the lacrimal fossa, including the lacrimal bone and the frontal process of the maxilla, was removed with a 2-mm Kerrison rongeur. The bony ostium was created as large as possible with or without uncinectomy in order to fully expose the medial lacrimal sac wall (Fig 2a).

The medial lacrimal sac wall was tented with a Bowman's probe before it was vertically incised with a crescent knife at the junction between the anterior one third and posterior two thirds of the lacrimal sac wall. Small horizontal cuts were made superiorly and inferiorly with the same crescent knife to facilitate the reflection of the large posterior lacrimal flap backwards. Adequate horizontal cuts were made to ensure that the posterior lacrimal sac flap would sit flatter on the lateral nasal mucosal wall. The small remaining anterior lacrimal sac was excised with a 2-mm Kerrison rongeur. Adequate exposure was achieved to allow bicanalicular silicone intubation (BD Vistec, Warks, United Kingdom) without difficulty at the end of surgery (Fig 2b). Dental sponges soaked with 0.04% mitomycin C were applied to the rhinostomy site for 5 minutes, followed by 40-mL normal saline irrigation.

All patients received postoperative oral antibiotics (cefuroxime 500 mg twice a day) for 5 to 7 days and eye drops containing antibiotics and steroid (gutt maxitrol 4 times a day). Nasal douching was carried out 4 times a day at home as instructed until the wound was completely healed. Patients were routinely followed up at out-patient clinics at weeks 1 and 2; months 1, 2, and 3; and then every 3 months postoperatively. Regular nasoendoscopic examinations were performed to remove blood clots or debris obstructing the rhinostomy site. This examination was also able to assess the patency of the rhinostomy site and determine healing before the stent was removed. Surgical success of the two groups was compared using the Chi squared test.

Results

A total of 102 EnDCR from 102 patients were identified from the records. Of those, three patients were excluded—

Table 1. Endoscopic dacryocystorhinostomy with lacrimal sac flap (the LSF group)

Case No.	Sex/Age (years)	Laterality	Anaesthesia*	Surgeon†	Mucocele	Intubation period (months)	Follow-up period (months)	Surgical success‡	Complications
1	F/62	Right	LA	LL	No	2	13	Yes	No
2	F/59	Right	LA	LL	Yes	2	17	Yes	No
3	F/37	Right	LA	MT	No	3	19	Yes	No
4	F/42	Left	LA	LL	Yes	3	20	Yes	No
5	F/85	Left	GA	MT	No	2	16	Yes	No
6	F/53	Right	LA	LL	No	5	27	Yes	No
7	F/77	Right	LA	MT	No	2	14	Yes	No
8	F/68	Left	LA	LL	Yes	4	32	Yes	No
9	F/40	Left	LA	LL	Yes	3	17	Yes	No
10	F/78	Right	LA	MT	No	2	40	Yes	No
11	F/78	Left	LA	MT	No	5	38	No	No
12	M/57	Right	LA	LL	No	3	36	Yes	No
13	F/60	Left	LA	MT	No	3	17	Yes	No
14	F/60	Right	LA	MT	No	4	21	Yes	No
15	F/63	Left	LA	MT	No	4	32	Yes	No
16	F/48	Left	LA	LL	Yes	4	16	Yes	No
17	F/42	Right	LA	LL	Yes	3	7	Yes	No
18	F/70	Left	LA	MT	No	2	7	Yes	No
19	F/44	Left	LA	MT	No	2	17	Yes	No
20	F/69	Right	LA	MT	Yes	2	8	Yes	No
21	F/69	Left	GA	LL	Yes	2	21	Yes	No
22	M/74	Left	LA	MT	No	2	14	Yes	No
23	F/70	Left	LA	LL	No	5	24	Yes	No
24	F/46	Right	LA	LL	Yes	2	21	No	No
25	F/79	Left	LA	MT	No	2	9	Yes	No
26	F/78	Right	LA	MT	No	2	20	Yes	No
27	M/59	Right	LA	LL	No	3	12	Yes	No
28	F/41	Right	LA	LL	No	2	8	Yes	GT§
29	F/67	Left	LA	MT	No	3	11	Yes	No
30	F/44	Right	LA	LL	No	3	10	Yes	No
31	F/52	Right	LA	MT	No	2	12	Yes	No
32	F/40	Right	LA	MT	No	2	24	No	No
33	M/57	Left	LA	LL	No	3	12	Yes	No
34	M/40	Right	LA	MT	No	3	18	Yes	No
35	F/47	Left	LA	MT	No	3	16	Yes	No
36	F/71	Right	LA	MT	No	3	22	No	GT
37	F/43	Left	LA	LL	Yes	3	19	Yes	No
38	M/63	Right	LA	LL	Yes	2	10	Yes	No
39	F/53	Right	LA	LL	No	3	17	No	No
40	F/62	Left	LA	MT	No	2	12	Yes	No
41	F/71	Right	LA	LL	No	3	6	Yes	No
42	F/50	Left	LA	LL	Yes	2	6	Yes	No
43	F/50	Left	LA	MT	No	3	18	Yes	No
44	F/40	Left	LA	MT	No	2	6	Yes	No
45	F/48	Left	LA	MT	No	2	25	Yes	No
46	F/50	Right	LA	MT	No	4	24	Yes	GT

