Endoscopic dacryocystorhinostomy - a case series of 6 years

Original Article

Authors

João Rosa
Centro Hospitalar Universitário Lisboa Norte, Portugal

César Silva
Centro Hospitalar Universitário Lisboa Norte, Portugal

Mariana Calha
Centro Hospitalar Universitário Lisboa Norte, Portugal

Vítor Oliveira
Centro Hospitalar Universitário Lisboa Norte, Portugal

Leonel Luís
Centro Hospitalar Universitário Lisboa Norte, Portugal

Correspondence:
João Rosa
joaopgomesrosa@gmail.com

Article received on July 13, 2023.
Accepted for publication on February 14, 2024.

Abstract

Objectives: evaluate the surgical effectiveness of endoscopic dacryocystorhinostomy (eDCR) and determine predictive factors of clinical and surgical success.
Study Design: retrospective descriptive study.
Materials and Methods: review of clinical records of patients undergoing eDCR in a tertiary center between 2017 and 2022, and statistical analysis.
Results: a total of 90 procedures were performed in 82 patients, including 17 revisions, with an overall clinical success rate of 89%. Exposure of the agger nasi (p=.018) and removal of the mucoperiosteal flap (p=.005) were statistically significant factors associated with higher clinical success. Revision surgery, history of dacryocystitis, silicone tube placement, and wide frontal maxillary apophysis osteotomy hadn't reach statistical significancy in surgical success (p>.05).
Conclusion: the authors emphasize the importance of removing the mucoperiosteal flap and opening the agger nasi, favoring the marsupialization of the lacrimal sac in the lateral wall, for surgical success.

Keywords: endoscopic dacryocystorhinostomy, epiphora, dacryocystitis, sucess rate

Introduction

Dacryocystorhinostomy (DCR) has long been the preferred treatment for epiphora and recurrent dacryocystitis due to anatomical or functional obstruction of the lacrimal sac or duct.[1–3] This procedure establishes a direct pathway between the lacrimal sac and nasal fossa, creating a shunt for the distal obstruction, thus improving lacrimal duct drainage and resolving obstructive symptoms. Direct endonasal DCR was described by Caldwell in 1893 but fell into disuse due to difficult visualization of the nasal fossa. Then, in 1904, Toti described external DCR, which remained the surgical reference for the treatment of lacrimal duct obstruction

for several decades, reaching success rates between 90–95%.[1,3–8]

With the development and innovation generated by endonasal endoscopy and the adaptation of the techniques described by McDonogh and Meiring (1989), endoscopic DCR (DCRe) gained popularity.[5] This technique allowed for a less invasive approach that preserves the skin, lacrimal pump function of the orbicularis oculi muscle, peripheral branches of the zygomatic nerve, and buccal branches of the facial nerve, in addition to providing a direct view of endonasal structures and the possibility of ancillary procedures such as septoplasty. This method is associated with a lower complication rate, lower morbidity, and similar success rates compared to external DCR.[1–3,9]

The aims of this retrospective study were to evaluate the surgical effectiveness of DCRe and determine the predictive factors for the surgical success of this technique.

Materials and methods

This retrospective study included 82 patients who underwent DCRe between January 2017 to December 2022 at the Centro Hospitalar Universitário Lisboa Norte, a tertiary hospital, in Lisbon, Portugal.

Clinical files were reviewed, and demographic data (age and sex), personal history, surgical indication, laterality, complementary diagnostic tests, obstruction level, surgical method variations (*agger nasi* opening, silicone stent placement, mucoperiosteal flap preservation, and osteotomy of the frontal process of the maxilla using a drill), intraoperative ancillary procedures (septoplasty, middle turbinoplasty, mitomycin C application, and maxillary, ethmoid, and frontal sinusotomy), time of permanence of the silicone stent (when applicable), intra- and postoperative complications, clinical success, surgical success, and time of postoperative follow-up were recorded.

