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Original Article

External Dacryocystorhinostomy Using Nasal Mucosal Flap Versus Non-Flap Technique: A Comparative Study in a Resource-Limited Setting

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ABSTRACT

Background: Nasolacrimal duct obstruction (NLDO) is a typical ophthalmic disease that results in chronic epiphora and recurrent cases of dacryocystitis, and external dacryocystorhinostomy (Ext-DCR) is the gold standard surgical intervention. This study aimed to compare the outcomes of the surgical interventions of Ext-DCR with nasal mucosal flap and non-flap. **Methods & Materials:** This prospective comparative study was conducted at Sir Salimullah Medical College & Mitford Hospital, Dhaka, Bangladesh from February 2017 to August 2017. 60 patients primarily affected with NLDO were assigned to two groups of the same size, Group A (flap, n=30) and Group B (non-flap, n=30). At 6 months after the surgical procedure, the outcome of the surgery was measured in terms of anatomical and functional measures. Data were entered and analyzed using SPSS version 26. **Results:** Every patient had epiphora; there was discharge in 60% (Group A) and 63.3% (Group B). The mean duration of surgery was much higher in the flap group (65.4 ± 8.2 vs. 52.6 ± 7.9 min; p<0.001). There were fewer complications in Group A after the operation surgery: no complication in 80% vs. 60. The success rate of anatomy was higher in Group A (93.3%) compared to Group B (80.0%) (p=0.138); the success rate of functionality was higher in Group A (90%) compared to Group B (73.3) (p=0.095). Two-thirds of 3.3% vs. 13.3% of cases required revision surgery. **Conclusion:** Ext-DCR nasal mucosal flap technique showed better anatomical and functional success, and reduced complications than the no-flap technique, indicating that it might be the technique of choice in situations when surgical expertise is at stake, and there are limited resources.

Keywords: *dacryocystorhinostomy, nasolacrimal duct obstruction, mucosal flap, epiphora, resource-limited setting*

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INTRODUCTION

NLDO is one of the most common disorders of the lacrimal drainage system in ophthalmic practice and occurs as a result of pathological obstruction at the nasolacrimal duct level of the lacrimal drainage system, which obstructs the normal drainage of the tears into the nasal cavity [1]. The typical clinical picture consists of chronic epiphora - the constant overflow of tears onto the cheek - which, although it does not pose an immediate threat to the vision, has a strong negative effect on the quality of life, blurring the vision, causing social embarrassment, and predisposing to frequent dacryocystitis [2]. Ext-DCR has been the surgical procedure that has been regarded as the gold standard in the treatment of acquired NLDO. The surgery entails formation of an in-situ anastomosis of the lacrimal sac and the nasal mucosa using a bony ostium in the lacrimal bone, which prevents the obstruction of the nasolacrimal duct and permits drainage of tears to flow directly into the nasal cavity [3]. Ext-DCR is the standard against which endoscopic and endonasal methods are compared, with success rates of 85 to 95 percent in the literature, being consistent across all studies, indicating that the procedure is effective [4]. Although the efficacy of the procedure is well established, technical differences in the surgical steps, especially how the nasal mucosal and lacrimal sac flaps are handled, are still debated amongst the oculoplastic surgeons [5]. Classical bicanalcular mucosal flap anastomosis is a procedure that was described by Dupuy-Dutemps and Bourguet, entailing suture of anterior and posterior flaps of the lacrimal sac and the nasal mucosa. Advocates believe that flap anastomosis enhances the epithelialization of the ostium, lessens granulation tissue, and provides greater long-term patency rates eventually [6]. On the other hand, the non-flap/flapless procedure is where the nasal mucosa and lacrimal sac are removed without anastomosis [7]. The supporters of the non-flap method mention its technical simplicity, shorter time of operation, similar success rate in the short-term research, and the ability to work in the environment where long surgical time and specialized skills can be limited [8]. The question of the technique of surgery has pragmatic consequences beyond the bare anatomical success rates in resource-limited healthcare settings, which are typified by large patient flows, scarce instrumentation, and unreliable access to trained ophthalmic surgeons. The healthcare landscape in Bangladesh, being a lower-middle-income nation, has an ophthalmic surgical service distribution that is usually dominated by tertiary centers that treat a high disease burden with a limited number of resources available to them [9]. It is of direct clinical and policy significance in such environments to know whether the extra complexity of flap making and anastomosis of the mucosa is being translated into meaningfully better outcomes. Although there is an increasing literature between flap and non-flap procedures of a comparative nature in various parts of the world, there are few prospective comparative studies among South Asian resource-constrained settings. This study, therefore, aimed to compare the surgical outcome and complication profile of Ext-DCR as done with the nasal mucosal flap technique and the non-flap technique of the procedure in a tertiary ophthalmology setting in Bangladesh.