* LA denotes local anaesthesia, GA general anaesthesia
† LL denotes LYM Lam, MT MWY Tse
‡ As defined by free fluorescein drainage from the conjunctival sac into the rhinostomy site at least 3 months after silicone stent removal
§ GT denotes granulation tissue formation at rhinostomy site

two due to incomplete hospital files, and one due to a loss of follow-up before stent removal. Of the remaining 99 patients, 46 patients received EnDCR with lacrimal sac flap (the LSF group) (Table 1) and the other 53 patients had EnDCR with the entire medial lacrimal wall excised (the ELS group) (Table 2).

In the LSF group, 87.0% (40/46) patients were female with a mean age of 57.4 (range, 37.0-85.0; standard deviation [SD], 13.4) years. In the ELS group, 94.3% (50/53) patients were female with a mean age of 62.1 (range, 34.0-90.0; SD, 14.2) years.

Mucocele were present in 26.1% (12/46) of the LSF group and 28.3% (15/53) of the ELS group. Approximately 4.3% (2/46) of the LFS group and 9.4% (5/53) of ELS group had the operation under general anaesthesia. The average silicone stent removal time was 2.7 (range, 2.0-5.0; SD, 0.9) months in the LSF group and 3.0 (range, 2.0-6.0; SD, 0.9) months in the ELS group.

Cheese-wiring of lacrimal punctum did not occur in patients of the LSF group but in 1.9% (1/53) of the patients in the ELS group, from whom the stent was removed 2 months postoperatively. The rhinostomy site was complicated by granulation tissue formation in 6.5% (3/46) of the LSF group and in 17.0% (9/53) of the ELS group. No other surgical complications were reported in either group.

Table 2. Endoscopic dacryocystorhinostomy with entire medial lacrimal sac wall excision (the ELS group)