We advocate the surgical technique described by Wormald[3], under general anesthesia. In brief, this technique entails nasal mucosa decongestion with a 1:5000 adrenaline solution; creation of a posterior-based mucoperiosteal flap using a Colorado-tip monopolar electrocautery (upper horizontal incision 8–10 mm above the middle turbinate axilla); identification and removal of the lacrimal bone; wide osteotomy of the frontal process of the maxillary sinus to expose the lacrimal sac up to its upper, posterior, and anterior limit using Kerrison forceps and a drill; uncinectomy and *agger nasi* opening; total or near-total mucoperiosteum removal, in the latter case positioning the remainder on the exposed bone; dilation of the lacrimal punctum canals and probing of superior and inferior canaliculi until the lacrimal sac is reached; marsupialization of the lacrimal sac and anterior and posterior opening of the respective flaps; and passage of the probe and fixation of the silicone stent with a silastic tube and surgical clips. These surgical steps were modified whenever necessary, as described below.

Nasal irrigation was recommended from the first postoperative day, along with systemic antibiotic prophylaxis, corticosteroid eye drops, and nasal corticosteroids to reduce edema and granulation tissue.[1,10,11] When used, the stent was removed after approximately seven weeks, frequently between 4–6 weeks.

The obstruction level in the lacrimal pathway (from the canaliculi to the Hasner valve) was defined by dacryocystography (DCG), and the paranasal sinuses were assessed by computed tomography (CT) for preoperative planning.

Clinical success was defined as complete resolution of the symptoms described by the patient, while surgical success was based upon endoscopic criteria for a patent and unobstructed neo-ostium, and both were evaluated six months after surgery. [3,9]

The IBM-SPSS® software v28.0, IBM Corp, NY, United States of America was used for statistical analysis, and the chi-square test was used to compare categorical variables. The significance level was set at 2% ($p < 0.02$).

Results

During the 6-year study period, 82 patients underwent surgery at our institution, of which 66 were female. The mean age was 63 years (σ = 17.71, 3–87): five patients were < 18 years old, 26 between 18–64 years, and 59 ≥ 65 years old. In total, 90 surgeries were performed. Epiphora was the most common clinical presentation in 59% of the patients (n = 53), followed by recurrent dacryocystitis in 19% (n = 19). The most frequently associated comorbidities were hypertension (n = 48), diabetes mellitus (n = 23), hypothyroidism (n = 8), and others (n = 20), including cardiovascular, renal, respiratory, and oncological diseases. Only five patients were smokers. A summary of the population characteristics is shown in Table 1.

Table 1
Characteristics of the study population

		N (%)
Sex	Female	66 (73)
	Male	24 (27)
Clinical	Epiphora	53 (59)
	Recurrent dacryocystitis	19 (21)
	Epiphora + dacryocystitis	18 (20)
Surgical	Primary	73 (81)
	Revision	17 (19)

Legend: Population characteristics by sex, clinical presentation, and type of surgery

The right side was operated in 47% patients, the left in 45%, and both in 8% (n = 7); among the patients who were operated on both sides, two patients underwent a single procedure and five underwent different surgeries.

DCG was performed in 72% of the patients (n = 65). The most common obstruction site was the lacrimal sac-duct transition (Krause's valve), which was affected in 19% of the patients (n = 14). DCG results were not available for one patient, and no anatomical obstruction was identified in another patient. Dacryocystocele was found in 13 patients. The obstruction levels are shown in Table 2.

Primary DCRe was performed in 73 patients (81%), with 17 revision surgeries. Among patients undergoing revision procedures, the primary surgery was endoscopic in 14 patients and external in three. The general clinical success rate was 89% (n = 80), 86% in primary surgery and 100% in revision surgery. Anatomical surgical success was achieved in 90% of the patients. Surgical techniques comprised wide osteotomy of the frontal process of the maxilla with motorized drill in 86% (n = 77), *agger nasi* opening in 74% (n = 67), and total or near-total mucoperiosteal flap removal in 76% (n = 69) patients. The lacrimal duct was cannulated with a silicone tube in 91% (n = 82) patients, which was removed in average after seven weeks (σ = 3.54, 2–16). There were four accidental extrusions.