METHODS & MATERIALS

This was a prospective comparative study conducted at the Department of Ophthalmology, Sir Salimullah Medical College & Mitford Hospital, Dhaka, Bangladesh from February 2017 to August 2017. Consecutive sampling was used to enroll 60 adult patients with a clinically determined primary acquired nasolacrimal duct obstruction (NLDO). The patients were equally divided into two groups of 30

patients each. Group A (n=30) received Ext-DCR treatment with nasal mucosal flap anastomosis, and Group B (n=30) received Ext-DCR treatment with a non-flap (flapless) technique. The study included patients with established primary NLDO on the basis of clinical examination (positive regurgitation test, unsuccessful lacrimal irrigation), who had epiphora and/or frequent dacryocystitis, and could offer informed consent. Secondary NLDO (trauma, tumor, or prior sinonasal surgery), current nasal infection, and pathology of the nose that precludes surgery, hemorheological disorders, systemic conditions to which general/local anesthesia is unsafe, or patients who had lost to follow-up were excluded. The surgical technique (flap vs. non-flap) was the independent variable. Dependent variables were success in the form of the anatomy (patent lacrimal irrigation at 6 months), success in the form of functionality (epiphora resolved), length of operation, intraoperative bleeding, postoperative complications (wound infection, nasal synechiae, granulation tissue, bleeding), and revision surgery. The covariates were socio-demographic and clinical characteristics. The data were typed and analyzed with SPSS version 26. Frequencies and percentages were used to express the categorical variables; mean + standard deviation to express continuous variables. Chi-square test or Fisher's exact test of categorical variable and independent sample t-test of continuous variable were used as the methods of intergroup comparison. The p-value that was taken as significant was less than 0.05.

RESULTS

Table I represents the socio-demographic profile of both study groups. The mean age was 37.57 ± 12.63 years in Group A and 37.83 ± 11.25 years in Group B, with over 43% of patients in each group aged above 40 years. Females predominated in both groups (56.7% and 63.3%, respectively). Primary education was the most common educational level, and housewives constituted the largest occupational category (60% and 70%). The majority of patients belonged to the middle socioeconomic class. Both groups were demographically comparable with no statistically significant differences.

Table I
Socio-demographic characteristics of the study population (*n* = 60).

Variable	Category	Group A (Flap) (n = 30) n (%)	Group B (Non-Flap) (n = 30) n (%)
Age (years)	≤20	5 (16.7)	1 (3.3)
	21-30	6 (20.0)	10 (33.3)
	31-40	4 (13.3)	6 (20.0)
	>40	15 (50.0)	13 (43.4)
	Mean ± SD	37.57 ± 12.63	37.83 ± 11.25
Sex	Male	13 (43.3)	11 (36.7)
	Female	17 (56.7)	19 (63.3)
Educational status	Illiterate	5 (16.7)	3 (10.0)
	Primary	15 (50.0)	18 (60.0)
	SSC	6 (20.0)	7 (23.4)
	HSC	3 (10.0)	1 (3.3)
	Graduate	1 (3.3)	1 (3.3)
Occupational status	Housewife	18 (60.0)	21 (70.0)
	Service	4 (13.3)	3 (10.0)
	Business	1 (3.3)	1 (3.3)
	Student	5 (16.7)	1 (3.3)
	Others	2 (6.7)	4 (13.3)
Socioeconomic status	Poor	11 (36.7)	6 (20.0)
	Middle class	18 (60.0)	24 (80.0)
	Rich	1 (3.3)	0 (0.0)

Table II outlines the clinical characteristics of the enrolled patients. Disease laterality was nearly equal between the two eyes across both groups. The majority of patients had symptoms lasting 1-3 years (46.7% in Group A; 50% in Group B). Epiphora was universally present in all 60 patients, with ocular discharge reported in 60% and 63.3%, respectively. Chronic dacryocystitis was the most common lacrimal sac status (70% and 66.7%), with mucocele present in approximately one-third of patients in each group.

Table II
Clinical characteristics of the study patients (*n* = 60).

Variable	Category	Group A (Flap) n (%)	Group B (Non-Flap) n (%)
Laterality of disease	Right eye	16 (53.3)	14 (46.7)
	Left eye	14 (46.7)	16 (53.3)
Duration of symptoms	<1 year	9 (30.0)	8 (26.7)
	1-3 years	14 (46.7)	15 (50.0)
	>3 years	7 (23.3)	7 (23.3)
Presenting symptoms	Epiphora	30 (100)	30 (100)
	Discharge	18 (60.0)	19 (63.3)
	Recurrent dacryocystitis	7 (23.3)	6 (20.0)
Lacrimal sac status	Mucocele	9 (30.0)	10 (33.3)
	Chronic dacryocystitis	21 (70.0)	20 (66.7)

Table III summarizes preoperative ophthalmic findings. A positive regurgitation test was noted in 93.3% of Group A and 90.0% of Group B patients. Lacrimal irrigation confirmed complete obstruction in all 60 participants. Nasal cavity assessment revealed a deviated nasal septum in 20% and 16.7%, and inferior turbinate hypertrophy in 13.3% and 10.0% in Groups A and B, respectively, with the majority having a normal nasal cavity.

