



Original Article



Success of Endoscopic Dacryocystorhinostomy Using Flap Technique

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ABSTRACT

Acquired nasolacrimal duct obstruction is a frequent cause of epiphora and recurrent dacryocystitis, leading to substantial impairment in quality of life. Endoscopic dacryocystorhinostomy using mucosal flap techniques has been advocated to enhance ostium patency and reduce failure rates. **Objectives:** To evaluate the success rate, complications, and factors associated with outcomes of flap-based endoscopic dacryocystorhinostomy in patients with acquired nasolacrimal duct obstruction. **Methods:** This prospective single-arm interventional study was conducted in the Department of Otorhinolaryngology, Shaikh Zayed Hospital, Lahore, from January to June 2025. Seventy-two adults with syringing-confirmed acquired nasolacrimal duct obstruction were enrolled through non-probability consecutive sampling. All underwent standardized endoscopic dacryocystorhinostomy using a mucosal flap technique under general anaesthesia. **Results:** Seventy-two patients were enrolled, with a mean age of 42.03 ± 11.36 years and a mean disease duration of 7.97 ± 2.61 months. Most patients were female (63.9%). At 3 months, functional success was 66/72 (91.7%), anatomical success 68/72 (94.4%), and overall success 66/72 (91.7%; 95% CI 83.0–96.1), with no significant associations with baseline variables (all $p > 0.05$). Complications declined over time; 3-month rates were infection 2.8%, granulation 5.6%, synechiae 2.8%, and restenosis 5.6%. At 1 week, infection 6.9% and granulation 11.1%. **Conclusions:** Endoscopic dacryocystorhinostomy using a mucosal flap technique provides a high success rate with low complication frequency in acquired nasolacrimal duct obstruction and appears largely independent of baseline clinical variables.

INTRODUCTION

Epiphora, the overflow of tears onto the face, is a common ophthalmic complaint that causes both social inconvenience and functional disturbance [1]. The most frequent underlying cause is acquired nasolacrimal duct obstruction (NLDO), which affects predominantly middle-aged and elderly individuals, with a higher incidence in women [2]. Chronic obstruction predisposes to recurrent dacryocystitis, mucocoeles, and pyocoeles, placing a significant burden on patients and healthcare systems [3]. The definitive treatment of NLDO is dacryocystorhinostomy (DCR), a surgical procedure designed to bypass the obstruction by creating a direct fistula between the lacrimal sac and the nasal cavity [4, 5].

First attempted by Caldwell in 1893 through an endonasal route and later popularized by Toti in 1904 through an external approach, DCR has since evolved into two major techniques: external and endonasal [6, 7]. With advances in endoscopic visualization and powered instrumentation, endoscopic endonasal DCR (EnDCR) now achieves outcomes comparable to external DCR while offering additional benefits, including the absence of external scars, shorter recovery, and simultaneous management of intranasal pathology [8]. The long-term outcome of endoscopic dacryocystorhinostomy (EnDCR) is often limited by restenosis of the osteotomy, most commonly caused by granulation tissue, synechiae, and cicatricial



closure [9]. To reduce this risk, surgical refinements have focused on preserving and apposing mucosal flaps rather than sacrificing them. Conventional EnDCR removes the nasal mucosa overlying the sac, leaving bare bone that heals by secondary intention and predisposes to scarring [10]. Variants such as posteriorly based, inferiorly based, double-sided overlapping, lobulated pedicled, and combined nasal-lacrimal sac flaps have been introduced to create mucosa-to-mucosa anastomosis, encouraging primary healing and long-term patency [11]. Results in the literature remain inconsistent: Romanos *et al.* observed superior outcomes with flap preservation (98%) compared to conventional excision (84.8%, $p=0.013$) [12]. Meta-analysis by Vinciguerra *et al.* noted overall success rates above 89% in both flap and non-flap groups, with no significant statistical difference, though flap preservation was associated with lower granulation and restenosis [13]. Given these controversies, further evaluation of flap-based techniques in EnDCR is warranted. This study seeks to provide clarity on the role of flap preservation in sustaining long-term patency and reducing restenosis, thereby contributing to improved surgical standards for the management of nasolacrimal duct obstruction.

