RESEARCH ARTICLE

Endoscopic dacryocystorhinostomy with marsupialization of the lacrimal sac. [version 1; peer review: 1 approved with reservations, 1 not approved]

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Abstract

Objective: To analyze the efficacy of endoscopic dacryocystorhinostomy (DCR) with marsupialization of the lacrimal sac compared with other techniques of endoscopic dacryocystorhinostomy.

Material and methods: Clinical chart review. Patients with lacrimal sac pathologies and endoscopic DCR with or without marsupialization of the lacrimal sac were included from 2011 to 2015. The outcome measurements were absence of ocular symptoms and permeability of the lacrimal sac.

Results: A total of 24 patients were evaluated, 17 women and 7 men, average age was 47 years. Seven patients underwent DCR with marsupialization, 17 patients underwent other endoscopic techniques. Average follow-up was 18 months. The efficacy (absence of symptoms and permeability of the lacrimal sac) of the DCR technique with marsupialization was 71%, without significant difference compared to other techniques ($p = 0.686$).

Conclusion: Similar results were found in the different types of endoscopic DCR techniques. More studies are needed to corroborate our results.

Keywords

dacryocystorhinostomy, marsupialization, lacrimal sac, endoscopy.

Open Peer Review

Approval Status ? X

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Any reports and responses or comments on the article can be found at the end of the article.

This article is included in the Eye Health gateway.

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Introduction

Lacrimal disease manifests clinically as epiphora, recurrent conjunctivitis, or dacryocystitis, and it occurs most frequently in pediatric patients. Dacryocystorhinostomy (DCR) creates a low-pressure system by diverting tear flow through the lacrimal bone and an artificial opening. Toti first described external DCR in 1904, and Caldwell used an endonasal technique in 1893 that West modified in 1914¹⁻³.

Endoscopic DCR is the surgical procedure of choice to treat saccular or post-saccular nasolacrimal obstruction; this technique has been gaining popularity, with high success rates (sustained ostium patency, symptom relief, or both) comparable with external DCR rates, primarily because of the technological advances of endoscopes and surgical instruments. Multiple modifications have been suggested regarding endoscopic DCR procedures, with pros and cons. Previous endoscopic DCR procedures included making a small opening in the lacrimal sac and removing the nasal and lacrimal mucosa; this procedure likely contributes to surgical failure because the small neoformed ostium is obstructed by the granulation tissue or synechia formed during the postoperative period¹.

Currently, two techniques are used to perform endoscopic DCR: laser-assisted and “cold steel”; both can be performed with or without powered drilling equipment. The former technique is less effective, perhaps because of the size of the ostium and the laser heat that results in fibrosis and stenosis⁴.

Generally, the size of the ostium created during surgery is crucial to the procedure's outcome. Therefore, the anatomical characteristics of the lacrimal sac should be evaluated to achieve complete exposure when approaching the sac intranasally^{5,6}.

Massegur *et al.* suggested a modification to the technique known as marsupialization of the lacrimal sac, which causes the flaps of the lacrimal mucosa to contact the nasal mucosa after the resection of the bone surrounding the sac, thereby incorporating the lacrimal sac in the lateral nasal wall^{1,3}.

The current study describes the results of a DCR with lacrimal sac marsupialization compared with other endoscopic techniques.

Methods

Study background

A clinical chart review study was conducted in patients who presented with obstruction of the lacrimal route in their excretory portion and were submitted to endoscopic DCR. The inclusion criteria were any patient with obstruction of the lacrimal duct or sac that resulted in epiphora or lacrimal sac infection. Exclusion criteria were incomplete clinical information or lack of surgical data. This study was conducted at the Ophthalmology and Otorhinolaryngology clinic in a secondary care center, (Hospital Civil de Culiacán, Rosales, México), from November 2011 to September 2015. Data regarding age, gender, affected side, symptoms, relevant background for the condition

(e.g., trauma, infection, and previous ocular surgery), operative experience and patient follow-up results, were retrospectively collected.

A team of two otorhinolaryngologists and two certified ophthalmologists performed the surgical intervention using the following standardized technique with small individual variations.

Standard lacrimal sac surgery

The surgery was performed under general anesthesia. A topical decongestant was placed in the nasal cavity, and the lateral wall was infiltrated with 2 ml lidocaine with epinephrine at 2%. The surgery was guided using a 0° nasal endoscope. A scalpel was used to section a mucosal flap approximately 5–8 mm on top of the middle turbinate insertion in the lateral wall, extending the incision anteriorly by 8 mm. A vertical incision was made halfway up the middle turbinate. The flap was raised with a Freer elevator and hidden around the middle turbinate to avoid obstructing the dissection later. The frontal process of the maxilla was extracted or removed with a 90° Kerrison rongeur, until the medial and anterior wall of the lacrimal sac was exposed.

