

Outcomes of Endoscopic Endonasal Dacryocystorhinostomy with Nasal and Lacrimal Flaps Preservations

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ABSTRACT

Background: Endoscopic Endonasal Dacryocystorhinostomy (DCR) is common surgical procedure in the treatment of chronic dacryocystitis to overcome the distal naso-lacrimal system obstruction; nonetheless, after surgery, stenosis, and failure are common. Despite the satisfactory results obtained with the traditional external approach, the disadvantage of this method is the need for skin incision that cause consequent scar.

Objective: To assess the outcomes of Endonasal Endoscopy Dacryocystorhinostomy with preservation of nasal and lacrimal mucosa

Patients and methods: This was a clinical trial conducted in Najaf at Al-Sader Medical City, Iraq, during the period from October 2019 to 2021. Endoscopic endonasal DCR was performed which involved creating nasal mucosal and large posterior lacrimal flaps, at the medial wall of the lacrimal sac with close apposition of the two flaps.

Results: Septoplasty was performed in (14.2%) of cases at the time of operation to get access to lacrimal sac area. In 8.5 percent of cases, conchoplasty from the middle turbinate was also added to this method. Revision surgery was done in 5 (14.2%) cases. In 7 patients stents were placed on. Symptomatic and anatomical success was reported in 94.2%. The success rate using this method was comparable to that of an external technique & it could be better than other endoscopic techniques.

Conclusion: Mucosal flap preservation is probably more important innovation in endoscopic DCR surgery what makes it convenient for the surgeon, and for the patient, as well as we reported a 94.2% success rate, the procedure was simple, affordable and comparable to external DCR and better than other endoscopic techniques.

Keywords: Epiphora, Nasolacrimal duct obstruction, Endoscopic endonasal dacryocystorhinostomy, Flap preservation, Outcome.

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1. INTRODUCTION

The anatomical location of the lacrimal duct has meant a continuous search for surgical techniques to approach it, which obtain at least the same results as the external approach, being able to add aesthetic advantages by avoiding facial injury or endonasal correction of concomitant pathology. or cause of the underlying pathology. Caldwell described the intranasal approach for the first time in 1893 (1), without being accepted due to visualization difficulties at the time, which would later be resolved with the use of microscopes and endoscopes, being in 1953 when Heermann began this technique. using a microscope, and it is in 1989 when McDonogh and Meiring describe endoscopic dacryocystorhinostomy (DCR) as we know it today and publish their results (2), assuming an alternative to external DCR since the results it offers are not worse than external DCR technique (3,4). Dacryocystitis is a disease that can be of congenital or acquired etiology, caused by obstruction of the nasolacrimal duct. Congenital obstruction can be caused by developmental abnormalities, failure to open the valves that form the lacrimal ducts, or tumors (5). They can be classified according to the place of obstruction as proximal obstruction of the lacrimal ducts: It affects the lacrimal puncta and the canaliculus system. Distal lacrimal duct obstruction: Affects the lacrimal sac and lacrimal-nasal duct (congenital lacrimal sac fistula, congenital dacryocystocele, congenital dacryocystitis or dacryostenosis, and congenital facial defects). The acquired one is produced by degenerative causes, by infectious or inflammatory processes at the level of neighboring structures and by facial trauma. It has been reported as more frequent on the left side and in individuals with brachycephalic skulls, in Caucasians, and in people with a worse socioeconomic situation. Studies show that between 70-83% is more common in women (6–8). The traumatic ones are caused by naso-orbital and Le-Fort II fractures, among others, this being the most frequent cause in men between 18 and 40 years of age. However, it is not uncommon to find patent lacrimal ducts in which there are no obstacles during examination despite the presence of epiphora. In these cases, other causes should be sought, such as abnormalities in the statics or dynamics of the eyelids (external canthal laxity, ectropion, orbicularis nerve palsy) or lacrimal pump dysfunction (9). Acquired dacryocystitis can be acute or chronic, the latter can present with tearing and secretion of