The study has gap in generalizability to other countries due to its multicenter design, the small sample size ($n=72$), which could fail to identify subpopulation differences, and short follow-up making it impossible to identify late failures, a non-probability sampling bias, and an uncontrolled control group to compare the techniques, and no validated patient-reported outcomes, which reduces its usefulness in assessing functional outcomes. This study aims to assess the success of endoscopic dacryocystorhinostomy using the flap technique, focusing on both anatomical and functional outcomes.

METHODS

This prospective single-arm interventional study was executed in the Department of Otorhinolaryngology, Shaikh Zayed Hospital, Lahore, from January 2025 to June 2025, following authorization from the Technical and Ethical Review Committee (02-TERC/NHRC-SZH/INT-SC/-497). A non-probability consecutive sampling was used to enroll patients. A sample size of 72 patients was calculated using a 95% confidence level, 5% margin of error, and an expected success rate of 95.1% for endoscopic dacryocystorhinostomy (EnDCR) using the flap technique [14]. Patients aged 18 to 70 years of either sex with symptomatic acquired nasolacrimal duct obstruction (NLDO) confirmed by probing and syringing, presenting with epiphora with or without recurrent dacryocystitis, and willing to provide informed consent with availability for follow-up, were included. Exclusion criteria comprised congenital NLDO, presacral obstruction (punctal stenosis,

canalicular or common canaliculus block), functional epiphora without anatomical obstruction, and secondary NLDO due to trauma, irradiation, granulomatous disease, nasal tumors, or lacrimal sac malignancy. Patients with prior lacrimal surgery, those undergoing major concurrent nasal surgery, and those with severe ocular comorbidities causing tearing (eyelid malposition, facial palsy, dry eye) were excluded. After taking informed written consent, baseline demographic and clinical information, including age, sex, side of involvement, duration of disease, and comorbidities such as diabetes mellitus, hypertension, allergic rhinitis/asthma, and smoking status, were recorded at enrolment. All procedures were performed under general anaesthesia using a 0-degree rigid endoscope. Nasal decongestion was achieved with adrenaline-soaked pledgets, followed by submucosal infiltration of lidocaine with adrenaline from the maxillary line to the anterior axilla of the middle turbinate. A mucosal incision was initiated at the upper border of the inferior turbinate with a No. 15 blade, extended ~10 mm anteriorly, and carried superiorly in a curvilinear fashion to 8–10 mm above the middle turbinate insertion, then completed posteriorly. The mucosal flap was elevated with a Freer elevator and reflected posteriorly. The lacrimal fossa was opened using a Kerrison punch. The lacrimal sac was tented with a probe, incised, and fashioned into anterior and posterior flaps. The nasal flap was divided into superior and inferior components to achieve circumferential mucosal coverage. A triamcinolone-impregnated absorbable gelatin sponge was placed to stabilise flaps. Postoperatively, saline irrigation, antibiotics, and anti-inflammatory therapy were prescribed. Postoperative visits were scheduled at 1 week, 1 month, and 3 months. Interim visits (1 week and 1 month) were conducted to assess healing, perform nasal endoscopic inspection and toilet where required, and document early adverse findings (infection, granulation tissue, synechiae, and early restenosis). The primary endpoint was assessed at 3 months, where functional success (complete resolution of epiphora) and anatomical success (endoscopic ostium patency with confirmed patency on irrigation) were formally determined. Overall success was defined as the concurrent presence of functional and anatomical success at 3 months. All data were entered and analyzed using IBM SPSS Statistics, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation (SD). Categorical variables were summarized as frequencies and percentages. Proportions were reported with 95% confidence intervals calculated using the Wilson score method for binomial data. Comparisons between categorical variables were performed using Chi-square or Fisher's exact test, as appropriate. All tests were two-

tailed, and a p-value <0.05 was considered statistically significant. No patients were lost to follow-up, and complete data were available for all analyses.

