



A COMPARISON OF ENDONASAL ENDOSCOPIC DACRYOCYSTORRHINOSTOMY AND EXTERNAL DACRYOCYSTORRHINOSTOMY

ENT

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ABSTRACT

Background: Dacryocystorhinostomy (DCR) can be performed either through external or endoscopic approach. The present study was undertaken to compare the external and endonasal DCR surgical procedure in regards to duration of surgery, intra and postoperative complications and postoperative success rate.

Method: Retrospective comparative study. Total 100 symptomatic cases of epiphora which were diagnosed as NLD obstruction and chronic dacryocystitis were included in the study. All 100 patients were prospectively randomized into two groups EX-DCR and EN-DCR. All patients were followed at 7th day, 1 and 6 months interval postoperatively.

Results: There was no statistically significant difference between the two groups in terms of age, sex and complications. (Respectively $p=0.46$, $p=0.57$, $p=0.1$). However, the number of females was higher than the number of males in the two groups. Physiological failure were seen 2 cases (8%) of external DCR due to pump failure resulting from the interruption of medial canthal anatomy, orbicularis oculi muscles, but none cases were seen in endonasal DCR. The success rate was 96% in the endoscopic DCR group and 84% in the external DCR group. There was no statistically significant difference in the success rate between the two groups ($p=0.609$).

Conclusion: In current study there was no statistical difference in term of complications and success rate between external and endonasal DCR however, physiological failure was seen in external DCR due to disruption of the physiological pump mechanism after dacryocystorhinostomy. In contrast endonasal DCR preserves lacrimal pump physiology.

KEYWORDS

Dacryocystorhinostomy, EX- DCR, EN- DCR, Epiphora, Dacryocystitis.

INTRODUCTION:

Nasolacrimal duct obstruction (NLDO) inhibits the flow of tears from the eye to the nose, leading to symptoms of epiphora^[1] Chronic dacryocystitis is defined as the chronic inflammation of the lacrimal sac due to stricture of the nasolacrimal duct secondary to chronic inflammation, which is usually nasal in origin. The essential symptom is epiphora, which is aggravated by conditions such as exposure to wind. There may be swelling at the site of the sac (mucocoele), and the neighboring parts of the conjunctiva are frequently inflamed.^[2] The clinical spectrum of epiphora ranges from the occasionally trickle to chronically irritating overflow of tears.^[3] It is caused by malposition of lacrimal puncta, obstruction anywhere along lacrimal drainage system and due to lacrimal pump failure.

Standard treatment for nasolacrimal duct obstruction has been dacryocystorhinostomy (DCR) surgery. DCR can be performed either through external or endoscopic approach. The technique of external DCR was originally described in 1904 by Toti^[4] and later modified by Dupuy-Dutemps and Bourguet with the addition of suturing of the mucosal flaps, thus forming an epithelium-lined fistula. External DCR is regarded as a gold standard with a success rate of 80 to 100%.^[5] Alternative pathway of DCR by intranasal route was described by Caldwell in as early as 1893.^[6] It was modified by West in 1910.^[7] Later on, the introduction of rigid nasal endoscopes enabled an endoscopic approach. McDonough and Meiring first described endoscopic intranasal DCR in 1989.^[8]

Moreover, various studies have showed that success rate for both procedures ranges from 63% to 97%.^{[9],[10]} The wide range of success rate is likely due to surgical variability, patient demographics and lack of standardized outcome measures. With advancement in technology accompanied by improved visualization, endoscopic DCR has gained much fame.^[11] With this background, the present study was done with the aim to compare the external and endonasal endoscopic DCR in regards to duration of surgery, intra and postoperative complications and postoperative success rate.

MATERIALS AND METHODS:

The present retrospective study was conducted in 100 symptomatic cases of epiphora attending ENT and Ophthalmology OPD and who were diagnosed as NLD obstruction and chronic dacryocystitis during a period of 6 months from January 2019 to June 2019. Also patients willing to undergo surgery were enrolled. Cases with canalicular and punctal obstruction, comorbid conditions, bleeding disorders were excluded from the study.

Diagnosis of NLD obstruction and chronic dacryocystitis was based on the presence of symptoms with epiphora, clinical observation of fluorescein dye disappearance test and documented obstruction by lacrimal irrigation and probing.