Table III
Preoperative ophthalmic examination findings (*n* = 60).

Variable	Category	Group A (Flap) n (%)	Group B (Non-Flap) n (%)
Regurgitation test	Positive	28 (93.3)	27 (90.0)
	Negative	2 (6.7)	3 (10.0)
Lacrimal irrigation	Complete obstruction	30 (100)	30 (100)
Nasal pathology	Deviated nasal septum	6 (20.0)	5 (16.7)
	Inferior turbinate hypertrophy	4 (13.3)	3 (10.0)
	Normal nasal cavity	20 (66.7)	22 (73.3)

Table IV compares intraoperative parameters. The mean surgical duration was significantly longer in Group A (65.4 ± 8.2 min) compared to Group B (52.6 ± 7.9 min), reflecting the additional operative steps required for mucosal flap creation and anastomosis. Intraoperative bleeding was predominantly mild in both groups (66.7% vs. 73.3%). Severe bleeding occurred in 6.7% (Group A) and 3.3% (Group B). Difficulty in creating an adequate bony ostium was encountered in 13.3% and 16.7% of cases, respectively.

Table IV
Intraoperative characteristics of the surgery (*n* = 60).

Variable	Group A (Flap)	Group B (Non-Flap)
Mean duration of surgery (minutes)	65.4 ± 8.2	52.6 ± 7.9
Intraoperative bleeding	-	-
Mild	20 (66.7%)	22 (73.3%)
Moderate	8 (26.7%)	7 (23.3%)
Severe	2 (6.7%)	1 (3.3%)
Difficulty creating an ostium	4 (13.3%)	5 (16.7%)

Table V details postoperative complications at follow-up. Group A demonstrated a notably lower complication rate overall, with 80% of patients experiencing no complications compared to 60% in Group B. Nasal synechiae were the most frequent complication in Group B (13.3%) versus 6.7% in Group A. Granulation tissue formation was three times more common in the non-flap group (10.0% vs. 3.3%).

Table V
Postoperative complications (*n* = 60).

Complication	Group A (Flap) n (%)	Group B (Non-Flap) n (%)
Postoperative bleeding	2 (6.7)	3 (10.0)
Wound infection	1 (3.3)	2 (6.7)
Nasal synechiae	2 (6.7)	4 (13.3)
Granulation tissue	1 (3.3)	3 (10.0)
No complication	24 (80.0)	18 (60.0)

Table VI shows the primary surgical outcomes at 6-month follow-up. Anatomical success was higher in Group A (93.3%) than in Group B (80.0%), though not statistically significant (p=0.138). Functional success (resolution of epiphora) was 90.0% in Group A versus 73.3% in Group B (p=0.095). Persistent epiphora was more frequent in the non-flap group (26.7% vs. 10.0%). Revision surgery was required in only 3.3% of flap patients compared to 13.3% in the non-flap group (p=0.161).

Table VI
Surgical success outcomes at follow-up (*n* = 60).

Outcome	Group A (Flap) n (%)	Group B (Non-Flap) n (%)	p-value
Anatomical success	28 (93.3)	24 (80.0)	0.138
Functional success	27 (90.0)	22 (73.3)	0.095
Persistent epiphora	3 (10.0)	8 (26.7)	0.095
Revision surgery required	1 (3.3)	4 (13.3)	0.161

Table VII provides a comparative statistical analysis of key continuous outcome measures. The duration of surgery was the only variable with a statistically significant intergroup difference (p<0.001), favoring the non-flap technique in terms of operative time. Hospital stays (2.1 ± 0.6 vs. 1.9 ± 0.5 days; p=0.187) and follow-up duration (6.3 ± 1.2 vs. 6.1 ± 1.3 months; p=0.542) were comparable. Overall surgical success was clinically higher in Group A (90.0% vs. 73.3%) but did not attain statistical significance (p=0.095).

Table VII
Comparative statistical analysis of surgical outcomes.

