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ORIGINAL RESEARCH

A comparative Study on Surgical Outcome of External Dacryocystorhinostomy and Endonasal Dacryocystorhinostomy with Nasolacrimal Duct Intubation and Mitomycin-C Application

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Abstract

Background: Aim of the study is to compare the results of external dacryocystorhinostomy (Ex-DCR) with mitomycin-c (MMC) and nasolacrimal duct (NLD) silicon intubation with that of Endoscopic endonasal dacryocystorhinostomy (EES-DCR) with MMC and NLD silicon intubation and the advantage or disadvantage of the two procedures over each other.

Materials and methods: This was a hospital based randomized prospective interventional study conducted among 40 eyes in 35 patients who presented with chronic dacryocystitis to the Department of Ophthalmology of NRIIMS, Visakhapatnam, over a period of 18 months from January 2021 to June 2022 after obtaining clearance from Institutional Ethics Committee and written informed consent from the study participants. All patients were subjected to detailed ocular examination and divided into two groups – group A underwent Ex-DCR and group B underwent EES-DCR with MMC and NLD silicon intubation.

Results: On comparing age and gender in group A and group B, there was no statistical significance (P value –group A - 0.2, group B - 0.49). On comparing unilateral and bilateral cases in both the groups, there was statistical significance (P value - 0.017). In comparing the total success and failure rates in both the groups there was statistical significance. (P value - 0.018).

Conclusion: The external DCR with intraoperative mitomycin C and nasolacrimal duct intubation had significantly better success rate when compared to the endonasal DCR with intraoperative mitomycin C and nasolacrimal duct intubation. The incisional scar induced by external DCR was insignificant and no patient complained about it. In view of the above two facts, external DCR is a better option when compared to endonasal DCR. Functional success and symptomatic relief were high in external DCR.

Keywords: Surgical Outcome, External Dacryocystorhinostomy, Endonasal Dacryocystorhinostomy, Nasolacrimal Duct, Intubation, Mitomycin-C Application.

Introduction

Tears from the conjunctival cul de sac enter the lacrimal sac through the lacrimal puncta and canaliculi. They drain into the nostril through nasolacrimal duct (NLD). Nasolacrimal duct

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

obstruction (NLDO) can be primary or acquired and can lead to acute or chronic dacryocystitis. Acquired NLDO often requires surgery. The most common symptom of acquired NLDO is epiphora which accounts for approximately 3% of all ophthalmologic clinic visits.[1]Dacryocystitis not only causes the disturbing symptom of epiphora (which can interfere with vision) but also is a source of infection. It can transform a simple corneal ulcer into perforation, and can lead to endophthalmitis/panophthalmitis in case of intraocular surgeries. Dacryocystitis is a constant menace to the eye since a minute abrasion is liable to become infected and give rise to an ulcer.[2] Hence, surgery for dacryocystitis is very important and fairly frequently performed. Dacryocystitis may lead to orbital cellulitis, and to even meningitis, so warrants proper management.[2]

The two commonly performed surgeries for dacryocystitis are dacryocystectomy (DCT) and dacryocystorhinostomy (DCR). Chronic epiphora, secondary to NLDO beyond age of 3 years would necessitate a DCR. DCR should not be performed earlier as the bones are not adequately developed till then.[2] DCR has been established as the prevailing procedure for acquired NLDO.[3]DCR is a surgical method that allows the direct drainage of tears from the lacrimal sac into the nasal cavity, bypassing the blocked NLD. There are two main types of DCR, namely external dacryocystorhinostomy (Ex-DCR) and endonasal dacryocystorhinostomy (Endo-DCR). Ex-DCR was described by Italian rhinologist Addeo Toti in 1904 where in with a 35 mm incision the sac was approached, osteotomy was made in the lacrimal bone and both the medial wall of the sac as well as nasal mucosa were excised and NLDO was bypassed.[4] With his procedure, there was a symptomatic relief in about 80% of the patients. Significant change to this procedure happened soon in 1920 when Dupuy-Dutemps and Bourguet introduced creation of lacrimal sac and nasal mucosa flaps with suturing to create an epithelium lined fistula.[5] Very few modifications have happened since then for example by viers in 1969[6] and Iliff in 1971[7] Endo-DCR was first conceptualized by Caldwell in 1893.[8,9] John West in 1914 modified this technique by creating a bony window within lacrimal and maxillary bone to clear the area of lacrimal sac and nasolacrimal duct into the middle meatus.[8,10]Rice first introduced the concept of endoscopic endonasal dacryocystorhinostomy(EES-DCR) in cadavers in 1988.[11]McDonogh and Meiring in 1989 introduced EES-DCR in patients.[12]