Case No.	Sex/Age (years)	Laterality	Anaesthesia*	Surgeon†	Mucocele	Intubation Period (months)	Follow-up Period (months)	Surgical Success‡	Complications§
1	F/67	Right	LA	LL	No	3	42	No	No
2	F/47	Right	LA	MT	No	6	58	No	No
3	F/48	Left	LA	MT	No	4	24	Yes	No
4	F/70	Left	GA	LL	Yes	2	11	Yes	No
5	F/71	Right	LA	MT	No	3	16	Yes	No
6	F/43	Right	LA	MT	No	4	60	Yes	CW
7	F/49	Right	LA	LL	No	2	29	Yes	No
8	F/73	Left	LA	MT	No	3	38	No	GT
9	M/47	Right	LA	LL	No	4	33	Yes	No
10	F/69	Left	LA	LL	Yes	4	35	Yes	No
11	F/73	Left	GA	MT	No	3	13	No	No
12	F/88	Right	LA	LL	No	3	6	Yes	No
13	F/63	Left	LA	MT	Yes	3	6	No	No
14	M/67	Left	LA	MT	No	5	36	Yes	No
15	F/41	Right	LA	LL	Yes	4	25	Yes	No
16	F/76	Left	LA	MT	Yes	2	49	No	No
17	F/64	Left	LA	MT	No	4	28	Yes	No
18	F/46	Left	LA	LL	Yes	2	34	No	No
19	M/53	Left	LA	LL	Yes	3	40	Yes	No
20	F/65	Right	LA	LL	No	4	15	Yes	GT
21	F/42	Left	LA	LL	No	3	16	Yes	No
22	F/45	Right	LA	MT	No	2	41	Yes	No
23	F/56	Right	LA	LL	No	4	26	Yes	No
24	F/55	Left	LA	LL	Yes	4	31	Yes	No
25	F/38	Right	LA	LL	No	4	15	Yes	No
26	F/68	Right	LA	MT	No	2	12	Yes	No
27	F/53	Right	LA	MT	No	4	51	Yes	No
28	F/78	Left	LA	LL	Yes	3	36	Yes	GT
29	F/90	Right	LA	LL	No	3	40	Yes	GT
30	F/57	Left	LA	LL	No	3	44	Yes	GT
31	F/70	Left	LA	MT	No	3	6	Yes	No
32	F/73	Left	LA	LL	Yes	3	17	Yes	No
33	F/55	Left	LA	MT	No	3	8	Yes	No
34	F/41	Left	LA	MT	Yes	3	22	No	No
35	F/52	Left	LA	LL	No	2	12	Yes	No
36	F/34	Right	LA	MT	Yes	2	6	Yes	No
37	F/64	Left	LA	MT	No	2	16	Yes	No
38	F/78	Right	LA	MT	No	2	36	Yes	GT
39	F/37	Left	LA	LL	No	3	33	Yes	No
40	F/75	Left	GA	MT	No	3	16	Yes	No
41	F/77	Right	LA	LL	Yes	3	19	No	No
42	F/73	Right	GA	MT	No	3	20	Yes	No
43	F/77	Left	LA	LL	Yes	3	13	No	No
44	F/72	Right	LA	LL	No	3	23	No	No
45	F/80	Left	LA	LL	No	2	14	No	GT
46	F/69	Right	LA	LL	No	4	36	Yes	No
47	F/83	Right	GA	MT	Yes	2	12	Yes	No
48	F/53	Left	LA	LL	No	4	20	Yes	No
49	F/72	Right	LA	LL	No	2	25	No	No
50	F/66	Left	LA	LL	No	3	19	Yes	No
51	F/64	Left	LA	LL	No	3	27	No	No
52	F/73	Left	LA	LL	No	2	30	Yes	GT
53	F/50	Right	LA	MT	No	2	16	No	GT

* LA denotes local anaesthesia, GA general anaesthesia
† LL denotes LYM Lam, MT MWY Tse
‡ As defined by free fluorescein drainage from the conjunctival sac into the rhinostomy site at least 3 months after silicone stent removal
§ CW denotes cheese-wiring of lacrimal punctum, GT granulation tissue formation at rhinostomy site

The success rate was 89.1% (41/46) in the LSF group and 71.7% (38/53) in the ELS group with a statistically significant difference (Chi squared test, P=0.031). In all failure cases, the rhinostomy sites were completely closed by scar tissue.

Discussion

Despite the many advantages offered by EnDCR, many surgeons are still concerned that its success rate is lower than that of the external approach, which is commonly higher than 90%.[15,16] When compared with external dacryocystorhinostomy, the reasons may be related to the lack of sutured apposition of the nasal and lacrimal sac mucosa and the smaller bony ostium. Surgical failure occurs when the lacrimal sac does not marsupialise on the lateral nasal mucosal wall.

There are very few large-scale prospective randomised controlled trials in the literature to support the benefits of

the various adjunctive measures in EnDCR. Mitomycin C, an alkylating agent with inhibitory effects on fibroblasts, has been shown to cause a decrease in both the density and cellularity of nasal mucosal specimens taken from EnDCR.[17] However, its role in preventing closure of the rhinostomy site following EnDCR remains uncertain. A study by Camara et al[18] reported a statistically significant difference in the success rates comparing laser-assisted EnDCR with and without mitomycin C. However, Zilelioglu et al[10] found no such benefit of mitomycin C in their study of EnDCR. Bicanalicular intubation, most often by silicone stenting, is one approach to prevent closure of the rhinostomy site. However, some surgeons are concerned that intubation might increase the chance of rhinostomy site closure by granulation tissue formation.[12,19] The combination of 0.04% mitomycin C and bicanalicular silicone intubation in this study represents a novel approach to increasing the success rate of EnDCR.

Conventionally in EnDCR, the lateral nasal mucosal wall is removed completely to expose the underlying lacrimal fossa, then the medial lacrimal sac is either incised alone or excised completely to create a rhinostomy site. Patency of the rhinostomy site depends on anastomosis of the cut edges of the nasal and lacrimal sac mucosa. However, without sutured apposition, one cannot predict the pattern of anastomosis between the cut edges of the nasal and lacrimal sac mucosa. If lacrimal-to-lacrimal or nasal-to-nasal mucosa anastomosis occurs, the rhinostomy site will be closed. To overcome this problem, Tsirbas and Wormald[13,14] reported a technique of creating a C-shaped lateral nasal mucosal flap and a large anterior lacrimal sac flap to promote close apposition between the two mucosal surfaces.

