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Pandit VK
Associate Professor,
Department of Anatomy,
M.G.M. Medical College,
Indore, Madhya Pradesh,
India

Jehan M
Assistant Professor
(Corresponding author),
Department Of Anatomy,
M.G.M. Medical College,
Indore, Madhya Pradesh,
India

Pathak N
Consultant Ophthalmologist,
Rajas Eye & Retina Research
Centre, Indore,
Madhya Pradesh, India

Choudhary R
Consultant Ophthalmologist,
Rajas Eye & Retina Research
Centre, Indore, Madhya
Pradesh, India

Kate T
Consultant Ophthalmologist,
Rajas Eye & Retina Research
Centre, Indore,
Madhya Pradesh, India

Singhai J
Consultant Ophthalmologist,
Rajas Eye & Retina Research
Centre, Indore,
Madhya Pradesh, India

Correspondence
Jehan M
Assistant Professor,
(Corresponding author),
Department Of Anatomy,
M.G.M. Medical College,
Indore, Madhya Pradesh,
India

To analyse the success rate of external Dacryocystorhinostomy related with anatomical osteotomy size made during surgery

Pandit VK, Jehan M, Pathak N, Choudhary R, Kate T and Singhai J

Abstract

Introduction: Dacryocystorhinostomy (DCR) surgery failure is usually due to the closure of the surgical osteotomy. Creation of a large osteotomy helps to increase the chances of success of surgery.

Objective: To evaluate the size of osteotomy made during surgery and its correlation with successful DCR surgery.

Methodology: A retrospective review of 50 patients (19 males, 31 females) more than 10 years of age, over a period of 24 months were done. The External DCR surgery was performed by ophthalmic surgeon in patients of chronic dacryocystitis or after resolution of acute inflammation. All patients were operated by same technique of local anesthesia and nasal packing. Curvilinear skin incision 7-8 mm from medial canthus. Cutting of medial palpebral ligament. Identification of lacrimal sac and fossa. Creating large bony ostium by direct visualization. Measuring and recording of size of ostium using sterile measuring caliper. Suturing of anterior mucosal flaps. Retrospective data collection included the patient's age, sex, affected side, symptoms, operative experience, and follow-up results.

Results: Complete Patency in 49 (98%) patients and Partial Patency in 01 (2%) patient. Overall success rate of Ext. DCR surgery is 92-94% with complete relief from epiphora achieved in 90% of cases.

Conclusion: The successful DCR surgery requires a Big Osteotomy size with a mean value of $1.2\text{cm} \pm 0.3$ SD which differs from patient to patient according to sac size and bone, along with meticulous surgery and proper identification of structures and tight apposition of anterior mucosal flaps.

Keywords: DCR, lacrimal apparatus, lacrimal fossa, lacrimal sac, osteotomy

Introduction

The lacrimal excretory pathway consists of punctum, canaliculi, lacrimal sac, nasolacrimal duct. Its major portion is lacrimal sac which is situated in lacrimal sac fossa. Obliteration in any region of this pathway may lead to epiphora. For the relief of chronic complaints, Dacryocystorhinostomy (DCR) surgery is done. The main purpose of DCR surgery is to eliminate the obstruction and to accomplish normal tear. DCR is a procedure performed to drain the lacrimal sac in which lacrimal flow is diverted into the nasal cavity through an artificial opening made at the level of the lacrimal sac in cases of chronic dacryocystitis or symptomatic nasolacrimal duct obstruction not relieved by simple probing and syringing [1, 2]. It can be performed externally or endoscopically.

Results of endonasal or external approach for DCR became comparable [3]. Some studies have suggested that external approach is better than endonasal, which may be due to good anatomic identification of the sac and mucosal lining, because the inside of the sac may not always visible in endoscopic surgery. External DCR is better if the tiny tear ducts in the eyelids (canaliculi) are blocked as well as the bigger duct in the nose. Endoscopic surgery may be better if you have polyps or sinus problems, which may be dealt with at the same time as the tear duct operation. Knowledge of the anatomy of the lacrimal drainage system is important prior to performing any lacrimal surgery procedure.

The lacrimal sac fossa (Figure 1) is a depression in the inferomedial orbital rim, formed by the maxillary and lacrimal bones. Anterior and posterior lacrimal crest of maxillary bone and lacrimal bone respectively forms its borders. The fossa is approximately 16-mm high, 4- to 9-mm wide, and 2-mm deep [4] and is narrower in women [5], widest at its base, where it opens into the nasolacrimal canal. The anterior lacrimal crest is an important landmark

during external dacryocystorhinostomy, as the anterior limb of the medial palpebral ligament attaches to the anterior lacrimal crest superiorly. This attachment is often detached from the underlying bone along with the periosteum in order to gain better exposure during surgery.