Intubation: An inert and easily tolerable silicone material in DCR surgery was first described by Older.[13] While some surgeons routinely use silicone tubes, the others prefer it for only complicated cases. It is believed that silicone tubes prevent the closure of ostium.[14,15]Although, it was reported that using silicone tube intubation was one of the most effective ways to increase the surgical success rate,[16] it has been a controversial issue.

Mitomycin C (MMC): It is derived from Streptomyces caespitosus, an alkylating agent with anticancer property. It reduces fibroblast collagen synthesis by inhibiting DNA dependent RNA synthesis and can suppress cellular proliferation in any period of the cell cycle. The beneficial effect of MMC as a surgical adjuvant is thought to be related to its potent inhibition of fibroblast proliferation. Intra-operative use of MMC in both endoscopic and Ex-DCR procedures may possibly improve the success rates over the traditional DCR procedures. MMC in Ex-DCR when used in appropriate doses minimizes post-operative fibrosis and granulations thereby maintaining a bigger post op ostium throughout the post-operative period.

Aims and Objectives

- To compare the results of Ex-DCR with MMC and NLD silicon intubation with that of EES-DCR with MMC and NLD silicon intubation
- To study the advantage or disadvantage of the two procedures over each other.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Materials and methods

This was a hospital based randomized prospective interventional study conducted among 35 patients(15 Ex- DCR and 20 EES-DCR) who presented with chronic dacryocystitis to the Department of Ophthalmology of NRIIMS, Visakhapatnam, over a period of 18 months from January 2021 to June 2022 after obtaining clearance from Institutional Ethics Committee and written informed consent from the study participants.

Inclusion Criteria

All cases of chronic dacryocystitis of age > 5 years and who gave consent to participate in the study.

Exclusion Criteria

1. Previous DCR to same eye.
2. Canalicular obstruction.
3. Common canalicular obstruction
4. Lacrimal sac obstruction due to tumours.
5. Patients with an acute attack of dacryocystitis within last month.
6. History of naso-orbital trauma/ sinus surgery.
7. Sino-nasal abnormalities like gross deviated nasal septum, polyposis, hypertrophied turbinates, tumour causing nasolacrimal duct (NLD) obstruction
8. Cases with ectropion or entropion.
9. Cases with noticeable lower lid laxity.

Statistical Methods

Data was entered in MS excel and analysed using Statistical Package for Social Sciences (SPSS) software. Results were presented as tables.

Results

Sl. No.	**Age (Years)**	**Male**	**Female**	**Total**
1.	0-10	1	0	1
2.	11-20	1	0	1
3.	21-30	0	1	1
4.	31-40	3	0	3
5.	41-50	3	4	7
6.	51-60	2	0	2
Total		10	5	15
Age and Gender Distribution in Group A				
Sl. No	**Age (Years)**	**Male**	**Female**	**Total**
1	0 – 10	1	0	1
2	11 - 20	0	0	0
3	21 - 30	1	1	2
4	31 - 40	2	5	7
5	41 - 50	5	4	9
6	51 - 60	1	0	1
Total		10	10	20
Age and Gender Distribution in GroupB				
Demographic Distribution				
Table 1				

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Among 15 cases in group A, most of them presented in 5th decade. The mean age of presentation was 38.8 ranging from 9 to 52 years. On comparing age and gender in group A, there was no statistical significance (P value - 0.2). Of 15 patients who underwent external dacryocystorhinostomy, 10 (66.6%) patients were males and 5 (33.3%) patients were females.