Detailed ENT and Eye examination done by both ENT surgeons and ophthalmologist. All 100 patients were prospectively randomized into two groups EX-DCR and EN-DCR. All patients were well informed about the advantages and disadvantages of the EX-DCR and EN-DCR methods. In this study EX-DCR was done by ophthalmologist and EN-DCR by ENT surgeon.

External Dacryocystorhinostomy-

All cases of external dacryocystorhinostomy were done under local anesthesia with sedation except in children. For all operations, the nasal cavity was packed with roller gauze soaked in 4% xylocaine with adrenaline. All patients were given local anesthesia for the sac region, consisting of mixture of xylocaine+adrenaline 1:2, 00,000. A skin incision was made 20 mm J shaped. The incision was deepened through orbicularis oculi muscle to expose the anterior lacrimal crest and the periosteum. Exposed periosteum was divided at the anterior lacrimal crest in order to enter the lacrimal fossa and gain access to the bony suture between thick maxilla anterior and thin lacrimal bone posterior. A bony ostium of approximately 14x10 mm wide was created in the frontal process of maxilla and lacrimal bone using increasing number of bone punches. Exposed nasal mucosa was identified and excised. Lacrimal sac was opened on medial wall to create large anterior flap and small posterior flap. Posterior small flap of sac was excised. Then anterior flap of lacrimal sac was sutured to

periosteum over anterior lacrimal crest, with 4-0 chromic catgut suture. The incision was closed in two layers. Intermittent skin sutures (6 in numbers) were taken with 6-0 Vicryl. Betadine dressing was done. Post-operative systemic antibiotics, analgesics were given for 2 days and patient discharged. Patients follow up done on day 7, 1 month, 3 month and 6 month. On post op day 7 sutures removed.

The cosmetic outcome of scar is to be subjectively evaluated by the patients and by surgeon other than operating surgeons. By the end of the follow-up, the patients were asked to grade the visibility of the scar on a four grades scale: 0) invisible scar; 1) minimally visible scar; 2) moderately visible scar; and 3) very visible scar. Surgeon uses the same grading scale taking in consideration that examiner doesn't know the patient's opinion about scar evaluation. Scars of Grade 0 and 1 were considered cosmetically insignificant and scars of Grade 2 and 3 were considered cosmetically significant. Nasal decongestant for 5 days and topical antibiotics eye drops were continued for 30 days.

Endonasal Dacryocystorhinostomy-

All cases of Endonasal dacryocystorhinostomy were performed under local anesthesia with sedation except in children where general anesthesia was used. Nasal pack with 4% lignocaine with 1:1, 00,000 adrenalin was applied 15 min before surgery. The site of operation, in the area of anterior attachment of the middle turbinate was injected with 2% xylocaine with 1:1, 00,000 adrenalin solution. Incision with the help of no.12 knife or sickle knife was taken starting just superior to the axilla of middle meatus, continued down vertically till about 2/3rd the length of the middle turbinate on the lateral nasal wall, then curved horizontally for about 8 mm and the joined to the posterior limit of uncinate process. The mucosa was elevated with a freer's elevator to expose the underlying frontal process of maxilla beneath which lacrimal sac lies. The lacrimal bone and adjoining part of frontal process of maxilla was removed with Kerrison's straight and curved punch forceps. The thick bone of the frontal process of maxilla was removed with osteotome. The position and exposure of the lacrimal sac was confirmed by probing with a metal probe. The lacrimal sac was then incised with the keratome, lacrimal mucosa was removed and ablated, and opening was enlarged sufficiently. Nasal mucosal flap was cut to create superior and inferior mucosal flap. Superior flap was used to cover the raw bone left superior over the upper limit of sac. The inferior flap was trimmed and opposed with posterior lip of sac. After confirming the common canaliculus, sac syringing was done to confirm the free flow of fluid through the ostium. All patients were followed at 7th day, 1 and 6 months interval postoperatively. During the follow-up visit, patients were asked about the symptom relief of epiphora and check patency by fluorescein dye disappearance test, lacrimal irrigation, and intranasal endoscopic examination.

Primary outcome measurements were the anatomical and functional success at the final visit. Anatomical success was defined as patency confirmed by intranasal endoscopic inspection of the ostium and successful lacrimal irrigation. Functional success was defined as complete resolution of epiphora and positive fluorescein dye disappearance test. Secondary outcome measurements were the postoperative time to the resolution of epiphora and surgical-related complications. All patients were followed up for at least 6 months.