Table 2
Obstruction levels

Obstruction level	Number
Common canaliculus	2
Common canaliculus/ lacrimal sac transition	4
Lacrimal sac (proximal)	11
Lacrimal sac (distal)	12
Lacrimal sac/ lacrimal duct transition	14
Lacrimal duct (proximal)	8
Lacrimal duct (distal)	11
Not available	27

Legend: Obstruction level assessment by dacryocystography (DCG) and computed tomography (CT).

The average postoperative follow-up period was 14 months. Eight patients missed subsequent appointments, and were lost to follow-up before one year. There were no major intraoperative complications, and 22 (24%) patients experienced minor postoperative complications (n = 28), as shown in Table 3. Surgical failure was not considered a postoperative complication. *Agger nasi* opening (p = 0.018) and mucoperiosteal flap removal (p = 0.005) were associated with greater clinical effectiveness. However, regarding surgical success, revision surgery (p = 0.105), history of dacryocystitis (p = 0.054), placement of a silicone tube (p = 0.19), wide

Table 3
Postoperative complications

Complication	Number
Septal-turbinate synechia	9
Lateral-turbinate synechia	8
Accidental stent extrusion	4
Punctum laceration	2
Epistaxis	2
Eyelid ecchymosis	2
Vestibulitis	1
Total	28

Legend: Characteristics of the complications

Table 4
Concurrent ancillary procedures

Procedure	Number
Septoplasty	3
Middle turbinectomy	2
Antrostomy	2
Antrostomy and anterior ethmoidectomy	1
Draf 2a frontal sinusotomy	1
Use of mitomycin C	2
Total	11

Legend: Ancillary procedures with dacryocystorhinostomy

osteotomy of the frontal process of the maxilla with a drill (p = 0.217), obstruction level (p = 0.511), preoperative DCG (p = 0.096), preoperative DCG in cases of epiphora (p = 0.179), sex (p = 0.613), and age (p = 0.156) showed no statistical significance. Among the ten cases of clinical failure, obstruction level was high in two (between the common canaliculus and proximal half of the lacrimal sac), low in three (between the distal half of the lacrimal sac and Hasner valve), and unknown in five patients. Additional procedures were performed during 12% (n = 11) surgeries, with no statistical significance, as shown in Table 4.

Discussion

The clinical and surgical success outcomes of this study are concurrent with those in the literature.[1,3,6,7,9]

Despite being a limitation, the average follow-up period was longer than one year (14 months), in accordance with the recommendations and criteria of other studies.[3,6,10] The overall effectiveness of the procedure is influenced by the time since surgery, with a more significant reduction in the first year, the period with the highest risk of stenosis, followed by constant gradual reduction over ten years of follow-up.[9] Most studies have identified synechia or granuloma formation leading to ostium occlusion as the primary cause of DCRe failure.[1,3,9,11] Other important causes are poor patient selection, inadequate surgical technique (insufficient sac exposure and marsupialization), and the surgeon inexperience. In this study, the analyzed patients were not operated by a single surgeon, which may have an impact over the technique performed, influencing the results and their comparison. The healing process may be impaired in older patients, making them particularly susceptible to ostium closure.[1] Nevertheless, our study found no correlation between age and DCRe failure.

Our study underscores the importance of a complete osteotomy and *agger nasi* opening, allowing for a complete exposure and marsupialization of the upper limit of the lacrimal sac, which decreases the risk of occlusion by enlarging the opening and coapting the flaps of the sac mucosa with the *agger nasi* mucosa. This enables better positioning of the posterior lacrimal sac flap[3], and was found to be statistically significant for surgical success in our study.