Among 20 cases in group B most of them presented in 5th decade. The mean age of presentation was 38.65 ranging from 9 to 55 years. On comparing age and gender in group B, there was no statistical significance (P value - 0.49). Of 20 patients who underwent endonasal dacryocystorhinostomy, 10 (50%) patients were males and 10 (50%) patients were females.

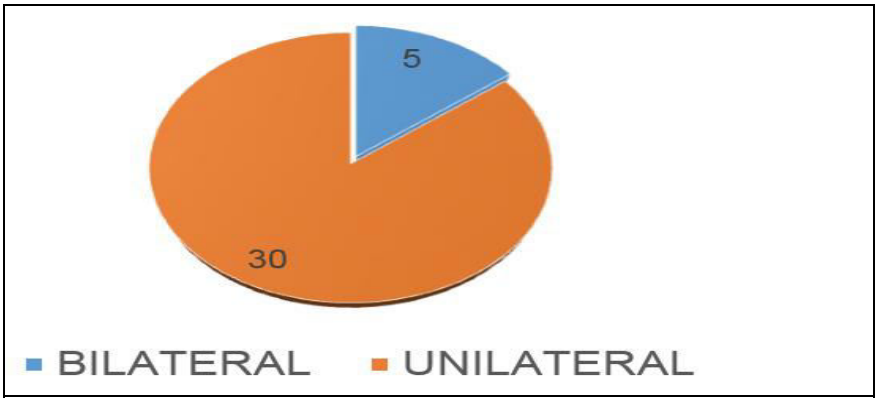

Chart 1: Laterality

Out of 15 cases in Ex-DCR, 5 cases presented bilaterally and 10 cases unilateral and out of 20 cases in endo-DCR, all cases were unilateral.

On comparing unilateral and bilateral cases in both the groups, there was statistical significance. (P value 0.017). LE was most commonly involved in both the groups (57.5%) than RE (42.5%). Out of which 8 (40%) RE and 12 (60%) LE in group A and 9 (45%) RE and 11 (55%) LE in group B. In comparing the presenting complaints of right eye with left eye in both the groups, there was no statistical significance (P value 0.749).

Out of 20 eyes in group A, 11(55%) cases presented with watering, 8 (40%) cases presented with discharge and 5 (25%) cases presented with swelling. Out of 20 cases in group B, 19 (95%) cases presented with watering, 12 (60%) cases presented with discharge, 1(5%) case presented with swelling.

The duration of symptoms in both the groups were 6 - 12 months which was predominant. In comparing the duration of symptoms in both the groups, there was no statistical significance. (P value 0.922).

Out of 20 eyes in group A, 12 (60%) cases presented with ROPLAS positive and out of 20 cases in group B, 13 (65%) cases presented with ROPLAS positive. In comparing ROPLAS positive and negative in both the groups, there was no statistical significance. (P value 0.744).

Syringing	**Group A**	**Group B**
Regurgitation of clear fluid from opposite punctum	2 (10%)	3 (15%)
Regurgitation of mucus from opposite punctum	18 (90%)	17 (85%)
Total	**20**	**20**

Table 2: **Pre-operative Syringing**

Out of 20 eyes in group A, 2 (10%) eyes had regurgitation of clear fluid and 18 (90%) eyes had regurgitation of mucopurulent fluid. Of 20 eyes in group B, 3 (15%) eyes had regurgitation of clear fluid and 17 (85%) eyes had regurgitation of mucopurulent fluid. In comparing the syringing results in both the groups, there was no statistical significance. (P value - 0.633).

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

In group A postoperatively, one case presented with watering in which syringing shows regurgitation of clear fluid from opposite punctum and DDT was positive. In group B post-operatively, 7 cases presented with watering in which syringing shows regurgitation of clear fluid from opposite punctum and DDT was positive(Table 2).

Outcome

In group A, success rate was seen in 19 (95%) out of 20 and failure rate was seen in 1 (5%) out of 20. Wound infection, dehiscence and stent prolapse was noted in 1 patient who was managed by antibiotics and resuturing. Regurgitation of clear fluid from opposite puncta was noticed in 1 patient after 3 months. In group B, success rate was seen in 13 (65%) out of 20 cases and failure rate was seen in 7 (35%) out of 20 cases. Regurgitation of clear fluid from opposite puncta was noticed in 6 cases and punctal atresia was noticed in 1 patient.

