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## RESEARCH ARTICLE

### A modified technique of external dacryocystorhinostomy with maintaining of pump function (Mini –DCR)

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#### Abstract

**Purpose:** To evaluate a new modified technique of external dacryocystorhinostomy(DCR) in maintaining of pump function and improvement of post-operative epiphora.

**Patients and methods:** This is a prospective interventional case series including 30 consecutive patients with unilateral nasolacrimal duct obstruction presenting with epiphora without chronic dacryocystitis or mucocele. A modified external DCR (mini-DCR) was performed in all cases. In this technique we had performed the same steps of conventional external DCR but we did not disrupt the medial palpebral ligament , the lower half of the medial wall of the sac below the medial palpebral ligament is only opened and anastomosed with the adjacent nasal mucosa after performing an osteotomy and a silicon stent was applied and removed after 3 months.

**Results:** This study included 30 cases with acquired NLD obstruction presenting with epiphora. They were 14 females(46.67%) and 16 males(53.33%). Mean age  $37.33 \pm 3.34$  (range from 22 to 52 years). The mean surgical time was  $55 \pm 4.3$ . After one month of mini-DCR 28 cases(93.33%) showed anatomical and functional patency. After 3 and 6 months of surgery 25 cases (83.33%) maintained patency.

**Conclusions:** This study describe a new modified more conservative technique of external DCR with maintaining of pump function of the sac in cases of nasolacrimal duct obstruction presenting with epiphora without chronic dacryocystitis or mucocele resulting in parallel functional and anatomical success.

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#### Introduction:-

Primary acquired nasolacrimal duct obstruction (NLDO) is a common cause of adult epiphora being more common in females (Maini et al,2007and Walker et al,2011)It may be caused by several factors including; chronic non-specific inflammation of the nasolacrimal duct which is the most common one , naso-maxillary trauma and tumors, iatrogenic causes including; complicated sinus and rhinoplasty surgery(Walker et al,2011).

Dacryocystorhinostomy( DCR) is the surgical procedure of choice to bypass an obstruction within lacrimal passages distal to the common canaliculus(Leong et al,2010, Carifi et al,2012). Since it was first described by Toti in 1904, DCR surgery has undergone many modifications. However, external DCR remains the gold standard for management of those cases(Leong et al,2010).

Success is measured by two factors; anatomical patency of the nasolacrimal system determined by syringing and functional success defined as resolution of epiphora (Lee et al,2010).

Recently, the importance of functional success after DCR has been recognized as an important end point since anatomical success is not always associated with functional success (Eichhorn et al,2010, Mansour et al,2005, Ibrahim et al, 2001, Dolman, 2003, Yigit et al,2007, Lester et al,2008).

External DCR procedure has the advantage of direct visualization of the anatomical structures of the sac area compared to endoscopic DCR (Khan et al, 2011). However, the presence of a cutaneous scar and injury of the medial canthal structures and its impact upon the functional success due to interference with the physiological pump represent limitation of this technique (Shun-Shin et al, 1997).

On the other hand, one of the advantages of endoscopic DCR is maintaining of pump function of the sac due to preservation of orbicularis muscle and medial canthal tendon (Khan et al, 2011).

Although there is a controversy regarding the exact mechanism of pump action of lacrimal sac, most studies agree that it relies on the action of the orbicularis oculi muscle, particularly its deeper part (Horner's muscle), which inserts in the wall of the lacrimal sac (Amrith et al, 2005). According to Jones' theory, the contraction of Horner's muscle may cause expansion of the sac and creation of negative pressure resulting in tear suction. On the contrary, Rosengren-Dóane theory postulates that the elastic expansion of the lacrimal papillae upon opening of the eyelids sucks tears into the sac and subsequent contraction of orbicularis oculi creates a positive pressure gradient that may drive tears along the nasolacrimal duct into the nose (Wesley, 1994, Hurwitz, 1977, Nesi, 1998).