generally sterile mucus on compression of the sac, and can be associated with conjunctivitis (10,11). The definitive treatment when there is an obstruction of the duct is surgical. Endoscopic dacryocystorhinostomy is currently the surgical technique of choice (12). Endoscopic DCR is a relatively simple and fast surgical technique that, with the improvement of vision systems and surgical material, has success rates that are statistically very similar to those of the gold standard, external DCR (13,14) The success rate of endoscopic DCR is described in the literature from 85 to 94% according to different authors (3,4,12–15). The endoscopic approach versus the external one avoids making a facial incision, bleeding in a very limited surgical field, and possible canalicular stenosis (16,17). The endoscopic approach makes it possible to explore and treat endonasal pathologies that may contribute to or be the cause of lacrimal pathology. There is a dichotomy of opinion regarding the preservation or not of the lower base flap with subsequent replacement over the osteotomy, with some authors presenting better results with its preservation. The performance of post-surgical endoscopic cures is also a matter of debate, with authors having presented better results with their performance (18,19). Endoscopic dacryocystorhinostomy (DCR) is a creation of a fistula from lacrimal sac into the nose. Its main use is in cases with obstruction of the distal outflow for the lacrimal system (1). It is well known in many literature about external DCR that a small ostium is not achieving the same success as a larger lacrimal sac opening (20). There is a growing body of literature supporting the endoscopic approach. DCR Success rate documented to be comparable to the traditional external approach (21,22). Advantages of endoscopy DCR include no skin incision and scars, keeping the eye pumping mechanism of orbicularis oculi muscle, Fewer interruptions of the medial canthal canal anatomy, shorten the operation time, reduce bleeding during surgery and the ability, at the same time, to address anomalies of the nasal cavity or sinuses (23,24). Tearing occur as a result of both hypersecretion of tears (lacrimation) or lack of drainage (epiphora). However, aacquired nasolacrimal obstruction could occurs with epiphora and/ or infection. On the other hand, epiphora can be unilateral or bilateral and can be constant or intermittent. This may be due to trauma in the middle face , diseases of sinuses or surgical, inflammatory diseases and episodes of previous lacrimal sac Inflammation. DCR indicated for symptomatic distal obstruction of the nasolacrimal duct that not resolved by probing and syringing. This suggests

that the lock is in the tube and the endoscopy rating is DCR Will not ignore these areas. The crucial element for successful treatment of pathology in the distal lacrimal system that need endoscopic endonasal non-laser DCR is the creation of as many as possible marsupialization of the lacrimal sac medial wall (25). Surgical failure are not uncommon with endonasal endoscopic DCR, and the main cause of failure in endonasal endoscopy DCR is neostium blocked by granulation tissue or posteriorly formed synechiae after the operation (26,27). Epiphora due to obstruction of the nasolacrimal is anatomical in (70%) of cases and functional in (30%). However, many obstructions of the nasolacrimal system are unknown. Idiopathic obstruction is most commonly observed with increasing age, and shows a predominance of women who initially acquire lacrimal duct obstruction. Less common causes of obstruction are congenital , traumatic granulomatous such as Wegener's granulomatosis . There are three grades of epiphora identified: Grade I , II and III, according to its occurrence, outside in cold and windy weather, permanent outside and permanent outside and inside, respectively (28–30). Examination of the patient epiphora before surgery includes the full history and through clinical examination of the eye and nasal cavity and clinical tests, in addition to imaging like CT-scan, MRI and lacrimal scintillography (31,32).

2. METHODOLOGY

This was prospective clinical trial conducted in Al Najaf city, at Al-Sader Medical City, department of otolaryngology during the period from 2019 to 2021.

Endoscopic endonasal DCR was done in 35 eyes of 35 Patients. Patients included 23 females and 12 males aged 14-60 years. All patients in our clinic who have lacrimal obstruction were examined with lacrimal irrigation and probing to confirm anatomical obstruction, or distal to sac level.

Inclusion criteria

1. Nasolacrimal obstruction ; primary or PANDO
2. Patients with, patent, superior, inferior or common canaliculi.
3. Normal eyelid function
4. Complete nasolacrimal obstruction due to chronic / acute recurrent dacryocystitis.
5. Patients who were presented with previous lacrimal surgery

Exclusion criteria

1. Presaccal Obstacle confirmed by probing
2. Patients with ophthalmological proved failure of drainage system.
3. Anomalies of the eyelid.
4. Acute inflammation of the lacrimal passages
5. Bone pathologies that affect the nose or orbit.
6. Suspected malignant neoplasms of the lacrimal system.
7. Radiotherapy of the head.

In the case of acute dacryocystitis, surgery was scheduled after a week of antibiotic treatment.

In all cases a rhinoscopy and an endoscopic nasal assessment were done to check access, nasal septum deviation, hypertrophy of turbinate, or any other concomitant pathologies. All patients were tested to exclude SARS– COV19 infection. All cases were examined by specialist expert anesthesiologist for their general clinical conditions and fitness for general anesthesia. All operations were performed under general anesthesia and intravenous antibiotics were given before the operation. Position was reverse trendelenburg, with the head, elevated at almost in 30 positioning. This operation was performed using a video camera connected to a hard 4 mm Hopkins 0 " Nasal Endoscope (Storz).