RESULTS:

A total of 100 patients were enrolled in the study, out of them 50 were either operated for external or endonasal dacryocystorhinostomy. This study showed that NLD obstruction was more common with age group of 31-50 years as shown in Table 1. Female constituted 70% and male 30% with male: female ratio of 1:2.3. In Ex-DCR group, out of 50 patients, 36 (72%) were females and 14 (28%) were males, (M: F ratio= 1:2.5) while in En-DCR group out of 50 patients, 34 (68%) were females and 16 (32%) were males (M: F ratio=1:2.1). This intergroup gender ratio difference, was statistically insignificant ($p=0.57$, Chi square test). Mean age for Ex-DCR was 45.6 ± 12.43 whilst mean age for En-DCR was 41.66 ± 15.25 . This difference was found to be statistically insignificant ($p=0.48$; Mann-Whitney U test).

Table 1: Age Distribution of the Patients

Age group (In years)	External DCR N=50	Endo-DCR N=50	P value
<20	2 (4%)	4 (8%)	0.469 NS Chi square test
21-30	6 (12%)	6 (12%)	
31-40	12 (24%)	12 (24%)	

41-50	12 (24%)	12 (24%)	
51-60	10 (20%)	8 (16%)	
61-70	8 (16%)	8 (16%)	
Total	50 (100%)	50 (100%)	

The operative duration of external DCR ranged from 25 to 40 minutes with a mean of 36.23 ± 13.32 minutes and for endonasal DCR, 20 to 35 minutes with a mean of 29.12 ± 17.25 minutes. The difference was found to be statistically significant using chi-square test ($p=.028$). The maximum patients (44%) in External-DCR group had > 40 minutes of surgery while in Endonasal- DCR group maximum patients (48%) had duration of surgery between 20-40 minutes, Table 2.

Table 2: Duration of surgery

Time in Minutes	External-DCR N=50	Endonasal- DCR N=50	P value
<20	10 (20%)	10 (20%)	0.593 NS Chi square test
20-40	18 (36%)	24 (48%)	
>40	22 (44%)	16 (32%)	
Total	50 (100%)	50 (100%)	

The complications were more in external- DCR group than observed in endonasal group as shown in Table 3.

The major difficulty which was encountered in EX-DCR was intraoperative bleeding that hampered visualization. Intraoperative moderate bleeding were seen in 8 (16%) cases either during punching of the lacrimal bone or while making an incision on the nasal mucosa. The bleeding was stopped by placing a ribbon gauze which was soaked in dilute adrenaline. One patient (4%) had severe bleeding while making the skin incision, due to injury to the angular vein, which may have been due to the varied anatomical position or the accessory vein. Hemostasis was attained by clamping and ligating the vein and the operation was continued. In EN-DCR intraoperative moderate bleeding was seen in 2 (4%) case while making incision on nasal mucosa but it stopped by placing a merocel piece which was soaked in dilute adrenaline and the operation was continued. There was no statistically significant difference between the two groups in terms of intraoperative bleeding. ($p=0.127$) Wound gaping were seen in 6 (12%) cases of EX-DCR after removal of stitches on 7th day. Cases were hospitalized and was treated with daily dressings and high dose of antibiotics.

Wound scarring were seen in 6 (12%) cases of EX-DCR. Scar of grade 2 seen in 4 cases, grade 1 in 1 case and grade 3 in 1 case seen.

In EX-DCR granulation at neo-ostium site were seen in 2 (4%) cases and in EN-DCR in 4 cases (8%) completely obstructing the neo ostium. On follow up visits these granulations were removed. Out of these cases, 1 case in EX-DCR and 2 cases in EN-DCR had complete resolution of epiphora at the end of 6 month. Synechia formation between the lacrimal sac flap and nasal mucosal flap were seen in 2 (4%) cases in each group which was removed on follow up visits and patient had complete resolution of epiphora.