Irrespective of the exact mechanism, contraction of orbicularis oculi (blinking) as well as an adequate elastic tension of the eyelids (adequate eyelid-eyeball apposition and medial palpebral ligament) are considered critical in maintaining of the pump mechanism (Detorakis, 2009).

So, disruption of medial palpebral ligament and deeper part of orbicularis are claimed to be the cause of loss of pump function in conventional external DCR. In our modified technique we perform the conventional external DCR with the advantage of preservation of medial palpebral ligament and maintain the pump function thus decreasing post-operative epiphora and achieving both anatomical and functional success.

### **Patients and methods:-**

This is a prospective interventional case series included 30 cases attended Mansoura ophthalmic center, Mansoura, Egypt from June 2013 to June 2014 presenting with epiphora due to NLD obstruction without chronic dacryocystitis or mucocele.

Cases with canalicular obstruction, chronic dacryocystitis, post traumatic bone deformity in nasolacrimal region and obstruction secondary to nasal pathology and recurrence after previous lacrimal surgery were excluded from the study.

Full ophthalmological examination with particular reference to the lacrimal apparatus was done in all patients. ENT evaluation was done by ENT surgeon to rule out nasal causes of obstruction.

A preoperative assessment of tear meniscus height was done using the slit lamp after staining the tear film with fluorescein dye, regurgitation on pressure over the lacrimal sac and syringing was performed with normal saline and results were recorded.

### **Technique of mini-dacryocystorhinostomy (mini-DCR):-**

After getting ethical approval from Mansoura medical ethics committee (MMEC) and a written consent from all patients was taken, mini-DCR was done for all patients under general anaesthesia. Packing of the ipsilateral nasal cavity was done with gauze soaked in adrenaline 1:100,000 and adrenaline 1:200,000 was infiltrated around lacrimal sac for haemostasis.

A linear incision of 10-15 mm length was made along the anterior lacrimal crest starting at the level of medial palpebral ligament and 10 mm medial to medial canthus taking care to avoid injury of angular vessels. The orbicularis oculi muscle fibers were separated with blunt dissection. retractors were used to retract the edges of the incision.

Contrary to the conventional DCR, attachment of the medial canthal ligament was not divided and was just retracted upwards using a muscle hook for exposure of the lower half only of the lacrimal sac. (figure 1)

Orbital periosteum was incised 3 mm anterior to the lacrimal crest with a blunt dissector and the lower part of the sac was separated from the lacrimal fossa. The posterior half of the lacrimal fossa was fractured with a blunt

dissector with the help of a periosteal elevator, the nasal mucosa was stripped from lacrimal bone to avoid damage to the nasal mucosa.

An osteotomy of approximately 15 x15 mm was created by successive punching of bone by bone rongeur including the anterior lacrimal crest, lacrimal bone and extending down to the nasolacrimal canal.

The upper punctum was dilated with a Nettleship's punctal dilator, a Bowman's probe was passed through the upper canaliculus to confirm the position of the common canaliculus and related part of the medial wall of the sac which is tented to facilitate its opening.

With No.11 blade the lower half only of the lacrimal sac and adjacent nasal mucosa were opened in a (H-shaped) fashion forming a larger anterior and a smaller posterior flap then, the posterior flaps of the sac and nasal mucosa were excised.

The Bowman's probe was removed and bicanalicular silicon stent was applied through the upper and lower canaliculi and retrieved from the wound where the guide probes were removed and two ends of the silicon tube were tied in a proper tension in order not to be loose to prolapse or tight to cause cheese wiring of the puncti then, passed through the osteotomy into the nasal cavity and kept in place using the tube of the suction device applied through the ipsilateral nostril.(figure 2)

The anterior flaps of nasal mucosa and lacrimal sac were sutured using 6/0 polyglactin interrupted sutures.(figure 3)

The incised orbicularis muscle were closed using 6/0 polyglactin interrupted sutures. The skin incision was closed by interrupted 5/0 polypropylene sutures. Suction tube was removed from the nose and nasal pack was applied to the ipsilateral nostril.