RESULTS

The mean age of the patients was 42.03 ± 11.36 years, while the mean duration of disease was 7.97 ± 2.61 months. Out of 72 patients, 34 (47.2%) were aged ≤ 40 years, and 38 (52.8%) were > 40 years. There were 26 (36.1%) males and 46 (63.9%) females. Side involvement was almost equal, with 34 (47.2%) cases on the right and 38 (52.8%) on the left. Diabetes mellitus was present in 12 (16.7%) patients, while 60 (83.3%) had no diabetes. Hypertension was observed in 14 (19.4%) patients, whereas 58 (80.6%) were non-hypertensive. Allergic rhinitis was found in 10 (13.9%) patients and absent in 62 (86.1%). Asthma was noted in 8 (11.1%) patients, while 64 (88.9%) had no history of asthma. Regarding smoking status, 42 (58.3%) were non-smokers, 12 (16.7%) were ex-smokers, and 18 (25.0%) were current smokers (Table 1).

Table 1: Baseline Demographic and Clinical Characteristics of Patients (n=72)

Variables	Categories	Frequency (%)
Age group	≤ 40 years	34 (47.2%)
	> 40 years	38 (52.8%)
Sex	Male	26 (36.1%)
	Female	46 (63.9%)
Side involved	Right	34 (47.2%)
	Left	38 (52.8%)
Diabetes mellitus	Yes	12 (16.7%)
	No	60 (83.3%)
Hypertension	Yes	14 (19.4%)
	No	58 (80.6%)
Allergic rhinitis	Yes	10 (13.9%)
	No	62 (86.1%)
Asthma	Yes	8 (11.1%)
	No	64 (88.9%)
Smoking status	Non-smoker	42 (58.3%)
	Ex-smoker	12 (16.7%)
	Current-smoker	18 (25.0%)

The three-month follow-up functional success was achieved in 66 (91.7%) patients, while anatomical success was achieved in 68 (94.4%) patients. Overall success was observed in 66 (91.7%, 95% CI 83.0% to 96.1%) patients (Figure 1).

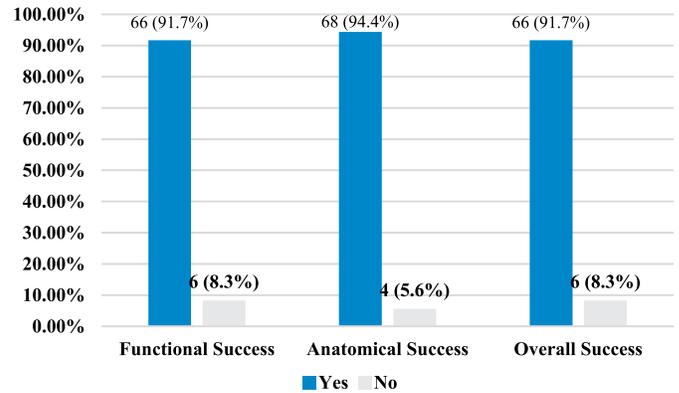


Figure 1: Functional, Anatomical, and Overall Success of Endoscopic Dacryocystorhinostomy Using Flap Technique at Three Months

At 3 months, overall surgical success showed no significant association with baseline factors. Success was comparable in patients ≤ 40 years and > 40 years (p=0.887), and between males and females (p=0.459). Outcomes were similar for right and left side procedures (p=0.117). Hypertension (p=0.369), allergic rhinitis (p=0.150), asthma (p=0.070), and smoking status (p=0.073) also showed no significant impact on surgical success (Table 2).

Table 2: Association of Baseline Characteristics with Overall Surgical Success at 3 Months (n=72)

Variables	Categories	Overall, Success Yes, n (%)	Overall, Success No, n (%)	P-value
Age group	≤ 40 years	31 (47.0%)	3 (50.0%)	0.887
	> 40 years	35 (53.0%)	3 (50.0%)	
Sex	Male	23 (34.8%)	3 (50.0%)	0.459
	Female	43 (65.2%)	3 (50.0%)	
Side of involvement	Right	33 (50.0%)	1 (16.7%)	0.117
	Left	33 (50.0%)	5 (83.3%)	
Diabetes mellitus	Yes	12 (18.2%)	0 (0.0%)	0.253
Hypertension	Yes	12 (18.2%)	2 (33.3%)	0.369
Allergic rhinitis	Yes	8 (12.1%)	2 (33.3%)	0.150
Asthma	Yes	6 (9.1%)	2 (33.3%)	0.070
Smoking status	Non-smoker	40 (60.6%)	2 (33.3%)	0.073
	Ex-smoker	9 (13.6%)	3 (50.0%)	
	Current-smoker	17 (25.8%)	1 (16.7%)	

