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A comparative study in the use of topical mitomycin-C versus nasolacrimal stent in endoscopic dacryocystorhinostomy for chronic dacryocystitis

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ABSTRACT

Background: Inflammation of the lacrimal sac and duct is a common and unpleasant condition, leading to troublesome epiphora and recurrent dacryocystitis. Surgery is the preferred treatment modality of chronic dacryocystitis which can be performed by external approach or endoscopic nasal approach. Endoscopic dacrycocystorhinostomy (EnDCR) is now a well-established procedure to relieve nasolacrimal duct obstruction, becoming ENT surgeons' domain. The aim of this study is to assess the efficacy and compare results of intraoperative use of nasolacrimal stent in comparison of mitomycin-C (MMC) in endoscopic dacryocystorhinostomy.
Methods: A prospective study of 56 patients with acquired NLDO with epiphora and recurrent dacryocystitis who were evaluated and managed between Oct 2014 and Oct 2016. All patients were offered surgical line of management by endoscopic route. They were randomly assigned into two groups-mitomycin-C group (Group A) and silastic nasolacrimal stenting (Group B). 46 patients who matched inclusion criteria's were included in the study after formal evaluation by ENT surgeon and Ophthalmologist. 26 patients underwent endoscopic dacryocystorhinostomy with Mitomycin-C application intra – op, 20 patients underwent nasolacrimal silicone stent placement.
Results: At 6-month follow-up visit, the management was considered successful if the lacrimal sac irrigation succeeded with relief of symptoms. The success rate in Group A was 92.30%. Group B had 85% success rate. However, no significant (p value=0.37) was noticed between two groups.
Conclusions: Despite, no significant difference in outcome between two modalities, there is a trend towards the better outcome with use of mitomycin-C. Mitomycin-C is a safe, effective, and economical adjuvant in endoscopic DCR assisting in improved outcomes of surgery.

Keywords: Chronic dacryocystitis, Epiphora, Mitomycin–C, Dacryocystorhinostomy, Nasolacrimal stent, Nasolacrimal duct obstruction

INTRODUCTION

Epiphora is the symptom most frequently associated with nasolacrimal duct obstruction (NLDO). The lacrimal passage is prone to infection and inflammation for various reasons. The mucous membrane lined tract is continuous with conjunctival and nasal mucosal surfaces that are normally colonized with bacteria. Stagnation of tears in pathologically obstructed lacrimal drainage system can result in dacryocystitis.[1] If the canaliculi are patent; the mucopurulent contents of sac can be expressed by digital pressure over the sac which is pathognomic of obstruction.

Medical treatment has a very limited role in treatment of acquired NLDO and dacryocystitis. Dacryocystor-

hinostomy whether performed by external or intranasal approach is the mainstay of treatment of acquired nasolacrimal duct obstruction and chronic dacryocystitis. With availability of better endoscopes, camera system, instruments, expertise and availability of adjuvants like mitomycin-C or nasolacrimal stents, with better outcome, endoscopic dacryocystorhinostomy (EnDCR) has become the mainstay treatment for chronic dacryocysytitis.[2,3]

Success rate post EnDCR are comparable with external dacrocystorhinostomy, which has success rate of >90%.[4,5]

Meticulous pre op planning, sound surgical techniques, prevention of cicatrisation of neo ostium are important for successful outcome of the surgery.[6]

This prospective study has been conducted to compare the efficiency of intraoperative use of mitomycin-C vis a vis use of silicone stenting in enhancing the success rate of EnDCR and to find out if any modification can be done to provide suitable cure to this benign troublesome condition. EnDCR is now a well-established procedure to relieve NLDO, becoming ENT surgeons' domain.

METHODS

A clearance from Institutional ethical review board was taken prior to initiation of the study. It is a prospective study, conducted at a tertiary care hospital of Armed Forces Medical Services. 56 consecutive patients were enrolled and randomly divided into two groups. Patient undergoing EnDCR with mitomycin-C as adjuvant were assigned as Group A and those undergoing NLD stenting were assigned as Group B.