#### ***Post operative management:***

All patients were given systemic antibiotics for 5 days and tobramycin eye drops were instilled 4 times/day for 7days and nasal decongestant drops(xylometazoline hydrochloride 0.05%) was used for 7 days.The nasal pack was removed after 24 hours, the first dressing was done after 24 hours. Skin sutures were removed on the7th post-operative day.

All patients were followed-up on 1st week, 1st month, 3rd month and 6th month. At every follow up, patients were asked about epiphora as an indicator of functional success. Symptoms of patients were documented at each follow-up as no tearing or excessive tearing.

Objective tests like height of tear meniscus and lacrimal syringing were done at each visit as an indicator of anatomical success and the results were documented. The result of syringing was documented as patent and non-patent and lacrimal tear meniscus was documented as normal height if less than 1mm or high if more than 1mm.

Failure of mini-DCR surgery was defined as having excessive tearing, non-patent on lacrimal syringing and high tear meniscus.

Success of mini- DCR surgery was defined as having no tearing, patent on lacrimal syringing and normal tear meniscus.

Data were collected and analysed using McNemar Test.

#### **Results:-**

This is an interventional case series including 30 cases with acquired NLD obstruction presenting with epiphora without chronic dacryocystitis or mucocele. They included 14 females(46.67%) and 16 males(53.33%) with a mean age of  $37.33 \pm 3.34$  (ranging from 22 to 52 years).

After one month of mini-DCR 28 cases (93.33%) showed successful results (no tearing, patent passage on syringing and normal height of lacrimal tear meniscus) and two cases(6.67%) failed (excessive tearing, non-patent passage on syringing and high lacrimal tear meniscus).

After 3 months of surgery 25 cases (83.33%) showed successful results (no tearing, patent passage on syringing and normal height of lacrimal tear meniscus) and 5 cases (16.67%) failed (excessive tearing, non-patent passage on syringing and high lacrimal tear meniscus).

After 6 months of surgery the same results were achieved as those after 3 months.

As regard the parameters of failure (excessive tearing, non-patent passage and high lacrimal tear meniscus) there were no statistically significant difference in results between one month and three months post-operatively ( $p=0.2$ ) and between one month and six months post-operatively ( $p=0.2$ ) and there was no difference between three and six months ( $p=1.0$ ) (table 1)

Mean surgical time of mini-DCR in this study was  $55\pm 4.3$  minutes (ranging from 45 to 66 minutes).

Postoperative epistaxis occurred as a complication in one case (3.33%) after 3 days of surgery and was controlled by application of nasal pack that was removed 48 hours later.

### Discussion

External DCR surgery remains the gold standard in management of nasolacrimal duct obstruction. The main advantage of this procedure is the ability of direct visualization of the anatomy of the medial canthal structures. However, occurrence of a visible scar and possibility of injury of medial canthal structures with subsequent affection of the lacrimal pump mechanism represent a limitation of this procedure (Shun-Shin et al, 1997).

On the other hand, endoscopic DCR has been assumed to reduce the risk of interfering with the physiology of the lacrimal pump due to preservation of the medial canthal structures (Durvasula, 2004).

Recently, the importance of functional outcome after DCR in the form of improvement of epiphora is seen as an important end point of this procedure as anatomical success alone is insufficient if not associated with functional one (Leong et al, 2010).

Detorakis et al 2010 reported that despite patent lacrimal passages after external DCR, functional success was not parallel to anatomical success in all cases.

Kristin et al 1995 achieved anatomical success in up to 95% of cases however, functional success was only 92%.

Tessa et al 2009 reported a functional success of 69% compared to 74% anatomical success after 6 months of follow up.