A vertical suture runs centrally between the anterior and posterior lacrimal crests, representing the anastomosis of maxillary bone to the lacrimal bone. A suture located more posteriorly within the fossa would indicate predominance of the maxillary bone, whereas a more anteriorly placed suture would indicate predominance of the lacrimal bone. The lacrimal bone at the lacrimal sac fossa has a mean thickness of 106 microns, which is very thin and allows it to be easily penetrated to enter the nasal cavity during surgery [6]. In a patient with a maxillary bone dominant fossa, the thicker bone makes it more difficult to create the osteotomy and may result in failure of surgery.

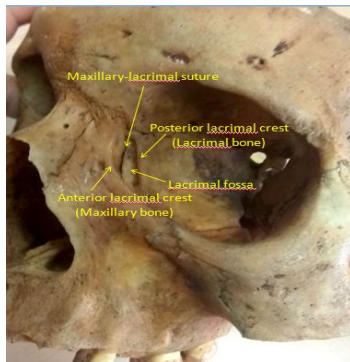


Fig 1: Bony anatomy of the lacrimal sac fossa and medial orbital wall (Left orbit: frontal and slightly lateral view)

The nasolacrimal canal originates at the base of the lacrimal sac fossa, and is formed laterally by the maxillary bone and medially by the lacrimal and inferior turbinate bones. The duct runs posteriorly and laterally in the bone formed by the medial wall of the maxillary sinus and the lateral nasal wall for 12 mm to drain into the inferior meatus of the nose [7].

The lacrimal excretory pathway for tears begins on the medial portion of each eyelid called the punctum [4, 8] which opens into the canaliculi. In more than 90% of individuals, the superior and inferior canaliculi merge to form a common canaliculus before entry into the nasolacrimal sac [8, 9]. The sac rests in the lacrimal sac fossa, with its medial aspect tightly adherent to the periosteal lining of the fossa. The functional valve between the common canaliculus and the lacrimal sac is the valve of Rosenmuller, although some studies have been unable to find and document this structure [10]. The nasolacrimal sac and duct are portions of the same continuous structure. The total sac measures a length of 12–15 mm vertically and 4–8 mm anteroposteriorly. The nasolacrimal duct then travels inferolaterally and slightly posteriorly in its bony course to the inferior turbinate for an interosseous distance of 12 mm [11]. A mucosal flap, Hasner's valve, may be present at the opening of the duct into the inferior meatus of the nose.

During DCR procedure, osteotomy should extend superior to the level of the medial palpebral ligament as more than 1/3rd of the lacrimal sac may lie above it. The large osteotomy was created by excising the entire medial wall of the lacrimal sac which helps to increase the chances of successful DCR surgery. Bone may be removed until thickening of the frontal bone is noted. This point should

generally lie 5 mm or more above the common internal punctum [12]. DCR surgery failure is usually due to the closure of the surgical osteotomy, which may be due to insufficient osteotomy during surgery or due to exuberant fibrosis or granulation tissue formation [7, 13]. Therefore, creation of a large osteotomy helps to increase the chances of success of surgery. Many studies till date said that creating a large (big) osteotomy will sufficient to ensure a good surgical result in the majority of patients but did not define the size of osteotomy made during surgery. Therefore, in this study we are mainly concerning on the anatomical size of osteotomy created during surgery & its correlation with success rate of surgery. We prefer the external approach as to watch and measure for the anatomical osteotomy size easily. The aims and objective of present study was to correlate and evaluate the success rate of External DCR with osteotomy size made during External DCR procedure.

Material and Methodology

A retrospective review of 50 patients (19 males and 31 females) over a period of 24 months (January 2014 to January 2016) was done who underwent external DCR without stenting at our hospital. Preoperatively, a thorough examination of the lacrimal system that included probing and sac syringing to establish patency of the lacrimal system was done by the ophthalmologist in all the patients. Nasolacrimal duct obstruction was confirmed by syringing where resistance to saline flow and regurgitation from opposite punctum was seen. A detailed clinical examination and routine blood investigations were done.

Inclusion Criteria

We included patients above the age of 10 years presenting with chronic dacryocystitis and diagnosed as primary acquired nasolacrimal duct obstruction having Complete NLD obstruction with symptoms of epiphora, Lacrimal Fistula and/or Mucocele.