56 patients with acquired NLDO epiphora and recurrent dacryocystitis were evaluated and managed between Oct 2014 and Oct 2016. Patients who satisfy following criteria were included- (a) adult patients suffering from acquired NLDO with history of epiphora and discharge; (b) confirmed patient suffering from NLDO in which other causes of epiphora were excluded; (c) no h/o undergoing any type of surgery for epiphora previously.

Exclusion criteria were- (a) patients suffering from other causes of epiphora like lid malposition, entropion, ectropion, punctual abnormalities, and blepharitis; (b) patients having acute dacryocystitis; (c) tumors of lacrimal sac; (d) prior failed DCR; (e) previous history of eye trauma; (f) anatomic mal-position of lacrimal duct or bony canal.

Out of 56 patients, 19 patients were male and 37 patients were female in age group ranging from 31 to 66 yrs. Out of these, 40 patients were referred from Ophthalmology department who were incidentally found to be suffering from dacryocystitis prior to cataract surgery. 16 patients reported directly to ENT department via general OPD.

A detailed history was obtained in all patients. All patients underwent complete ocular examination by ophthalmologist to rule out associated ocular pathology. They also underwent complete anterior rhinoscopy followed by endoscopic nasal examination to exclude any local nasal pathology, like chronic rhinosinusitis, nasal polyposis, deviated nasal septum and to assess the adequacy of space for endoscopic surgery.

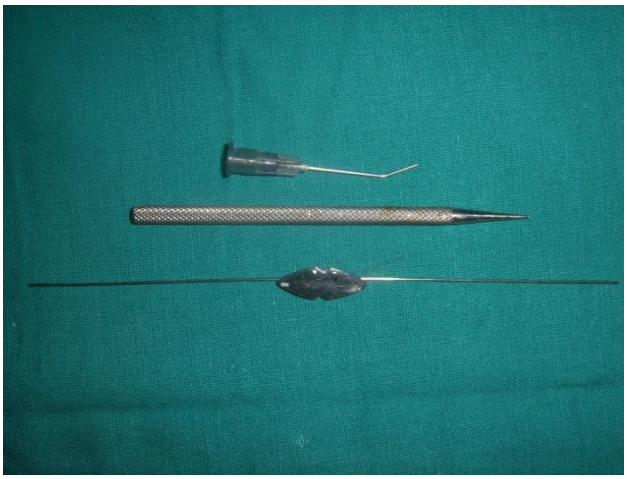

Figure 1: Instruments for sac probing and syringing.

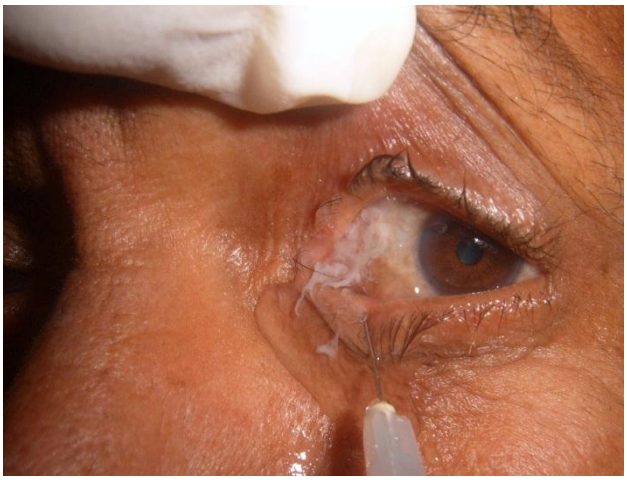

Figure 2: Sac syringing.