So, in patients with acquired nasolacrimal duct obstruction without chronic dacryocystitis whose main complaint is epiphora, patients will not be satisfied if epiphora persists after conventional DCR.

In this study a modified technique of external DCR (mini-DCR) was used. In this technique we tried to use the advantage of familiarity of the standard external DCR and still maintaining the pump function by avoiding disruption of the medial canthal tendon that is assumed to be responsible with the orbicularis muscle in maintaining of pump mechanism thus improving results of the standard external DCR.

In this study anatomical and functional success were parallel in all cases and were achieved after mini-DCR in 93.33% of cases after one month of surgery but this result had dropped to 83.33% after three and six months of surgery.

This is in matching with most of the studies that revealed a success rate ranging from 85% to 95% of cases of conventional external DCR (Dressner et al, 1991, Emmerich et al, 1994, Rosen et al, 1989, Tarbet et al, 1995).

Our results showed that the success rate initially after one month of surgery was 93.33% but it dropped to 83.33% on the third month and no further drop occur on six month however, this difference was statistically insignificant ( $p=0.2$ ).

Rashid Baig et al, 2013 at a tertiary hospital in Karachi, Pakistan 2013 reported that in spite of initial high success of external DCR, this result usually drop with time and the longer the duration of follow-up the lower the success rate.

Other studies were performed to evaluate the long term follow up of functional success of external DCR and showed a lower success rate the longer the follow up as those performed by Mirza 2002 in UK with average follow up of 9 months who achieved a success of 83.7%, Yigit 2007 in Turkey with average follow up of 12 months showed a success of 69.1% and Leong 2010 in UK with average follow up of 16.8 months showed a success of 71% (Rashid Baig et al, 2013).

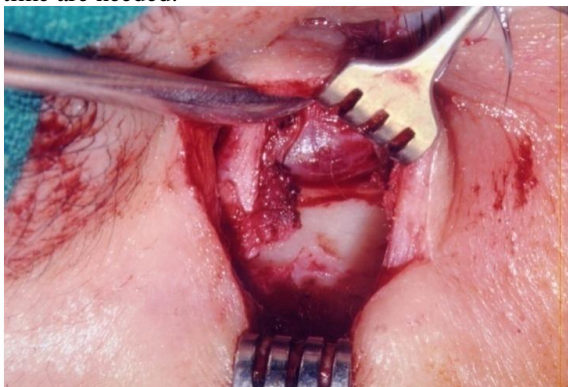
Most of those studies reported that scarring at the osteotomy site and formation of inflammatory granuloma were the most common causes of drop in success rate.

So, in spite of drop in success rate between first and third month of mini-DCR, it was not far from the reported results of conventional DCR.

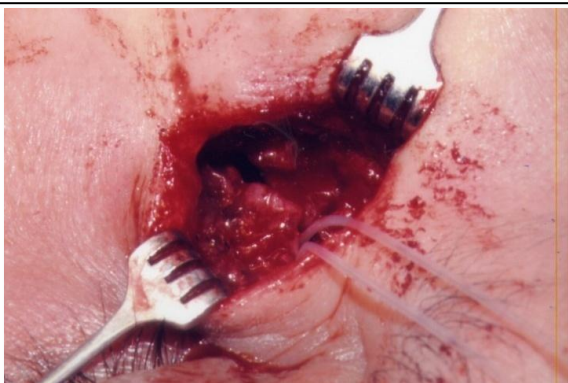
Malhotra 2003 reported that the mean surgical time of external DCR was  $41.1 \pm 10.3$  however, Dolman 2003 reported a mean time of  $34.3 \pm 4.7$  (Dior et al, 2010).

The mean surgical time of mini-DCR in this study was longer than average time of conventional DCR ( $55 \pm 4.3$  minutes) and this may be explained by difficulty of dissection of the sac without disinsertion of the medial palpebral ligament.