Exclusion Criteria

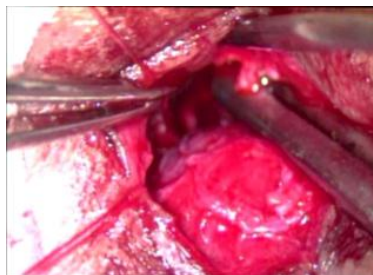
We excluded any patient with < 10 years of age, canalicular obstruction, lacrimal sac tumor, dacryolith or traumatic obstruction or coexisting nasal pathologies which could influence the outcome of the surgery like atrophic rhinitis, chronic granulomatous diseases of the nose, any nasal tumours, etc. Also immunocompromised patients or uncontrolled systemic disease patients were excluded. Patient History was taken to ruled out any previous surgery (Nasal/Sac), Use of topical medication, Previous trauma, Long standing sinus diseases or any Environmental allergies as they may affect our results during and after surgery. Examination findings & preoperative work up done including blood investigations & sac syringing.

Methodology

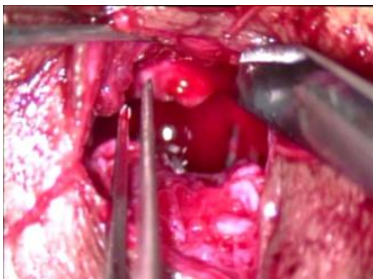
The procedure was performed in patients of chronic dacryocystitis or after resolution of acute inflammation after antibiotic medication. Informed consent was obtained after explaining the surgical procedure and its consequences to all patients.

All patients were operated by same common technique of Local anesthesia and Nasal packing. Curvilinear skin incision was given 7-8 mm from medial canthus. Cutting of Medial Palpebral Ligament. Identification of lacrimal sac

and fossa (Figure 2a). Creating large bony ostium by direct visualization (Figure 2b). Measuring and recording of size of osteotomy (largest diameter) using sterile measuring caliper (Figure 2c-d). Suturing of anterior mucosal flaps. No silicon tube intubation was done. Retrospective data collected included the patient's age, sex, affected side, symptoms, operative experience, and follow-up results. Follow-up: Assessment done next day post operative & 1 week post operative by syringing of lacrimal passage & symptomatic relief of Epiphora. The passage should be patent on irrigation and the patient should be free of symptoms. Also scheduled at 1 months and 6 months after surgery. The procedure was considered successful if the patient had no or minimal epiphora and complete patency of the lacrimal drainage system confirmed by irrigation at the final visit.



(2a)



(2b)



(2c)



(2d)

Fig 2: (a-d) Bony ostium and its size recording during External DCR surgery

Observations and Results

There were 50 patients between 10 to 80 years of age, having both eyes affected almost equally. These patients were divided into two groups (Table 1) according to age and sex of patients. Group A in which less than 40 years patients were present and group B with patients between 40 to 80 years of age. Out of which majority were females 62 % (31/50) as against 38% male patients (19/50), in which females of age group of 40 to 80 years were more commonly affected (52%) group and males of less than 40 years affected the least (8%).

Table 1: Age and Sex Distribution

Age	No. of Patients (total = 50)	
	Males	Females
< 40 years	04 (08%)	05 (10%)
40 years - 80 years	15 (30%)	26 (52%)
Total	19 (38%)	31 (62%)

Table 2: Success rate of External DCR at follow up

Post Operative Results	At 1 month follow-up	At 6 months follow up
Complete patency	46 (92%)	46 (92%)
Partial Patency	02 (04%)	02 (04%)
No Patency	01 (02%)	01 (02%)
Canalicular Block	01 (02%)	01 (02%)
Scar	+++	(+) Very faint, Acceptable

Complete NLD obstruction with symptoms of epiphora were noted in 48 (96%) patients, Lacrimal Fistula in 01 (02%) and Mucocele in 01 (02%) patients. During operation, surgeon made the osteotomy of at least the size of the tip of index finger i.e. approximately about 9mm to 15mm (0.9 to 1.5cm) depending on sac size and bone type which differs from patient to patient and measure its exact longest size in each case.

Some intraoperative complications during surgery were noted like Bleeding from incision site in 04 (08%) patients, Bleeding from Nasal Mucosa in 07 (14%), Inappropriate Osteotomy size in 01 (02%) of less than 9mm and difficulty in fashioning mucosal flaps in 01 (02%) of patients were occur.