Postoperative complications were infrequent. At 1 week, infection was observed in 5 patients (6.9%), granulation tissue in 8 (11.1%), and synechiae in 6 (8.3%). By 1 month, the frequency of infection decreased to 3 patients (4.2%), granulation to 6 (8.3%), and synechiae to 4 (5.6%); ostium restenosis was documented in 2 patients (2.8%). At 3 months, infection further declined to 2 patients (2.8%), granulation to 4 (5.6%), and synechiae to 2 (2.8%), whereas ostium restenosis increased to 4 patients (5.6%) (Table 3).

Table 3: Postoperative Complications at Different Follow-Up Intervals(n=72)

Complications	1 Week, n (%)	1 Month, n (%)	3 Months, n (%)
Infection	5 (6.9)	3 (4.2)	2 (2.8)
Granulation	8 (11.1)	6 (8.3)	4 (5.6)
Synechiae	6 (8.3)	4 (5.6)	2 (2.8)
Ostium restenosis	0 (0.0)	2 (2.8)	4 (5.6)

DISCUSSION

The present study evaluated the outcomes of endoscopic dacryocystorhinostomy (EnDCR) using a mucosal flap technique in patients with acquired nasolacrimal duct obstruction (NLDO). At three months, the overall surgical success rate was 91.7%, with low complication rates and no significant influence of baseline demographic or clinical variables on outcome. The mean age of our study population was 42.03 ± 11.36 years, which is comparable to findings by Bani-Ata *et al.* who reported a mean age of 41.6 years in their series of 77 patients undergoing single- or double-flap EnDCR [15]. Shahid *et al.* also described a similar mean age of 51.1 years in 100 patients with chronic dacryocystitis [16]. In contrast, Jeong and Kim noted a higher mean age of 66.5 years in their large retrospective series of 509 eyes [17]. The broad age range across studies suggests that EnDCR is effective across diverse age groups, consistent with our finding that success rates did not differ significantly between patients ≤ 40 years and those > 40 years ($p=0.887$). Female predominance was evident in our study (63.9%), aligning with prior reports. Bani-Ata *et al.* reported 67.5% females, Wang *et al.* 85.7%, and Jeong and Kim 84.3% [17, 18]. This consistent female preponderance reflects the recognized epidemiology of acquired NLDO, which is more common among women due to narrower bony nasolacrimal canals. However, in our series, gender was not associated with surgical outcome ($p=0.459$). Laterality in present study was balanced (47.2% right, 52.8% left), which mirrors the distribution observed by Bani-Ata *et al.* (46.8% right, 53.2% left) and Wang *et al.* (50.8% left, 42.9% right) [15, 18]. As in these prior reports, we found no difference in outcomes between right- and left-sided procedures ($p=0.117$), suggesting that anatomical laterality does not alter prognosis when surgical technique is standardized. Comorbidities were infrequent in our cohort: diabetes mellitus in 16.7%, hypertension in 19.4%, allergic rhinitis in 13.9%, and asthma in 11.1%. These rates are broadly consistent with those reported by Romanos *et al.* who documented diabetes in 13%, hypertension in 17.4%, and allergic conditions in 21.7% of their series of 188 patients [12]. In our study, none of these comorbidities significantly affected outcome (all $p > 0.05$). This finding is in agreement with Zloto *et al.* and Rezaeian *et al.* all of whom demonstrated no significant