Marsupialization of the lacrimal sac

To perform the marsupialization, the wall of the medial lacrimal sac was incised vertically along its entire length and then horizontally in a “cross-like shape”. The flaps of the lacrimal sac were exteriorized toward the lateral wall, leaving the lacrimal sac open (Figure 1). The superior and inferior canaliculi were canalized; then, a bicanalicular silicone probe was passed whose ends were knotted inside the nostril (Figure 1). A Gelfoam sponge with a dexamethasone patch was lightly squeezed into the exposed sac.

Other techniques

Once the lacrimal sac is exposed, a resection of the medial wall is performed with various surgical instruments, such as rongeurs, and/or Blakesly forceps. There is no intent to preserve

Figure 1. Intraoperative image of lacrimal sac marsupialization. MT, middle turbinate.

the lacrimal sac. The superior and inferior canaliculi were canalized; then, a bicanalicular silicone probe was passed whose ends were knotted inside the nostril.

Follow-up and clinical outcomes

A follow-up assessment of the patients was conducted. The results were measured subjectively based on improvements in the symptomatology (i.e., the absence of ocular symptoms and lacrimal sac permeability) compared with the preoperative conditions. Objective measures were conducted via endoscopic controls that enabled the observation of an open fistula (Figure 2).

The Research Committee at Hospital Civil de Culiacán approved this research (Comité de Investigación del Centro de Investigación y Docencia en Ciencias de la Salud, number: 278). Since this was a retrospective chart review and the clinical images were non-identifying, the ethics committee waived the need for participant consent.

Figure 2. An example of a successful DCR fistula. MT, middle turbinate.

Statistical analysis

The information was entered into a database using SPSS version 22 for Windows. Frequencies and percentages were calculated for the categorical variables. The numerical variables were evaluated considering the means, confidence intervals, minimums, and maximum. The qualitative variables were measured using frequencies. The continuous variables were compared with Student's t-test, whereas the categorical variables were compared with a chi-square test. A p-value of ≤ 0.05 was considered significant.

Results

Subjects

During the study period, 24 endoscopic DCRs were performed on 17 women and 7 men with a mean age of 47.21 years (7–82 years). Of these patients, two patients presented with congenital disease, five suffered from traumatism, and one patient reported a history of eye surgery (Table 1).

Techniques used

A total of seven patients (29.2%) underwent endoscopic DCR with lacrimal sac marsupialization. The remaining 17 patients underwent other endoscopic techniques. The follow-up period was 18 months (4–43 months). One patient received previous dacryointubation and two had previous dacryocystorhinostomies. Electric drilling equipment was used for five patients. Bone removal was performed via a Kerrison clamp for 19 patients. There were three patients lost to follow up.

Efficacy of procedures

The efficacy (i.e., the absence of symptoms and patent lacrimal sac) was 71% ($n=5/7$ patients) for the lacrimal sac marsupialization and 71% ($n=10/17$ patients) for the other endoscopic techniques. No significant differences were found in the surgical outcomes between the techniques ($p=0.686$). Raw data are available on figshare⁷.

Follow-up

A total of seven patients presented with postoperative complications: six with infection and one with granuloma and infection (Table 2).

Table 1. Demographic variables of patients with DCR with and without marsupialization.

Variable	Without marsupialization (n=17)	Marsupialization (n=7)	P value
Mean age, years	45.8	50.4	0.69
Female, n	11	6	0.30
Time of evolution, days	1183	3089	0.30
Insufficiency of lacrimal passages, n	3	4	0.05
Chronic dacryocystitis, n	9	3	0.65
Other lacrimal disorder, n	5	0	0.10
Previous surgery: dacryocystorhinostomy, n	2	0	0.29
Previous surgery: dacryointubation, n	0	1	0.51
Other previous ocular surgeries, n	1	0	0.51

Table 2. Surgical outcome of patients with DCR with and without marsupialization.

Variable	Without marsupialization, n	Marsupialization, n	P value
Surgical technique	17	7	
Complications			
• Infection	4	2	0.76
• Granuloma	1	0	0.51
Technique failure	4	2	
Resolution achieved	10	5	1.00
Lost to follow up	3	0	

A total of seven patients presented with postoperative complications: six with infection and one with granuloma and infection (Table 2). Patients with infection resolved with topical and oral antibiotics (typically a cephalosporin) and the one patient with granuloma resolved once it was removed the silastic tube. No long-term complications were reported in the study.

Three of our patients were lost to follow up. Unfortunately, six cases reported no improvement, regardless of endoscopic technique.