After surgery the outcome was categorized as Complete Patency in 49 (98%) patients and Partial Patency in 01 (2%) patient. Overall success rate of External DCR surgery is 92-94% in our setup with complete relief from epiphora achieved in 90% of cases. Follow up was also done at one month and 6 month period to see for post operative complications and results were also described as shown in Table 2, which were same at both period with complete patency in 92% patients, partial patency in 04%, no patency in 02% and canalicular block in 02% of patients. Scar were very faint and acceptable cosmetically at six month of follow up period.

Discussion

In recent years, there have been several advances in the evaluation and management of lacrimal obstruction. Different studies may not define success rate equally with varied surgical techniques. There has been a trend toward endoscopically assisted, minimally invasive lacrimal surgery which require a good understanding of the surgical anatomy [14]. With the advent of powered instrument to remove the lacrimal bone, laser to make a clean stoma on the lacrimal

sac mucosa and lighted probe to identify the lacrimal sac area, all these things add cost to the surgery and to the patient, however with the conventional instrument external DCR is still very effective. Generally the long term success rates have not been equivalent to that achieved with external DCR or the results are similar to those obtained for both external DCR as well as for other endonasal approaches^[3].

When properly indicated, DCR gives a high success rate to treat epiphora, externally or through the endoscopic endonasal approach^[15-17]. The outcome of the external DCR, both anatomical and in relieving the symptoms of epiphora is very satisfactory varies from 90%-95%^[15, 18] compared to endoscopic DCR which varies from 82% to 95%^[19] & therefore we prefer External DCR approach with minimal requirements at our setup. External DCR is still performed in a similar way with minor alterations^[20-23] with success rate as high as 90%^[21-23]. However, external DCR leaves a scar in the medial canthal area but it is acceptable cosmetically at our setup.

In our study and studies of Sing *et al*^[24] and Naik *et al*^[25], chronic dacryocystitis was found to be significantly more common in women than men mainly due to lower socioeconomic group having bad personal habits, long duration of dust exposure or exposure to smoke in kitchen. Also congenital and anatomical narrowing of the NLDO in females may contribute to the higher incidence among women^[25]. The lower nasolacrimal fossa and the nasolacrimal duct are narrower in females, which may account for the female predominance of nasolacrimal obstruction^[5].

Failures in endoscopic dacryocystorhinostomy are due to reclosure of the stoma. Over the past three decades it has become common practice for surgeons to place stents at the time of DCR. It has been assumed and propagated that they increase the success rate of the procedure by maintaining the patency of the fistula during the post operative healing period. But some studies^[2, 26-28] revealed no benefit in using Silicone stent as an adjunct in primary endoscopic DCR. In Shashidhar *et al*^[2] study, the anatomical and functional success rate in the group with stenting and without stenting was found to be statistically insignificant, implying that stenting in DCR had no significant effect on the outcome of the procedure. Therefore, we prefer the external DCR approach without stenting. Though the cause for postoperative stomal closure is postulated to be inadequate bone removal commonly, it remains difficult to predict which cases can fail. We therefore prefer to correlate stomal size created during surgery with success rate of surgical outcomes and tried to find out the exact osteotomy size in terms of mathematics as every author till date only describe this size in terms of a big osteotomy size only.

Several methods like intubation, mitomycin C application to the rhinostomy opening, suturing of the mucosal flaps, merogel covering on the wound etc. have been suggested to maintain a permanent opening. In an attempt to maintain a patent anastomosis, the use of the antimetabolite mitomycin C has been previously studied in external DCR surgery and found to increase the number of symptom-free cases^[29, 30]. But we mainly focussed on making proper stomal size during DCR procedure so that the application of above methods can be avoided and therefore measure the osteotomy size in each case and calculated statistically for its size so that it can be correlated with the success rate of surgery and its postoperative closure can be avoided. We

found the size of osteotomy created during surgery was between 9mm to 15mm (1.2cm±0.3 SD) gives the success rate of 92 to 94% at our setup and hence correlated significantly. On follow up 2% of cases shows no patency and 2% shows canalicular block which may be due to intraoperative complications faced like inappropriate osteotomy which may be due to maxillary bone prominence at fossa or due to difficulty in fashioning mucosal flaps during surgery.

Conclusion

A successful DCR is a one where there is both anatomical as well as functional patency. The successful external DCR surgery requires a Big Osteotomy size with a mean value of 1.2cm±0.3 SD which differs from patient to patient according to sac size and type of bone (predominance of lacrimal or maxillary bone) along with meticulous surgery and proper identification of structures and tight apposition of anterior mucosal flaps. This given osteotomy size is significantly correlated with the success rate of surgery. The reported success rates of external DCR at our setup is 92% with a very faint or invisible scar after a few months which is acceptable cosmetically.

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