While some authors advocate preserving the mucoperiosteal flap to aid incorporating the sac into the lateral wall mucosa and reducing granuloma formation due to bone exposure, most studies have shown comparable long-term surgical effectiveness with flap preservation or flap removal.[1,7,13,14] In our study, flap removal had a statistically significant association with surgical effectiveness, possibly due to better exposure of the surgical field, less hemorrhage, and absence of overlapping mucous tissue on the lacrimal sac

flaps, leading to better drainage and healing.
The lacrimal pathway is often cannulated to maintain the permeability of the rhinostoma. Although popularized in studies regarding external DCR, its use is not consensual in DCRe, with systematic reviews and meta-analysis showing lack of benefit on this approach[1,14–16] Silicone stents have better success rates and fewer complications compared to other types of material, and are considered optional in DCRe[1] but recommended in the external approach. In our study sample, the lacrimal duct was cannulated with a silicone stent in 91% of the patients, but showed no statistical significance for surgical success. Stents were not used in: three children under five years of age due to anticipated removal difficulties without sedation and to avoid complications; two cases with nasal pyramid anatomy distortion due to an accident; two cases due to the surgeon's preference; and one case because one of the lacrimal puncta was not patent.
In this study, revision DCRe procedures (n = 17) demonstrated a success rate of 100%. In these cases, the authors reinforce the importance of revising and enlarging the osteotomy, which was often incomplete, to uncover the entire lacrimal sac, resolve minor complications from previous surgeries, and complete the lacrimal sac marsupialization.
Topical mitomycin C (0.4 mg/mL) was used in the two revision surgeries, and both achieved surgical success. Mitomycin C inhibits protein synthesis and fibroblast proliferation, thus modulating scar and fibrosis formation and maintaining the patency of the neo-ostium.[1,17,18] However, there are conflicting reports regarding the impact of mitomycin C on DCRe success;[17,18] some authors do not recommend its use in primary DCRe, only in revision surgeries.[1]
The main DCRe complications include hemorrhage, infection, synechia formation, restenosis, and canaliculi erosion. Lamina papyracea lesion, orbit lesion, and cerebrospinal fluid fistula are rare complications.[3,19] Synechia formation represented 60% (n = 17) of the complications in our study, and in two cases it was associated with surgical failure. Conversely, accidental stent extrusion (n=4) was associated with surgical failure in half of the cases. The other cases with surgical failure cases had no complications. DCRe is not associated with any serious complications, demonstrating its safety.
There were no significant associations between DCRe effectiveness and sex, clinical status (history of dacryocystitis), obstruction level, and ancillary procedures.
Multivariate analysis was not conducted due to sample size restrictions and retrospective study limitations. The authors recognize that this analysis can shed light on the relative contribution of each variable and reveal possible correlations between them.

Conclusion

Our results demonstrate the effectiveness of DCRe for treating lacrimal duct obstruction, and emphasize the positive outcomes associated with mucoperiosteal flap removal and *agger nasi* opening. Considering the limitations of a retrospective study and our small sample size, the conclusions of this study should be supported by future studies with more representative study samples.

Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Data Confidentiality

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

Protection of humans and animals

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the 2013 Helsinki Declaration of the World Medical Association.

Funding Sources

This work did not receive any contribution, funding or scholarship.

Availability of scientific data

There are no datasets available, publicly related to this work.

Bibliographic references

1. Yim M, Wormald PJ, Doucet M, Gill A, Kingdom T, Orlandi R. et al. Adjunctive techniques to dacryocystorhinostomy: an evidence-based review with recommendations. Int Forum Allergy Rhinol. 2021 May;11(5):885-893. doi: 10.1002/alr.22699.

2. McDonogh M, Meiring JH. Endoscopic transnasal dacryocystorhinostomy. J Laryngol Otol. 1989 Jun;103(6):585-7. doi: 10.1017/s0022215100109405

3. Wormald PJ. Powered Endoscopic Dacryocystorhinostomy. In: Endoscopic Sinus Surgery: anatomy, three-dimensional reconstruction, and surgical technique. New York: Thieme Medical Publishers; 2018. p. 161-176

4. Shapira Y, Macri C, Usmani E, Psaltis AJ, Chan WO, Selva D.Outcomes of intubation and endoscopic DCR in functional nasolacrimal duct obstruction. Rhinology. 2022 Aug 1;60(4):308-312. doi: 10.4193/Rhin22.047.

5. Yakopson VS, Flanagan JC, Ahn D, Luo BP. Dacryocystorhinostomy: history, evolution and future directions. Saudi J Ophthalmol. 2011 Jan;25(1):37-49. doi: 10.1016/j.sjopt.2010.10.012.