association between comorbidities and EnDCR success [19, 20]. Smoking was recorded in 41.7% of our patients (16.7% ex-smokers, 25% current smokers), similar to the 39.9% prevalence reported in the conventional flap group of Romanos *et al.* Our results showed no significant effect of smoking status on outcome ($p=0.073$), paralleling Romanos *et al.* who found no adverse impact of smoking on long-term success [12]. The overall success rate of 91.7% at three months in our study is consistent with the literature, which generally reports success between 88% and 96%. Wanumkarng *et al.* in a multicenter Thai series of 729 procedures, observed 92% overall success, with improvement to 100% after refinement of bone removal and flap suturing techniques [21]. Shahid *et al.* documented anatomical success in 94% of cases, while Bani-Ata *et al.* achieved 84.4% overall, with significantly higher rates in the double-flap (96.8%) compared to the single-flap (76.1%) group [15, 16]. Jeong and Kim reported six-month anatomical success of 95.6% with combined flaps, 92.9% with nasal flap alone, and 88.2% with no flap, confirming that flap preservation improves long-term patency [17]. Hamdy *et al.* compared posteriorly versus inferiorly based flaps and reported overall success of 93.3% at six months, with no significant intergroup difference [22]. Rezaeian *et al.* in a randomized trial of 60 patients, found success rates approaching 99% for both double-sided overlapping flap and conventional approaches, with no statistical difference [20]. Similarly, Patel *et al.* reported complete resolution in 100% with flap preservation and 97.05% with flap excision, again without a significant difference [23]. The meta-analysis by Vinciguerra *et al.* including 3059 procedures, confirmed a pooled success of ~90% irrespective of powered versus mechanical techniques and found no significant difference between flap and non-flap strategies [13]. Minor variations in reported rates across studies likely reflect differences in flap design, use of stenting, follow-up duration, and surgeon experience. Importantly, all agree that success rates are consistently high when meticulous technique ensures wide, mucosalized ostium creation. Complications in our series were infrequent and minor. Granulation occurred in 5.6%, synechiae in 2.8%, restenosis in 5.6%, and infection in 2.8%. These findings mirror other reports, where complication rates were generally below 10% and most commonly involved granulation or synechiae. For example, Hamdy *et al.* reported overall complications in 33.3% of patients, largely minor issues such as adhesions and granuloma, while Wang *et al.* noted only a single case of granulation (1.5%) among 67 eyes over two years [18, 22]. Patel *et al.* found granulation in 8.8% of flap-excised cases, while none occurred in the flap-preservation group [23]. Jeong and Kim demonstrated significantly reduced

granulation rates in combined flap techniques (2-3%) compared with no flap (6-8%)($p < 0.05$)[17]. These findings collectively support the view that flap preservation techniques minimize granulation and restenosis by providing mucosa-to-mucosa anastomosis, which is consistent with the relatively low complication profile observed in our study. This study's strengths lie in its prospective design, standardized flap-based EnDCR technique, and structured follow-up, which provide reliable outcome assessment. A specifically designed proforma minimized data loss and ensured consistency.

Limitations include the single-center setting, modest sample size, and relatively short follow-up of three months, which may not capture late failures or restenosis. Future research should involve larger, multicenter cohorts with extended follow-up to confirm durability, explore patient-reported functional outcomes, and compare flap techniques with adjunctive measures such as stenting or mitomycin C, thereby refining surgical standards and optimizing long-term results for patients with NLDO.

CONCLUSIONS

This study demonstrated that endoscopic dacryocystorhinostomy (EnDCR) using a flap technique achieved an overall success rate of 91.7% at three months, with minimal postoperative complications. Outcomes were not significantly influenced by baseline variables, including age, sex, laterality, diabetes, hypertension, allergic rhinitis, asthma, or smoking status. Infection, synechiae, granulation, and restenosis occurred infrequently and were managed conservatively. These findings support flap-based EnDCR as a safe, effective, and broadly applicable approach for the management of acquired nasolacrimal duct obstruction.

Authors' Contribution

Conceptualization: RA, MAS

Methodology: RA, MI, SL, MZA

Formal analysis: HAI,

Writing and Drafting: RA, MI, SL, MZA, MAS

Review and Editing: RA, MI, SL, MZA, HAI, MAS

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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