Table 3: Complications observed in both the groups

Complications	External-DCR N=50	Endonasal-DCR N=50	P value
Intraoperative bleeding	8 (16%)	2 (4%)	0.127 NS Mann-Whitney U test
Wound gaping	6 (12%)	0 (0.0%)	
Wound scarring	6 (12%)	0 (0.0%)	
Granulations at the neoostium	2 (4%)	4 (8%)	
Synechia	2 (4%)	2 (4%)	
Failure at the end of 6 months	8 (16%)	2 (4%)	
Total	32 (64%)	10 (20%)	

At the end of 6 month fluorescein dye disappearance test were done. (Table 4). In EX-DCR anatomical failure was seen in 4 (8%) cases and in EN DCR 2 (4%) case ($p=0.551$). Anatomical failure was defined as persistence of epiphora with non-visualization of ostium on intranasal endoscopic inspection. Physiological failure were seen in 4 (12%) cases of EX-DCR. Physiological failure was defined as incomplete resolution of epiphora despite a clear, patent, free flowing syringing observed endoscopically in the inferior meatus and positive fluorescein dye disappearance test. The cause of functional failure in EX DCR group was probably physiological pump failure resulting

from the interruption of medial canthal anatomy, orbicularis oculi muscles.

Table 4: Fluorescein dye disappearance test at 6 month

Failure at end of 6 month	External DCR N=50	Endonasal DCR N=50
Anatomical failure	4 (8%)	2 (4%)
Physiological failure	4 (8%)	0 (0%)
Total	8 (16%)	2(4%)

At 6 month of follow-up, 48 (96%) out of 50 cases ultimately had a successful surgical outcome in endonasal DCR compared to external DCR which showed 42 (84%) out of 50 cases a successful outcome. This difference was not statistically significant ($P = 0.609$, Fisher's exact test), Table 5.

Table 5: Surgical outcomes in both groups

Classification	EX DCR (n=50)	EN DCR (n=50)
Surgical success	42 (84%)	48 (96%)
Surgical failure	8 (16%)	2 (4%)
Total	50 (100%)	50 (100%)

DISCUSSION:

External DCR surgery, a gold standard in treatment of nasolacrimal duct obstruction, has advantage of direct visualization of the anatomical structures surrounding the lacrimal sac. This technique facilitates accurate anastomosis between the lacrimal sac and nasal mucosa. However, external DCR has some disadvantages, including facial scarring, lacrimal pump dysfunction resulting from the interruption of medial canthal anatomy, orbicularis oculi muscles, and increased post-op morbidity due to the skin incision and limitations in acute dacryocystitis patients with abscess formation.^[1]

Nowadays, endoscopic DCR is getting popularity among patients due to equal promising results and especially due to lack of external scar. Endoscopic DCR allows direct inspection of lacrimal sac for underlying pathology. Assessment of failure can also be viewed endoscopically, so mistakes can be corrected immediately. Again it can be converted to external DCR in difficult cases or those with lacrimal sac tumors.^[12] The endoscopic approach has a reduced risk of interfering with the medial canthal anatomy. There is the advantage of angular facial vessels, orbicularis muscle, lacrimal pump physiology preservation, no external scar, providing a desired cosmetic effect for patients. More importantly endoscopic endonasal DCR surgery has been shown to have short surgical time and earlier postoperative recovery time. Additionally, the Watters et al paper on long-term results for endoscopic DCR surgery showed lower rates of air regurgitation while nose blowing.^[13] The disadvantages of endoscopic DCR are high equipment cost and relatively steep learning curve.

In present study, total 100 cases presented with epiphora or chronic dacryocystitis were enrolled, among them 50 were undergone endoscopic endonasal-DCR and remaining 50 undergoes external DCR to compare surgical procedure, duration of surgery, intraoperative and postoperative complications and postoperative success rate. The patients included in the study were between 8 to 69 years of age as similar to Moras et al^[2] study, in which they reported age ranged from 16-68 years. Mean age for Ex-DCR was 45.6 ± 12.43 whilst mean age for En-DCR was 41.66 ± 15.25 . In both groups, maximum patients were observed in the age group of 31-50 years. However, maximum patients that underwent external and endoscopic DCR were in the third and fourth decade of life which is comparable to Moras et al study.^[2] This indicates that acquired nasolacrimal duct obstruction is more common in middle age group. There is a declining trend towards both extremes of age. This may be due to the fact that amount of lacrimal secretion is less in extremes of ages. Similar findings were reported by Gupta et al^[14] and Goel et al.^[15]

Out of 100 cases female constituted 70% (70 cases) and male 30% (30 cases) with male: female ratio of 1:2.3 as similar to Rasaily et al^[16] study, in which they reported male: female ratio 1:3.6. Similar findings were seen in other studies Iliff et al^[17] and Duwal et al.^[18]