Variable	Group A Mean ± SD	Group B Mean ± SD	p-value
Duration of surgery (minutes)	65.4 ± 8.2	52.6 ± 7.9	<0.001
Hospital stays (days)	2.1 ± 0.6	1.9 ± 0.5	0.187
Follow-up duration (months)	6.3 ± 1.2	6.1 ± 1.3	0.542
Overall surgical success (%)	90.0	73.3	0.095

DISCUSSION

This prospective comparative study assessed the results of external dacryocystorhinostomy (Ext-DCR) done with and without nasal mucosal flap anastomosis in a resource-constrained environment in Bangladesh. We have shown that the flap technique achieved superior anatomical (93.3% vs. 80%), functional (90% vs. 73.3%), and a reduced complication rate; however, the differences were not found to be statistically significant, which can be explained by the relatively low number of patients per group. The anatomical success rate of 93.3% in the flap group is also consistent with Feretis et al. [4]. Sobel et al. have reported success rates as high as 88-96% of Ext-DCR using flap anastomosis [10]. In a systematic review, Akaishi et al. concluded that careful mucosal flap management is an important factor that can decrease the risk of ostium cicatrization and, thus, preserve long-term patency [11]. Our non-flap group demonstrated 80% anatomical success, and this also fits within the previous 75 to 90% range of those studies that support the use of flapless methods [12]. The functional success rate of the flap group at 90% versus 73.3% in the non-flap group is especially clinically relevant, as resolution of epiphora is the primary patient-reported outcome of DCR. Anatomical patency can exceed functional success because of dysfunction of the pump or chronic inflammation of the lacrimal sac, which can be partially alleviated by flap anastomosis, which encourages the formation of epithelialized, physiologically active ostia [13]. This is in keeping with the findings of Mansour et al., who had reported that the functional outcomes of flapless techniques could be poor even with similar short-term rates of anatomical patency [14]. The number of postoperative complications was higher in the non-flap group. The most significant differences were nasal synechiae (13.3% vs. 6.7%) and granulation tissue (10% vs. 3.3). The increase in granulation tissue at the rhinotomy area in the flapless group is in line with the hypothesis that a stronger inflammatory response is triggered by the exposed bone and connective tissue at the rhinotomy area in the absence of mucosal covering to support the proliferation of fibroblasts and subsequent stenosis of the ostium [15]. These results are consistent with the theory that mucosal flap cover provides an osteotomy site protective barrier to the osteotomy site. The duration of the operative time of the flap technique was statistically significant in our research (65.4 ± 8.2 vs. 52.6 ± 7.9 min; p<0.001). This is operationally significant as it is an approximation of 13 minutes (which is significant in busy surgery situations), and needs to be balanced with the clinical benefits. The lack of flap in the non-flap technique can be a logistical plus in a resource-constrained setting whose environment requires high surgical throughput demands, as long as the differences in success rates are considered to be acceptable clinically [16]. The reason to undergo revision surgery was significantly lower in the group of flaps (3.3% vs. 13.3%). From a health economic perspective, revision DCR has significant cost implications, such as extra operating time, anesthesia, and morbidity in the patients [17]. When this is verified in larger studies, then this trend would give a further impetus to the adoption of mucosal flap anastomosis as the method of choice in Ext-DCR [18]. The sociodemographic variables, preoperative clinical results, and the severity of the disease were also evenly spread across the two groups, which minimized the chances of confounding factors. The fact that female patients were mostly the victims (56.7% and 63.3%) agrees with the fact that the incidence of NLDO is higher among women due to the smallness of the bony nasolacrimal canal in females. The large percentage of patients over 40 years old who have chronic dacryocystitis as the most common pathology of the lacrimal sac represents the disease pattern that is normally seen in tertiary care units in South Asia [19]. Combined, our findings indicate that the nasal mucosal flap technique, which is more taxing and time-consuming, has clinically significant benefits compared to the non-flap technique regarding its success rates, burden of complications, and revision surgery rates. These results have significant implications for surgical training and resource allocation in the ophthalmology department, which are subject to the limitations specific to low- and middle-income countries settings.

LIMITATIONS

The sample size used in the study was relatively small, which could have underpowered the statistical analysis to find significant differences in surgical outcomes, and the study was also limited by the single-center design, which limits the generalizability of the results to a wider population and other practice settings.

CONCLUSION

This study demonstrated that the Ext-DCR using nasal mucosal flap anastomosis had better anatomical (93.3% vs. 80%), functional (90% vs. 73.3%), and lower postoperative complication rates than the non-flap technique (p=.977). The non-flap method was much less time-consuming in operation, and this was a pragmatic benefit in high-volume and resource-limited surgical practices. Its long-term clinical value is supported by the markedly lower revision surgery rate in the flap group (3.3% vs. 13.3%). Depending on these findings, the mucosal flap technique ought to be regarded as the preferred method of Ext-DCR when the expertise and the time to engage in a surgery allow, including in resource-constrained conditions, because its better clinical results probably offset the added complexity.

RECOMMENDATIONS

Future multicenter, randomized controlled trials with bigger sample sizes and longer follow-up periods will be required to conclusively determine the long-term comparative effectiveness, cost-effectiveness, and optimal indications of each of the techniques, especially in resource-limited health systems in South Asia and other similar environments.

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CONFLICT OF INTEREST

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