Sac syringing was done in all cases to confirm the level of obstruction in nasolacrimal system. The inferior and superior punctum were dilated and a Bowman's lacrimal probe is gently slid along the canaliculus towards the lacrimal sac (Figure 1). A hard stop meant that the probe entered the sac and stopped on the medial wall of the sac. A soft stop meant that the probe stopped at the entrance of the sac, which either indicates a tight common canaliculus sac junction or stenosis of common canaliculus. The patency of nasolacrimal system was assessed by syringing. A blunt lacrimal needle (25 gauge) was introduced from inferior punctum and saline was injected and regurgitation of saline mixed with mucoid or mucopurulent discharge through upper punctum with a

slight delay (Figure 2). This was done to exclude those patients with common canalicular block. There were 05 patients with soft stop, 03 patients with congenital agenesis of punctum and 02 patients with previous h/o undergoing DCR surgery. These patients were excluded from the study. Finally, a total of 46 patients (16 male and 30 female) were further evaluated.

Dacryocystography (DCG) was done to confirm and document the level of obstruction in 29 patients in whom there was inconsistency on sac syringing and probing. DCG was not performed in remaining patient in whom only sac syringing was done and it revealed regurgitation of fluid through the opposite punctum indicating distal obstruction.

Besides the above-mentioned investigation, routine tests for anesthesia fitness were done in all patients.

All the patients were offered surgical line of management by endoscopic route. They were randomly assigned into two groups- mitomycin-C group (Group A); silastic nasolacrimal stenting (Group B).

Single surgeon performed all the surgeries. 33 surgeries were done under GA and 16 surgeries were performed under LA. Informed consent was obtained from the entire patients.

Surgical technique

The standard surgical technique of endoscopic DCR was adopted. Nasal decongestion with infiltration of local anesthesia 2% and 1:100000 adrenaline and soaked neuropatties was done in lateral nasal wall just superior and anterior to the attachment of middle turbinate. A 4 mm O^0 or 30^0 nasal endoscope with single chip CCD camera and xenon light source was used. Using number 15 blade mucosal incision were made. The first horizontal incision made 8 to 10mm above axilla of the middle turbinate starting about 3mm posterior to axilla and brought about 10mm anterior to axilla onto the frontal process of maxilla. The incision turned vertically to about 2/3rd of the vertical height of middle turbinate stopping just above the insertion of inferior turbinate into the lateral nasal wall. The incision is than continued horizontally and posteriorly till the insertion of uncinate process. The mucosal flap was raised posteriorly and elevated backwards off the maxillary bone up to uncinate process. In the middle meatus the lacrimal bone is exposed, a round knife is used to elevate the lacrimal bone off the thin posterior inferior region of the sac. A forward biting Hajek Koeffler punch is used to remove thick bone of frontal process of maxilla. This bone lies over the antero-inferior aspect of the lacrimal sac. Bone removal is continued till the bone becomes too thick for the punch to engage. A 2.5 mm diameter burr was also used in a few patients to remove the thick bone overlying the upper half of the sac. Entire sac was exposed and identified as a bluish white translucent structure which moved with pressure over the lacrimal fossa and to a lesser extent with movement of eye ball. Punctum dilator was used to dilate the lower punctum and a Bowman's lacrimal probe was inserted through the inferior canaliculus into the lacrimal sac. The sac wall was indented against it. This also helped in sac identification, once the sac was identified and confirmed, it was incised with a number 12 blade or a sickle and the presence of mucopurulent material within sac and escaping into the nasal cavity was confirmatory of chronic dacryocystitis. The probe was seen coming through the common canaliculus. A large flap was made and rotated onto the frontal process of the maxilla. The original mucosal flap that was raised was trimmed and adjusted in size to cover the denuded bone surrounding the opened sac. The lacrimal sac flaps are incised, everted and adjusted to accurately oppose the nasal mucosa.