In comparing the total success and failure rates in both the groups there was statistical significance. (P value 0.018).

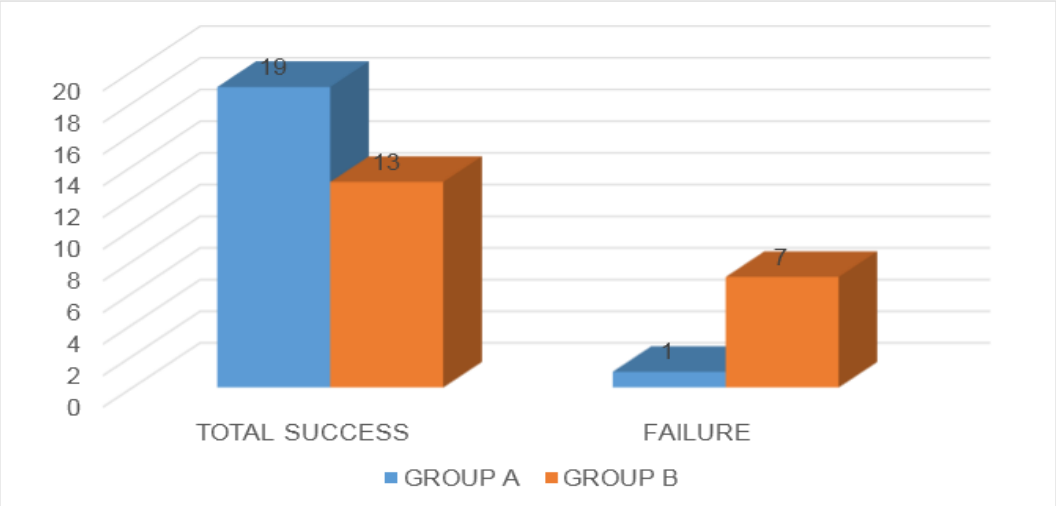

Chart 2: comparison of outcome of external DCR andEndonasalDCR

Out of 20 eyes of Group A, total success was seen in 19 (95%) and failure was seen in 1 (5%) cases.

Out of 20 cases of Group B, total success was seen in 13 (65%) and failure was seen in 7 (35%) cases.

In comparing the total success and failure rates in both the groups there was statistical significance. (P Value 0.018)

Figure 1: Pre op Ex-DCR

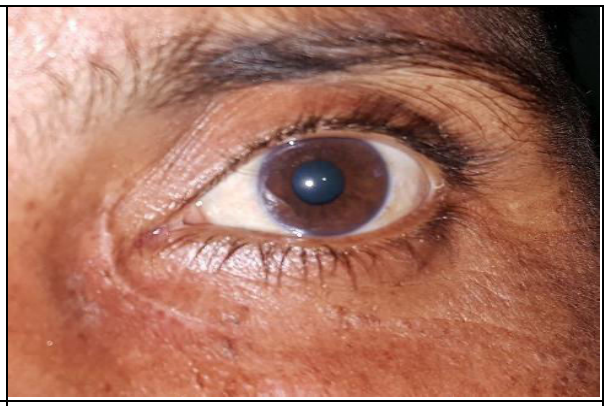

Figure 2: Post op Ex-DCR

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

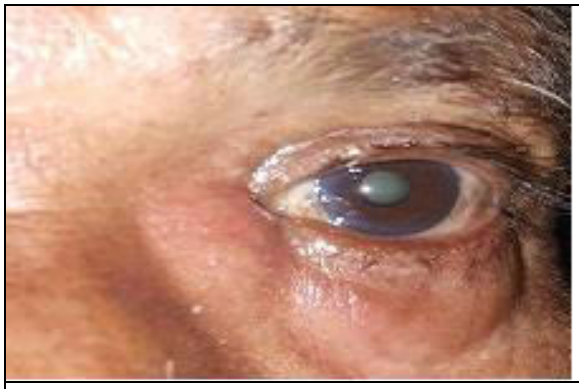

Figure 3: Pre op Endo DCR

Figure 4: Post op Endo DCR

Discussion

Our study included 35 cases of which 20 eyes of 15 cases underwent Ex-DCR (group A) and 20 cases underwent EES-DCR (group B).