In this study we presented a new modified technique of external DCR in a trail to decrease disparity between anatomical and functional success after conventional DCR however, further controlled studies on a larger number of patients and longer follow up time are needed.



**Figure 1: Exposure of the lacrimal sac without disruption of the medial canthal tendon.**



**Figure 2: Fashioning of the sac and mucosal flaps and application of silicon stent.**



**Figure 3: Suturing of the sac and mucosal flaps over the silicon stent.**

**Table (1) : Follow up of tearing, syringing and lacrimal tear meniscus after mini DCR**

	1 month		3 months		6 months		P value
	Normal	Excessive	Normal	Excessive	Normal	Excessive	
<b>Tearing</b>							P=0.2 P1=0.2 P2 =1.0
Normal	28	1	25	3	25	3	
Excessive	0	1	0	2	0	2	
<b>Syringing</b>	Non- patent	Patent	Non- patent	Patent	Non-patent	Patent	P=0.2 P1=0.2 P2 =1.0
Non- patent	1	0	2	0	2	0	
Patent	1	28	3	25	3	25	
<b>Lacrimal tear meniscus</b>	Normal	High	Normal	High	Normal	High	P=0.2 P1=0.2 P2 =1.0
Normal	28	1	25	3	25	3	
High	0	1	0	2	0	2	

P: statistical difference between 1 month and 3 month, p1: statistical difference between 1 month and 6 month ,p2 between 3month and 6 month  
McNemar Test

### References:-

1. Amrith S, Goh PS, Wang SC. Tear flow dynamics in the human nasolacrimal ducts - A pilot study using dynamic magnetic resonance imaging. *Graefes Arch Clin Exp Ophthalmol* 2005;243:127–31.
2. Carifi M, Zuberbuhler B, Carifi G. Efficacy of external and endonasal dacryocystorhinostomy. *J Craniofacial Surg* 2012; 23:1582-3.
3. Detorakis ET, Drakonaki E, Papadaki E, et al. Watery eye following patent external DCR: An MR dacryocystography study. *Orbit* 2010;29:239–43.
4. Detorakis ET, Drakonaki EE, Bizakis I, et al. MRI evaluation of lacrimal drainage after external and endonasal dacryocystorhinostomy. *Ophthal Plast Reconstr Surg* 2009;25:289–92.
5. Dior WX, Charmaine HC and Seng CL. Primary external dacryocystorhinostomy versus primary endonasal dacryocystorhinostomy: a review. *Clinical and Experimental Ophthalmology* 2010;38:418–26. 418..426
6. Dolman PJ. Comparison of external dacryocystorhinostomy with nonlaser endonasal dacryocystorhinostomy. *Ophthalmology* 2003;110:78-84.
7. Dressner SC, Klussman KG, Meyer DR, Linberg JV. Outpatient dacryocystorhinostomy. *Ophthalmic Surg* 1991; 22: 222–4.
8. Durvasula V, Gatland DJ. Endoscopic dacryocystorhinostomy: longterm results and evolution of surgical technique. *JLaryngol Otol*. 2004; 118:628–32.
9. Eichhorn K, Harrison AR. External vs. endonasal dacryocystorhinostomy: six of one, a half dozen of the other? *Curr Opin Ophthalmol* 2010;21:396-403.
10. Emmerich KH, Busse H, Meyer- Rusenberg HW. Dacryocystorhinostomia externa. Technique, indications and results. *Ophthalmologie* 1994; 91: 395–8.
11. Hurwitz JJ, Cooper PR, McRae DL, Chenoweith DR. The investigation of epiphora. *Can J Ophthalmol* 1977;12:196–8.
12. Ibrahim HA, Batterbury M, Banhegyi G, McGalliard J. Endonasal laser dacryocystorhinostomy and external dacryocystorhinostomy outcome profile in a general ophthalmic service unit: a comparative retrospective study. *Ophthalmic Surg Lasers* 2001;32:220-7.
13. Khan MK, Hossain MA, Hossain MJ, et al. Comparative study of external and endoscopic endonasal dacryocystorhinostomy for the treatment of chronic dacryocystitis. *JAFMC Bangladesh* 2011;7:15–7.
14. Kristin JT, Philip LC. External Dacryocystorhinostomy : Surgical Success, Patient Satisfaction, and Economic Cost. *Ophthalmology* 1995;102(7):1065–70.
15. Lee DW, Chai CH, Loon SC. Primary external dacryocystorhinostomy versus primary endonasal dacryocystorhinostomy: a review. *Clin Experiment Ophthalmol* 2010;38:418-26.