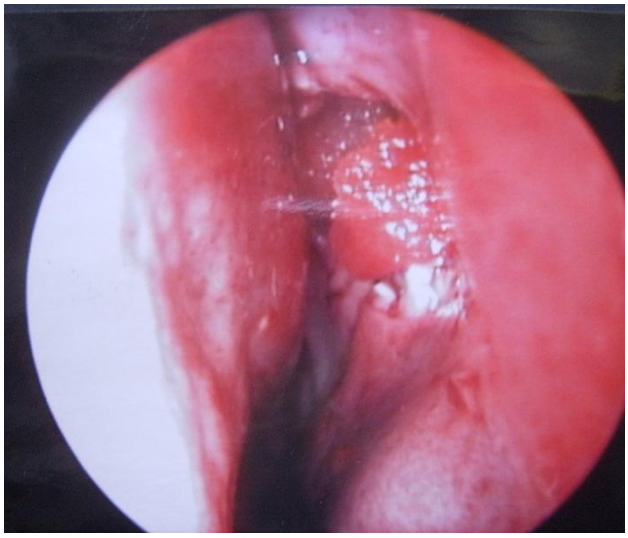

Figure 3: Mitomycin-C soaked gelfoam in-situ (arrow).

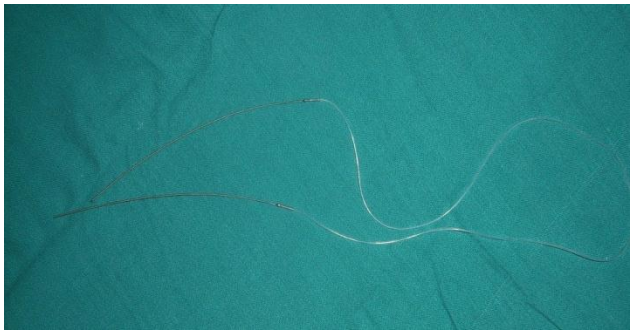

Figure 4: DCR stent.

Patients assigned in Group A- underwent mitomycin-C application over the sac area with the help of the gel foam in a concentration of 0.2 mg/ml for 3 min (Figure 3). It was followed with saline irrigation to wash out excess mitomycin-C. Eyes were also given saline wash to prevent any complication due to exposure to mitomycin-C. A total of 23 patients of group A and 03 patients of group B underwent mitomycin-C due to failed nasolacrimal intubation.

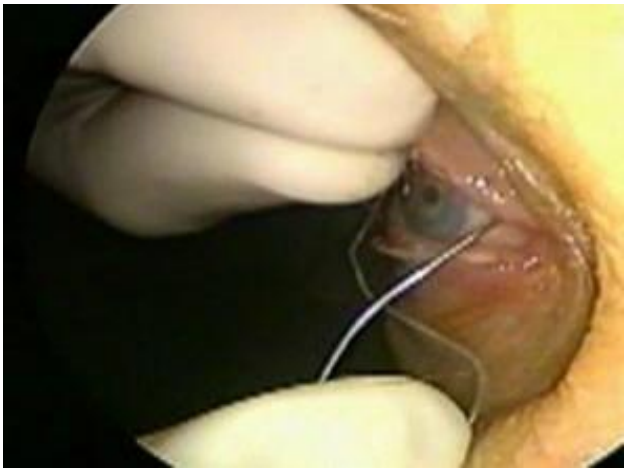

Figure 5: DCR stent being cannulated.

Patients in Group B underwent bicanalicular siliastic stenting. Stent was passed through upper and lower lacrimal punctum into the sac (Figure 4 and 5). The parts of the stent with in the eye were kept a little loose so to prevent damage to lacrimal puncta and the medial caruncle (preventing cheese wiring). The stents were secured in place with a silastic tube over the stent used as spacer and slid up into the lacrimal sac and about 6-7 knots below it. The stent was kept for minimum of 03 months duration. This procedure was employed in 20 patients out of 23 patients assigned to undergo nasolacrimal intubation. In 03 patients the metallic probe of the nasolacrimal stunt could not be negotiated through the common canaliculi. These 03 patients underwent mitomycin-C application.