Discussion

External DCR became popular because of its high success rates. However, the endoscopic DCR described by McDonogh and Meiring in 1989^{1,4,5} has been used more often because of the simplicity of its innocuous endonasal approach. In addition, it offers advantages over the external approach such as reduced surgical trauma and hemorrhage, the avoidance of facial scars, the maintenance of intact medial canthus structures, and a faster time to return to work^{3,5,6}. Failures of up to 12% of patients have been reported⁸. The main causes of failure of endoscopic DCR have been attributed to failure to locate the lacrimal sac, insufficient osteotomy, granulation tissue, synechiae, and closure due to premature scarring, fibrosis, and osteogenesis^{1,5,8}.

The additional advantages offered by endoscopic DCR are better visualization of intranasal structures, the avoidance of angular vein damage, the preservation of the pumping function of the nasolacrimal sac, the corroboration of the adequate site for nasolacrimal tube insertion, the better correction of errors, and the identification of surgical failures⁹.

To avoid or prevent the obstruction of the neoformed ostium, multiple techniques have been tried with several modifications (e.g., complete marsupialization of the lacrimal sac, i.e., the use of mucosal flaps after a wide resection of the bone that surrounds the sac)^{3,10}. Massegur *et al.* proposed this modification in 2004, with surgical success ranging from 87 to 92%³. The present study used a similar technique, an endoscopic DCR with marsupialization of the mucosal flap sac and resection of the

bone using Kerrison's rongeur. A mean follow-up time of 18 months was conducted. The other endoscopic techniques used in the study were partial resection of the lacrimal sac mucosa and maxillary line graft, using Blakesley forceps or Kerrison's rongeur.

A learning curve of the surgeons could explain similar results in both techniques. The first seven cases of DCR marsupialization are described in this case series.

Yigit *et al.* (2007) compared the results of external DCR (55 patients) to those of endoscopic DCR (48 patients) in 103 patients with chronic dacryocystitis. The evaluated results were considered as successful if the epiphora decreased, infections were reduced, or reflux from the canaliculus was absent during lacrimal irrigation. The patient management success rate was 69.9% for those undergoing external DCR, and it was 89.7% for those receiving endoscopic DCR. These results were evaluated based on a 1-year follow-up period¹¹.

Likewise, the use of a silastic tube has been a matter of debate. Grigori *et al.* (2008) examined 46 patients undergoing DCR via a prospective, randomized study: half with silastic tube insertion and the other half without a catheter. Success was defined as the absence of epiphora, decreased conjunctival discharge, and fewer infections. The success rate for the 46 patients was 89%; the success rates with and without the use of a silastic tube were 78% and 100%, respectively, a significant difference ($p=0.049$). The follow-up period was 6 months. In addition, the controversial use of a silastic catheter was demonstrated¹².

Conclusions

A similar efficacy was found between endoscopic DCR with lacrimal sac marsupialization and the other endoscopic techniques in this study. Studies with larger patient samples are needed. Appropriate follow-up and postoperative care are recommended for all cases.

Data availability

Figshare: Dacryocystorhinostomy dataset 2019, celis-aguilar *et al.* <https://doi.org/10.6084/m9.figshare.7716500.v4>⁷.

This dataset includes the following files:

- DCRSPSSFEB2016f10002.csv (dataset containing surgical information on all patients)
- data coding dacryocystorhinostomy article celis *et al.* docx (data dictionary)

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

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Michael K. Yoon

Department of Ophthalmology, Harvard Medical School, Boston, MA, USA

The authors describe their experience of endoscopic DCR with marsupialization versus endoscopic DCR with "other techniques". They compared their first 7 cases of endoDCR with marsupialization to the others. They found similar results (non-statistically significant) in comparing the surgical techniques.

Major comments:

Patients included in this study are not the same. Of the 24 patients, 2 had congenital disease and two had previous DCR (unclear endo or external). Thus, 16% of their patients had atypical disease.

It is unclear how various patients were assigned to have marsupialization versus other types of surgery.

The authors stated they collected subjective symptomatology outcomes, however this is not reported.

Three patients were lost to follow-up (all in the non-marsupialization group). These should be excluded from the analysis.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Ophthalmic plastic surgery; lacrimal surgery

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 22 March 2019

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Basil Mohammednather Saeed

Department of Surgery, College of Medicine, University of Mosul, Nineveh, Iraq

In the paragraph of 'Standard lacrimal sac surgery':

- How much is the dilution of adrenaline?

In the results section:

- In Table 1, the number of females and males in each group has to be mentioned fully, and what was the other ocular surgery in one patient?
- In the 'Efficacy of the procedures' paragraph, the last word needs correction.
- In the 'Follow up' paragraph, the first sentence was repeated on the next page.

The 'Discussion' was not that concise as the author concentrated on the comparison with external DCR, whilst your work was a comparison between different endoscopic procedures that was not satisfactorily covered.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Rhinology, endoscopic sinus surgery, rhinoplasty

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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