16. Leong SC, Karkos PD, Burgess P, et al. A comparison of outcomes between non-laser endoscopic endonasal and external dacryocystorhinostomy: single-center experience and a review of British trends. *Am J Otolaryngol* 2010; 31:32-7.
17. Leong SC, Macewen CJ, White PS. A systematic review of outcomes after dacryocystorhinostomy in adults. *Am J Rhinol Allerg* 2010;24:81-90.
18. Lester SE, Robson AK, Bearn M. Endoscopic 'cold steel' versus laser dacryocystorhinostomy: completing the audit cycle. *J Laryngol Otol* 2008; 122:924-7.
19. Maini S, Raghava N, Youngs R, et al. Endoscopic endonasal laser versus endonasal surgical dacryocystorhinostomy for epiphora due to nasolacrimal duct obstruction: prospective, randomised, controlled trial. *J Laryngol Orol* 2007;121(12):1170-11.
20. Mansour K, Sere M, Oey AG, et al. Longterm patient satisfaction of external dacryocystorhinostomy. *Ophthalmologica J Int d'ophthalmol Int J ophthalmol Zeitschriftfur Augenheilkunde* 2005;219:97-100.
21. Nesi FA, Waltz KL, Vega J. Basic principles of ophthalmic plastic surgery. In: Nesi FA, Lisman RD, Levine MR, editors. *Smith's Ophthalmic Plastic and Reconstructive Surgery*. St. Louis: Mosby; 1998. pp. 81–98.
22. Rashid B, Qazi A K, Khabir A. Long-Term Outcome of Primary External Dacryocystorhinostomy. *Journal of the College of Physicians and Surgeons Pakistan* 2013; 23(9): 641-4.
23. Rosen N, Sharir M, Moverman DC, Rosner M. Dacryocystorhinostomy with silicone tubes: evaluation of 253 cases. *Ophthalmic Surg* 1989; 20: 115–9.
24. Shun-Shin GA, Thurairajan G. External dacryocystorhinostomy-an end of an era? *Br J Ophthalmol* 1997;81:716–7.
25. Tarbet KJ, Custer PL. External dacryocystorhinostomy: surgical success, patient satisfaction and economic cost. *Ophthalmology* 1995;102: 1065–70.
26. Tessa F, Tania L, Eugene T, Jane M. Lacrimal Surgery Success After External Dacryocystorhinostomy: Functional and Anatomical Results Using Strict Outcome Criteria. *Ophthal Plast Reconstr Surg* 2009;25:472–5.
27. Toti A. Nuovo metodo conservatore di cura radicale delle suppurazioni croniche del sacco lacrimale (Dacriocistorinostomia). *Clin Moderna Firenze* 1904; 10:385-7.
28. Walker RA, Al-Ghoul A, Conlon MR. Comparison of nonlaser nonendoscopic endonasal dacryocystorhinostomy with external dacryocystorhinostomy.
29. Wesley RE. Lacrimal disease. *Curr Opin Ophthalmol* 1994;5:78–83.
30. Yigit O, Samancioglu M, Taskin U, et al. External and endoscopic dacryocystorhinostomy in chronic dacryocystitis: comparison of results. *Eur Arch Otorhinolaryngol* 2007; 264:879-85.