Gupta et al.[17] in his study reported a total of 20 patients who were enrolled by simple randomization in the Ex-DCR group and 20 patients in the Endo-DCR group with maximum incidence in fifth decade, age ranged from 5 to 65 years which correlate with our study.

A prospective non-randomized study done by SahaRinki et al,[18] in total 72 patients with six having bilateral involvement, out of which 20 were male and 52 were female. Most of the patients in the endoscopic group were in 31-40 years (34.1%), whereas in the external DCR group, majority of cases were in 41-50 years age group (27.3%). The mean age in endoscopic DCR group was 33.6 years. The mean age group in external DCR was much higher i.e., 46 years.

In the study done by Sinha V et al,[19] the mean age of the patient was 37 years (range from 16 years to 58 years) which correlates with our study.

In the present study, the patients operated were of mean age 38.8 years ranging from 9 to 60 years and 38.65 years ranging from 9 to 55 years for external DCR and endoscopic DCR respectively. Maximum patients who underwent external DCR and endoscopic DCR were in the age groups of 41-50 years. On comparing age and gender in group A, there was no statistical significance (P value 0.2). On comparing age and gender in Group B, there was no statistical significance (P value 0.49).

LE was most commonly involved in both groups (57.5%) than RE (42.5%). Out of which 8 (40%) RE and 12 (60%) LE in Group A and 9 (45%) RE and 11 (55%) LE in Group B.

In comparing the presenting complaints of right eye with left eye in both the groups, there was no statistical significance. (P value 0.749)

On comparing unilateral and bilateral cases in both the groups, there was statistical significance (P value 0.017)

Study done by Mohit Goel et al.[20]Out of 40 patients taken up for DCR, 20 underwent unilateral external DCR, 18 had unilateral endoscopic DCR and 2 had bilateral endoscopic DCR. Thus, a total of 22 eyes underwent endoscopic DCR. All the patients operated were in the age group of 15-60 years. Average age was 38.2 years and 39.75 years for external DCR and endoscopic DCR respectively. Epiphora was the most common complaint in both groups i.e., 16 (80%) and 17 (77.3%) eyes were having epiphora in external DCR and endoscopic DCR groups respectively.

In the present study, group A success rate was seen in 19(95%) out of 20 eyes and failure rate was seen in 1(5%) out of 20 eyes. Wound infection, dehiscence and stent prolapse was noted in 1 patient who was managed by antibiotics and resuturing.

Regurgitation of clear fluid from opposite puncta was noticed in 1 patient after 3 months.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

In group B, success rate was seen in 13(65%) out of 20 cases and failure rate was seen in 7(35%) out of 20 cases. Regurgitation of clear fluid from opposite puncta was noticed in 6 cases and punctal atresia was noticed in 1 patient.

Out of 20 eyes in group A, total success (total success was defined as when patient has no watering while syringing was patent) was seen in 19 (95%) and failure (failure was defined as patients has epiphora and regurgitation on syringing) in 1 (5%).

Out of 20 cases in group B, total success was seen in 13 (65%) and failure was seen in 7(35%) cases.

In comparing the total success and failure rates in both the groups, there was statistical significance. (P value 0.018)

Karim et al,[21] has carried out a recent study which showed both the approaches had similar success rates (endoscopic endonasal DCR 82.4% versus external DCR 81.6%; p=0.895). Surgical success rates in external DCR mentioned in above two studies commensurate with our result. Comparatively lower success rate of endoscopic DCR in our study might be due to steep learning curve. However, different experts still favour the notion of superiority of external DCR over endoscopic procedure. Present study also upholds this opinion.

A study of Karim, also evaluated both objective patency results and subjective patient symptom measurements resembling our study about the definition of surgical success.

The major outcomes used to define surgical success included subjective success based on the patients symptoms and objective success based on assessment of the patency through syringing.