All patients were followed up to 06 months postoperatively. Sac syringing was done at regular intervals, starting from second post op day in patients who were not stented, then weekly for one month followed by syringing at 03 months and 06 months after surgery. It was performed in every visit to verify the patency of ostium along with nasal endoscopy to remove crusts and debris from ostium gently. In patients undergoing stenting, sac syringing was done at 03 months, after removal of nasolacrimal stent, to confirm the patency of neo ostium. The surgical outcome was evaluated both subjectively and objectively. In subjective assessment, patients were asked to grade the degree of epiphora relief on a scale described by Munk et al.[6] In objective assessment, sac syringing was performed with simultaneous nasal endoscopy and saline dropping into nasal cavity was observed. Tear meniscus level was measured using slit lamp. The results were documented and studied.

RESULTS

Total 46 patients were finally enrolled in the study. There were 65% females (n=30) and 35% male (n=16) in the study (Table 1).

Table 1: Gender distribution of case.

Gender	No of cases (%)
Male	16 (34.78)
Female	30 (65.21)
	n=46

74% patients presented with symptoms of chronic dacryocystitis while 26% patients presented with simple epiphora (Table 2).

Table 2: Clinical presentation.

	No of cases (%) (n=46)
Chronic dacryocystitis	34 (73.91)
Simple epiphora	12 (26.08)

Sac syringing was done in all the patients which showed NLDO. DCG was done in 29 patients who showed lacrimal sac and blockage in NLD. It was performed in patients with inconsistent findings on sac syringing. It was not performed in balance 17 patients where sac syringing was confirmatory.

Among the study subjects, age wise distribution revealed that chronic dacryocystitis was most prevalent in 5th and 6th decade of life, with mean age of 55.54 and standard deviation of 12.5 (Table 3).

Table 3: Age-wise distribution of study subjects.

Age groups (yrs)	No of patients (%) (n=46)
31-40	04 (8.69)
41-50	07 (15.21)
51-60	21 (45.65)
61-70	14 (30.43)

Age: mean-55.44, S.D.-12.5.

Out of 46 patients enrolled, only 3 patients (6.52%) patient reported within 06 months of onset of symptoms, balance 43 (93.47%) patients reported after 06 months of onset of symptoms (Table 4).

Table 4: Duration of disease.

Duration	No of patients (%) (n=46)
<6 months	03 (6.52%)
>6 months	43 (93.47%)

20 patients had DNS, however, only in 6 patients it was severe enough to limit access to the sac per se during surgery. These patients underwent access endoscopic septoplasty.

26 patients underwent EnDCR with mitomycin-c application while rest 20 underwent EnDCR with stenting (Table 5).

At 06 months follow up 92% patients of group A (n=24) had a patent sac while in group B 85% (n=17) had a patent sac (Table 6, 7).

Improvement in epiphora was evaluated subjectively as per criteria given by Munk et al and objectively by measuring height of tear meniscus by slit lamp examination at the end of 6 months of follow up.

Table 5: Type of surgery.

Group	Type of surgery	No of cases (%) (n=46)
Group A	DCR with MMC	26 (56.52%)
Group B	DCR with stent	20 (43.47%)

Table 6: Patency of Sac at 6 months.

Group	Type of Surgery	No of cases (n=46)	Number of successful cases (n=41)	Number of failure cases (n=5)	Success percentage (%)	Failure percentage (%)
Group A	DCR with MMC	26	24	2	92.3	7.7
Group B	DCR with stent	20	17	3	85.0	15.0

Table 7: Patency of Sac on follow up (group A v/s group B).

Post op follow up	Group A (n=26) Patients (%) with patent sac	Group B (n=20) Patients (%) with patent sac
01day post op	26 (100)	-
01 month post op	26 (100)	-
03 months post op	25 (96.15)	19 (95)
06 months post op	24 (92.30)	17 (85)

Table 8: Subjective benefit based on grading by Munk et al.