All external DCR and endonasal endoscopy DCR surgeries were performed under local anesthesia except in children in both groups where general anesthesia was used. In both groups, patients stayed overnight in the hospital. Mean duration of surgery for external DCR ranged from 25 to 40 minutes with a mean of 35.12 ± 11.48 minutes and

for endonasal DCR, 20 to 35 minutes with a mean of 29.72 ± 10.15 minutes. In L Muscatello et al mean time for primary DCR was 30 minutes, range 15-110 minutes.^[19] In Serdar Ozer study mean duration of surgery was 35min for EXT-DCR (30-50 min).^[20] Longer operative time in external DCR was reported by many authors^{[15],[16],[17],[18],[19]} and is in accordance with present study. In expert hands, operative time is significantly reduced. The shorter operative time recorded for endonasal DCR was probably due to direct access of rhinostomy site endoscopically.

Complication rate was low in endonasal-DCR types of surgery. Complication of intraoperative bleeding occurred in external and endonasal DCR was 8 (16%) and 2 (4%) cases, respectively. This finding corroborates with study done by Moras et al.^[2] However, some studies show that bleeding is more common in endoscopic DCR surgeries. Postoperative scarring (12%) and wound gaping (12%) was more in external DCR while there was no such complications observed in endonasal DCR group which may be due to dissection required near the medial canthus in external DCR group. At the end of 6 month anatomical failure is seen in 4 (8%) cases and physiological failure seen in 4 (8%) cases in External DCR group and in Endonasal DCR group only anatomical failure was seen in 2 (4%) case due to obliterative scarring of the ostium. The cause of functional failure in External DCR group was probably physiological pump failure resulting from the interruption of medial canthal anatomy, orbicularis oculi muscles. Failure in the present study was reported in 8 cases (16 %) of external DCR and 2 (4%) case of endoscopic DCR.

In EX-DCR granulation at neo-ostium site were seen in 2 (4%) cases and in EN-DCR in 4 cases (8%) completely obstructing the neo ostium. On follow up visits these granulations were removed. Out of these cases, 1 case in EX-DCR and 2 cases in EN-DCR had complete resolution of epiphora at the end of 6 month. Synechia formation between the lacrimal sac flap and nasal mucosal flap were seen in 2 (4%) cases in each group which was removed on follow up visits and patient had complete resolution of epiphora In EX-DCR 2 patients (4%) and in endonasal DCR group, 4 (8%) patients with persistent obstruction of neo-ostium by granulations subsequently underwent revision procedures. At 6 month of follow-up, 48 (96%) out of 50 cases ultimately had a successful surgical outcome in endonasal DCR compared to external DCR which showed 42 (84%) out of 50 cases a successful outcome. This difference was not statistically significant ($p = 0.609$). The reported success rate of endonasal-DCR in the literature ranges from 60% to 99%^{[20],[21],[22]} and external-DCR from 80% to 95%.^{[23],[24]} Our success rate in both groups is comparable to various studies.^{[25],[26]}

The various studies for comparison of surgical outcomes of two approaches had been conducted and the results varied in the literature. There is still no consensus that which procedure is superior to the other. Lacking of standardized outcome measurements, variable surgical techniques, nonrandomized case selection, experience of the surgeon may all contribute to the variable reported outcomes. In present study, the success rates were assessed not only the symptoms relief from the subjective aspect of patients but also fluorescein dye disappearance test and lacrimal irrigation from the objective view of the physician.

CONCLUSION:

The therapeutic modality of choice for acquired nasolacrimal duct obstruction, irrespective of the cause, is dacryocystorhinostomy. Both the traditional external approach and the endoscopic approach have high success rates. In current study there was no statistical difference in term of complications and success rate between external and endonasal DCR however, in external DCR physiological failure was seen after dacryocystorhinostomy due to disruption of physiological pump mechanism resulting from the interruption of medial canthal anatomy and orbicularis oculi muscles. The endoscopic approach has a reduced risk of interfering with the medial canthal anatomy thus preserving the lacrimal pump physiology. The external approach suffers the disadvantages of an external scar, which, causes poor cosmesis and patient dissatisfaction. The endoscopic approach offers the added advantage of avoiding an external scar, thereby providing for improved cosmesis.

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