6. Kumar S, Mishra AK, Sethi A, Mallick A, Maggon N, Sharma H. et al. Comparing outcomes of the standard technique of endoscopic DCR with its modifications: a retrospective analysis. Otolaryngol Head Neck Surg. 2019 Feb;160(2):347-354. doi: 10.1177/0194599818813123

7. Hodgson N, Bratton E, Whipple K, Priel A, Oh SR, Fante RG. et al. Outcomes of endonasal dacryocystorhinostomy without mucosal flap preservation. Ophthalmic Plast Reconstr Surg. 2014 Jan-Feb;30(1):24-7. doi: 10.1097/IOP.0b013e3182a7502e.

8. Vinciguerra A, Resti AG, Rampi A, Bussi M, Bandello F, Trimarchi M. Endoscopic and external dacryocystorhinostomy: a therapeutic proposal for distal acquired lacrimal obstructions. Eur J Ophthalmol. 2023 May;33(3):1287-1293. doi: 10.1177/11206721221132746.

9. Cohen O, Amos I, Halperin D, Bavnik Y, Milstein A, Shoshani Y. et al. Five- and 10-Year outcomes for primary endoscopic dacryocystorhinostomy: failure rate and risk factors. Laryngoscope. 2021 Jan;131(1):10-16. doi: 10.1002/lary.28528

10. Barbosa L, Soares M, Guimarães A, Freire F, Veiga G. Dacriocistorrinostomia endoscópica nasal: resultados do Hospital Professor Doutor Fernando Fonseca. Port J ORL [Internet]. 2015 Jun; 53(2):121-5. doi: 10.34631/sporl.586

11. Ali MJ, Wormald PJ, Psaltis AJ. The dacryocystorhinostomy ostium granulomas: classification, indications for treatment, management modalities and outcomes. Orbit. 2015 Jun;34(3):146-51. doi: 10.3109/01676830.2015.1014510.

12. Keerl R, Weber R. Dacryocystorhinostomy - state of the art, indications, results. Laryngorhinootologie. 2004 Jan;83(1):40-50. doi: 10.1055/s-2004-814110.

13. Zloto O, Koval T, Yakirevich A, Ben Simon GJ, Weissman A, Ben Artsi E. et al. Endoscopic dacryocystorhinostomy with and without mucosal flap-is there any difference? Eye (Lond). 2020 Aug;34(8):1449-1453. doi: 10.1038/s41433-019-0716-4

14. Vinciguerra A, Nonis A, Resti AG, Barbieri D, Bussi M, Trimarchi M. Influence of surgical techniques on endoscopic dacryocystorhinostomy: a systematic review and meta-analysis. Otolaryngol Head Neck Surg. 2021 Jul;165(1):14-22. doi: 10.1177/0194599820972677.

15. Maldhure SV, Golhar PS, Moon PP. Endonasal dacryocystorhinostomy: results with or without stenting. Cureus. 2023 Jan 6;15(1):e33470. doi: 10.7759/cureus.33470.

16. Chong KK, Lai FH, Ho M, Luk A, Wong BW, Young A. Randomized trial on silicone intubation in endoscopic mechanical dacryocystorhinostomy (SEND) for primary nasolacrimal duct obstruction. Ophthalmology. 2013 Oct;120(10):2139-45. doi: 10.1016/j.ophtha.2013.02.036.

17. Sousa TTS, Schellini SA, Meneghim RLFS, Cataneo AJM. Intra-operative mitomycin-C as adjuvant therapy in external and endonasal dacryocystorhinostomy: systematic review and meta-analysis. Ophthalmol Ther. 2020 Jun;9(2):305-319. doi: 10.1007/s40123-020-00253-x.

18. Luu K, Tellez PA, Chadha NK. The effectiveness of mitomycin C in otolaryngology procedures: a systematic review. Clin Otolaryngol. 2022 Jan;47(1):1-13. doi: 10.1111/coa.13839

19. Wormald PJ. Powered endoscopic dacryocystorhinostomy. Laryngoscope. 2002 Jan;112(1):69-72. doi: 10.1097/00005537-200201000-00013.