Grade	Group A (DCR with MMC) n=26 (%)	Group B (DCR with stent) n=20 (%)
0	22 (84.61)	16 (80)
1	2 (7.69)	1 (5)
2	1 (3.89)	1 (5)
3	0	1 (5)
4	1 (3.89)	1 (5)
5	0	0

Table 9: Level of tear meniscus at 6 months.

Type of surgery	Normal (<0.1 mm)	Moderate (0.1-0.2 mm)	High (>0.2 mm)
DCR with MMC (n=26)	23	02	01
DCR with Stent (n=20)	17	01	02

* chi square test – p=0.755.

Table 10: Postoperative complications.

Postoperative complications	DCR with MMC (n=26)	DCR with stent (n=20)
Nasal bleeding	-	-
Infection	2	1
Synechiae	-	1
Cheese wiring of canaliculi	-	-
Corneal irritation	-	1
Prolapse of stent	-	1
Pyogenic granulomata	-	1
Persistent tearing	1	1

* Chi square value=1.42, p=0.23.

Patients in grade 0 and 1 of Munk et al were considered as successful patients. 92.3% patients in Group A (n=24) and 85% (n=17) patients in Group B had subjective benefit (Table 8).

Objective evaluation of epiphora was done by measuring tear meniscus level at 6 months. Patients with tear meniscus levels of less than 0.1mm were considered as successful surgical outcome (Table 9).

A few post-operative complications were noticed, however none of them was major complication. In Group A, 11.5% patient and in group B, 30% patient had post-operative complications (Table 10).

Statistical analysis

Chi-square test with Yate's correction was employed to give a value of 0.1 with confidence interval of 3.04–0.07. P value of greater than 0.05 (p=0.76) was obtained, therefore the difference in results obtained by two techniques were insignificant.

Table 11: Statistical analysis comparing the two techniques.

Category	RESULTS		Total	X^2, p value	CI	Odds ratio
	Surgical success	Surgical failure				
DCR with MMC	24	2	26	X^2= 0.1 (Yate's corrected) p=0.76	3.04-0.07	0.47
DCR with stent	17	3	20			

Similarly chi square test was employed to assess the difference in tear levels obtained after employing two techniques, p value obtained were 0.755, which means there is no significant difference in tear levels obtained post-surgery (Table 11).

As far as complications between the two groups are concerned the difference was statistically insignificant (p=0.23).

DISCUSSION

Chronic dacrocystitis is due to an obstruction for drainage in the lacrimal system, mainly at the level of nasolacrimal duct, with subsequent infection of the lacrimal sac.[7] Tearing and intermittent swelling of the medial canthus are the most frequent symptoms of the impaired drainage of the lacrimal system. The obstruction occurs primarily at 2 levels- (i) proximal - where the common canaliculus enters the lacrimal sac, (ii) distal- where the narolacrimal duct (NLD) enters the inferior meatus (dacryocystor-hinostenosis). The goal of the surgery is to re-establish intranasal drainage of the lacrimal sac, which can be achieved by a number of surgical methods.

Endoscopic dacryocystorhinostomy was initially described by Caldwell in 1893; however fell into disrepute due to limitation of technology at that time.[8] In Toti described the external procedure and later modified in 1921 by Dutemps et al.[9,10]

The endoscopic endonasal approach as performed today was pioneered by West (1910) who substituted a window resection over the lacrimal sac for wide resection.[11] This approach did not gain much popularity at that time because of poor visualization of intra nasal anatomy. The endonasal technique remained at best a neglected operation.