In 2000, Cokkeser Y, Evereklioglu.[22] reported the success rates of external and endonasal dacryocystorhinostomy where it was 89.8% for external and 88.2% for endonasal dacryocystorhinostomy after follow up of 115 patients. Lower complication rates were observed in the endoscopic group with minimal morbidity and shorter operative time compared with the external approach.

Asim Kumar Dey et al.[23] concluded that the surgical success rate in external and endoscopic DCR group was 100 % and 93.33% respectively after 24 weeks of follow– up period.

In a prospective, open label, interventional clinical study done by Yogeswari A et al,[24] with 50 patients, 25 patients underwent endoscopic DCR and 25 external DCR. In external DCR, cosmetic satisfaction was seen in 84% of the patients with 96 % having good symptom relief where as in endonasal DCR it was 100% and 88% respectively and concluded that success rate of external DCR was higher than endonasal DCR.

Tsirbas and Wormald used a technique in endoscopic DCR to fully expose the lacrimal sac and marsupialize it into the lateral nasal wall with nasal and lacrimal mucosa in apposition. They achieved success rate of 89% with this approach. In this study, success rate was 65% with endoscopic approach and 90% with external approach.

A study done by Saroj G, and Rashmi G,[25] all patients had preoperative counselling and both the procedures were explained in detail with their advantages and disadvantages. Twenty patients underwent endonasal dacryocystorhinostomy and twenty had external dacryocystorhinostomy. Silicon intubation was done in all cases of endonasal dacryocystorhinostomy for three months after surgery.

The success rate of Ex-DCR has been mentioned as 80% to 99% by Harkikainen et al,[26] (1998). The success of an Endo-DCR is completely dependent on a thorough knowledge of the intranasal anatomy, experience of surgeon and careful operative techniques. The success rate of both the procedures was comparable.

In a study done by Rajeev et al,[27] in which a total of 50 patients were included, 30 patients (60%) underwent external dacryocystorhinostomy and the remaining 20 (40%) underwent endonasal dacryocystorhinostomy. They concluded that both the approaches give comparable results in terms of success rate and both of them give equally good results in good hands.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

Boush[28] and Ulnu[29] found a strong relationship between silicon tube retention and success. In this study, both endoscopic and external DCR group silicon tube was retained up to 3 months. Endoscopic DCR is more expensive with high equipment costs in comparison to external DCR. Learning curve is also very high.

In a study done by Kao S C et al,[30] all patients in the mitomycin C group remained symptom free after removal of their silicone tube (100% success), and there was one patient in the control group who had recurrent epiphora (87.5% success). Septo-osteotomy adhesion was found in two patients in the control group (25%), but there was no such adhesion found in the patients in the mitomycin C group. In the mitomycin C group, the average final surface area of the osteotomy at the end of the sixth postoperative month was 27.10 +/- 5.78 mm^2, whereas that of the control group was only 10.83 +/- 3.37 mm^2. Although the immediate post-operative surface area of the osteotomy showed no significant difference between the two groups, a statistically significant difference was noted at 6 months.

In the present study, out of 40 eyes in 35 cases who underwent Ex-DCR and endo-DCR with MMC application, success rate was 92.5% when MMC was used.

In a study done by DevotoM.H et al,[31] to evaluate the appearance of the skin incision in external dacryocystorhinostomy 6 weeks and 6 months after surgery concluded that the change in appearance of the incision at 6 weeks and at 6 months was statistically significant ($p < 0.044$), as evaluated by patients and observers ($p < 0.001$). The skin incision in external dacryocystorhinostomy is satisfactory to most patients. Its appearance is improved with time; 86% of the incisions were graded invisible by observers and 91% by patients after 6 months.

Conclusion

The results from our study showed that external DCR with intraoperative mitomycin C and nasolacrimal duct intubation had significantly better success rate when compared to the endonasal DCR with intraoperative mitomycin C and nasolacrimal duct intubation. The incisional scar induced by external DCR was insignificant and no patient complained about it. In view of the above two facts, external DCR is a better option when compared to endonasal DCR. Functional success and symptomatic relief were high in external DCR.

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ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

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