In this study, we report another technique to encourage apposition of the nasal and lacrimal sac mucosa. Reflecting a large lacrimal sac flap posteriorly increases the distance between the edges of the lacrimal sac mucosa, thus reducing the chance of re-closure. The posterior flap also promotes marsupialisation of the lacrimal sac due to the close apposition of the lacrimal sac and the nasal mucosa. The surgical success rate of this new technique (89.1%) is comparable to those reported using other methods of EnDCR. When compared with the more conventional method of excising the entire medial lacrimal sac wall performed by the same surgeons, the surgical success of this new technique is statistically significantly higher (Chi squared test, P=0.031).

Our technique does not require the acquisition of new surgical skills by surgeons. The horizontal cuts of the lacrimal sac wall can be performed immediately after the vertical incision when the crescent knife is still inside the lacrimal sac. Once reflected backwards with enough relaxing horizontal cuts, the posterior flap would tend to sit naturally on the lateral nasal mucosa without flipping forward again. We excised the anterior sac flap with the sharp cutting edges of a Kerrison rongeur instead of using Blakesley forceps to avoid tearing of the lacrimal sac mucosa. It is also important not to create too small an anterior lacrimal sac flap, which is difficult to excise and incomplete excision might increase the chance of surgical failure.

Apart from cheese-wiring of the lacrimal punctum and the formation of granulation tissue at the rhinostomy site, no other significant surgical complication was reported. Orbital fat prolapse and frontal sinusitis could occur if dissection is taken too posteriorly into the uncinate. All failure cases in the study had closed rhinostomy sites observed by nasoendoscopic examination. However, the timing of rhinostomy site closure after stent removal was not clear due to the retrospective nature of the study. No synaechia between the lateral nasal mucosa and the middle turbinate was noted in these failure cases.

There are a few shortcomings of the study. Firstly, the retrospective study design did not allow patient randomisation to different surgical methods. Even though the two groups of patients were comparable in terms of their mean age, sex distribution, and proportion of mucocele, it is not certain why one surgical method was chosen instead of the other by the attending surgeon. A small and scarred nasolacrimal sac might be difficult for flap creation, thus leading the surgeon to excise the medial sac wall completely. A prospective randomised study is warranted to eliminate this potential bias. Secondly, the average size of the bony ostium in both groups, which may be a determining factor for the outcome, was not recorded due to the retrospective nature of the study. It was, however, a routine practice to create an as large bony ostium as possible by the surgeons to fully expose the lacrimal sac. Thirdly, there was no standardised protocol for the duration of postoperative stenting. The average silicone stent removal time was 2.7 (range, 2.0-5.0; SD, 0.9) months in the LSF group and 3.0 (range, 2.0-6.0; SD, 0.9) months in the ELS group. It is uncertain why the stent was kept in some patients for as long as 5 to 6 months postoperatively in the study. However, in this study surgical failure did not appear to be related to prolonged stenting. Of the 20 patients with surgical failure, only two had intubation time of more than 3 months. Granulation tissue complicating the rhinostomy site was more common in the ELS group than in the LSF group (17.0% [9/53] and 6.5% [3/46], respectively). It has been postulated that a long intubation period may lead to granulation tissue formation at the rhinostomy site and subsequent surgical failure.[12,20] In our study, the patients with granulation tissue were found to have a lower success rate due to closure of the rhinostomy site (66.6% in both LSF and ESF groups). Their mean intubation period, however, was only 2.7 (range, 2.0-4.0; SD, 0.7) months, which was similar to the mean intubation period of other patients in the study. Finally, the relatively small sample size should be taken into consideration while interpreting the study result.

Conclusions

We have described an improved approach to EnDCR. The method involves a new and easy technique of fashioning the large posterior lacrimal sac flap and excising the remaining small anterior sac flap. This method also promotes close apposition between the lacrimal sac and nasal mucosa. This retrospective non-randomised review showed that the success rate of this technique is statistically better than the conventional method involving excision of the entire medial lacrimal sac wall. A large-scale prospective randomised controlled trial to study the efficacy of this surgical method is under way.

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