With the introduction of endoscopes of different degrees of angulations, led to renewed interest in late 1980's and early 1990's by McDonogh, Merring and Massaro. The procedure is a valid alternative approach for NLDO and remained largely unchanged since then.[12,13] The success rate has been reported as approx 85% to 95% by both endonasal and external approach.[14-16] The endonasal approach has the added advantage of avoiding an external scar, maintaining the integrity of the pump mechanism and tackling any associated nasal pathology in the same sitting.[2,3]

Causes of failure of EnDCR are mainly due to granulation tissue around the neo-ostium due to scarring or fibrosis at mucosal/submucousal level. In order to enhance the success rate of dacryocystorhinostomy, intraoperative adjuncts were employed. These are (a) Intraoperative topical application of mitomycin-C, an antimetabolite that affectively reduces fibroblastic capillary proliferations at osteotomy site (commonly used by ophthalmologists) in external DCR procedure and also used in EnDCR by otolaryngologists.[17,18] (b) Intraoperative use of nasolacrimal silicone stent to maintain the patency of canaliculi and neo-ostium by preventing post-operative synechiae.[19] (c) Wide exposure of lacrimal sac with marsupialization of lacrimal sac with the nasal mucosa, thereby minimizing the formation of granulation tissue and synechiae.[4]

In our study all patients underwent marsupialization of widely exposed sac into nasal cavity with either intra-op mitomycin-C application or silicone stent to enhance the post-operative success rate. The surgical techniques employed in this study has been extensively described by Wormald.[4]

In endonasal lacrimal surgery, osteotomy closure by granulation tissue, fibrosis and cicatrisation has been reported as most important reasons for failure.[13] Thus if

an adjunct like applying mitomycin-c over osteotomy site, or using silastic stent can decrease the failure rate.[15,20-22]

Mitomycin-C, an alkaline agent is isolated from fermentation filtrate of '*Streptomyces caespitosus'*. After intracellular enzyme reduction of the quinine and loss of methoxy, mitomycin-C becomes bifunctional or trifunctional alkylating agent. It covalently binds with and alkylates DNA and inhibits its synthesis. It also inhibits DNA dependent RNA synthesis thereby inhibiting protein synthesis. It inhibits cell mitosis in all phases of cell cycle, most predominantly during late G1 and early S phase of cell cycle. It affects both replicating and non-replicating cells and thus no cell can proliferate after exposure to MMC. MMC decreases proliferation of fibroblasts as well as growing capillary endothelium of conjunctival vasculature and may alter ciliary epithelium as well. MMC has been shown to induce apoptosis in human tenon capsule fibroblasts and bovine trabecular meshwork cells.[23] Application of mitomycin-C in dosages of 0.2 mg/ml to 0.5 mg/ml was effective in subconjunctival fibroblasts for 1 to 3 min.[24,25] Liao et al used 0.2 mg/ml of MMC externally on the posterior flap and on the osteotomy site and removed after 30 min.[21] They reported 95.5% success rate.

Silicone intubation is a commonly suggested procedure in external DCR, especially in previous acute dacryocystitis, a small lacrimal sac, canalicular disease, or poor mucosal flap formation. Silicone tubing has been proposed to maintain the patency of the fistula by impeding fibrous closure during post- operative healing period.[15,16,26] It is also recommended for EnDCR procedures, because the surgical ostium created during surgery heals with granulation, and silicone stent has shown to maintain the patency of neo-ostium. Silicone stent should be placed both from superior and inferior canaliculi into lacrimal sac.[27]

In this comparative study there were 46 patients who underwent EnDCR. We had made an attempt to find out whether intra operative mitomycin-C application increases the postoperative success rate by preventing scarring during the healing stage as compared to DCR with stenting.

In our study, the age of patients in our study ranged from 31 years to 70 years, mean being 56.4 yrs. Thus there being a predilection to elderly age group, this corresponds to studies conducted by Bartley.[28] Various studies have indicated that females suffer more from this condition than compared to males.[14] This is true in our study where in the sex distribution was in favor of females- 30 (65.21%) and 16 (33.92%) males out of total of 46 patients. Females are more prone to lacrimal obstruction due to narrower lumen of bony canal. Menstrual and hormonal fluctuations have been stated as factors to explain the prevalence in the middle aged and elderly. In the study 30 (65.21%) patients had epiphora on right side and 16 (33.92) had epiphora on left side. None of the patient in our study had bilateral disease. This matches with the data mentioned in international literature; however exact cause of laterality has not been explained.

Epiphora was the dominant symptom and was present in all 46 patients, being the commonest symptom of uncomplicated chronic dacryocystitis.[16,29] Other symptoms included recurrent attacks of dacryocystitis and less commonly mucocele, pyocele that was seen in 02 patients in our study. In addition 15 (35.6%) had recurrent rhinitis probably due to chronic infection of nose/paranasal sinuses. 20 (43.7%) patients had DNS associated with it, but only 06 patients had to undergo access septoplasty as the deviation was severe enough to cause obstruction to osteotomy site.

Subjective improvement in symptoms was assessed by a questionnaire presented to all the patients to evaluate the improvement in epiphora based on grading system described by Munk et al. Patients in grade 0 and 1 after 6 months were considered as successful operations.

Grade 0– no epiphora; Grade 1– occasional epiphora requiring drying or dabbing less than twice a day; Grade 2– epiphora requiring drying 2-4 times/day; Grade 3– epiphora requiring drying 5-10 times/day; Grade 4– epiphora requiring drying >10 times/day; Grade 5– constant tear flow. In group A patient, 92.3% patients in Group A (n=24) and 85% (n=17) patients in Group B had subjective benefit.

Objectively the improvement was assessed by measuring height of tear meniscus level by slit lamp examination at ophthalmology dept. 88.46% patients in group A and 85% patients in Group B had significantly better tear levels.

The overall success rate for endoscopic DCR in this study was 88.56%. This is in keeping with the reports in the literature. For patients with mitomycin-c application was 92.30% and with stenting was 85%. Though worldwide data gives preference to mitomycin-C application for primary cases and stenting in revision cases, concurrent application of mitomycin-C plus stenting may be worthwhile to improve the outcome. The use of antiproliferative agent like mitomycin C to osteotomy site during surgery can inhibit fibrous tissue growth and scarring and the long-term success rate of DCRs may become much higher as compared to DCRs without use of any adjunct.

However, when both the adjuvant modalities were compared to each other, no significant difference in outcomes was noticed in both the groups. Despite this, Group A, that is EnDCR with mitomycin C did showed a trend towards better surgical outcomes as compared to use of silicone stent.

As far as cost effectiveness is concerned, the rates of stents available ranges from Rs 600 to 1500, while a vial of mitomycin-C costs around Rs 150 that can be used for 3-4 patients. Therefore it is not wrong if we conclude that mitomycin-C is a cheaper a safer alternative than stents. Moreover the patients compliances in mitomycin-C group is much better than with stents since it is required to be applied only once during the surgery, patient comfort is also much better than with stents, since irritation following placement of stent is absent.

CONCLUSION

EnDCR, beyond doubt is now the preferred and established modality of treatment for patients suffering from chronic dacryocystitis. Several studies have been conducted to compare the results in use of mitomycin-C versus no mitomycin-C, Nasolacrimal stent versus no stent, but as far as review of literature is concerned, we were unable to find any study which directly compared the results of mitomycin-C versus nasolacrimal duct stent, and hence this study was undertaken. The drawback of our study is its limited sample size, as it was planned like a pilot study. It would require further studies to validate the benefit of one adjuvant over other. It is also emphasized that established surgical steps should be followed diligently for better surgical outcomes. The comparative results in our study between two groups have been statistically non-significant, but a sure trend of benefit hints towards use of mitomycin-C even as adjuvant in cases being operated for the first time. This would warrant a study with a larger sample size. Silicone stent can be reserved for patients who come with failure of primary endoscopic DCR surgery.

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