Surgical technique included creating a posteriorly based mucosal flap, elevate the flaps, remove the frontal maxillary process, lacrimal sac marsupialization and mucosal flap repositioning.

Pass the silicon tubes:

In cases of revision DCR the puncta are dilated and silicon lacrimal tubes (O'Donoghue tubes) are placed through the upper and lower puncta and retrieved endonasally

Before cutting the silicon tubes a square of gelfoam is placed over the flaps to hold them in position. The silicon tubing is cut and the position of the flaps checked before it is replaced. The postnasal space is cleared of blood. The surgical site was packed with a small piece of merocel to hold the flap in position and to ensure homeostasis. The duration of surgery was measured.

Bleeding throughout the operation is assessed according to Modena bleeding score [48]. A high Deviated Nasal Septum (DNS) adjacent to the anterior end of the middle turbinate was removed endoscopically, the anterior cartilage was kept intact. In three cases, conchoplasty was performed to improve access and to avoid post-operative synechia formation. Stents were placed in seven cases: five requiring revision surgery and two with lacrimal fistula.

Postoperative Care

The Patients were discharged uneventfully the day after surgery with broad-spectrum antibiotics for 5 days [cefepodoxime 200mg once daily] ., antibiotic /steroid eye drops [tobradex, three times daily] and topical nasal steroids [Budesonide] are used for 4 weeks aiming to reduce granulation formation around the lacrimal stoma. The nasal pack was usually removed after 24 hours. Hypertonic 2.3% saline nasal spray is started in the day 1 of surgery, this aids in clearing any residual blood clots and keeping the nasal cavity moist and clear of secretions. Patients were advised to avoid nose blowing for 4–7 days, as to avoid nasal hemorrhage and orbital emphysema. Patients asked to perform regular gentle massages of the external aspect of the lacrimal sac (inner angle of the eye) to facilitate drainage. Silastic splint were removed in the first visit (1st week). The silicon tubes used to stent the surgical ostium is removed 8-12 weeks post operatively. In this study, three postoperative follow-up visits were scheduled, the first one being at 1 week, the second one at 1 month and the last one at 3 months. Outcomes were evaluated subjectively using patient symptoms, syringing results and endoscopic appearance. Epiphora was assessed according to the Sahlin et al. score (33). Nasal obstruction assessed using visual analogue score. Nasal bleeding: if bleeding continue more than an hour post de-packing the nose, or any time after that. Endoscopic visualization of the nasal cavity was performed in order to remove crust and granulation and to check the patency of the newly created ostium using lacrimal irrigation.

Post-operative complications was assessed and reported.

Statistical analysis was carried out using SPSS version 23. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as (Means \pm SD). Statistical tests for comparisons were applied according to the variables type, chi-square test and Fisher's exact test used alternatively when applicable. Level of significance of

0.05 was considered as a cut-off point below which the difference considered statistically significant the results presented in tables and figures accordingly using the MS. Office version 2013, Word and Excel software

3. RESULTS

The baseline (preoperative) characteristics of the studied group are shown in (**Table 1**), where the mean age of the 35 patients was 38.3 ± 10.8 (range: 14 – 60) years. Females were dominant (65.7%), with a female to male ratio of 1.9 to one. Five patients had history of previous lacrimal surgery while none had a history of nasal trauma, Nasal obstruction reported in 5 patients (14.3%). Majority of the patients presented with Epiphora, (85.7%), 8.5% with mucocele and two patients with Lacrimal fistula, (**Table 1**). Intraoperative assessment revealed a mean operation time of 70.7 ± 12.5 (Range: 55-95) minutes, bleeding score of 2 in 15 (42.8%) of patients, score of 3 in 17 (48.6%) and a bleeding score of 3 reported in only 4 cases (8.6%), (**Table 2**). Follow-up of the patients postoperatively, after one week, one month and after three months revealed a significant improvement in the Epiphora at each assessment time, complete improvement in epiphora was 17.1% after one week, increased to 71.4% after one month and 74.3% at three months, nasal bleeding reported in only two cases after one week postoperatively and none of the patients had nasal bleeding at the next follow up time. Complete nasal obstruction observed in only three (8.6%) of cases at the first week postoperatively, however, nasal obstruction rate reduced significantly during the follow up period where 82.9% of the cases had no obstruction by the third month of follow up compared to only 20% at the first week, (**Table 3**). Findings of the postoperative objective assessment of the patients are summarized in (**Table 4**), at first week, stoma was patent in all cases, however, after three months, it was patent in 33/35 (94.2%) and obstructed in 2 cases (5.7%). Granulation tissue was present in 4/35 cases at the first postoperative week only, none of the cases had granulation tissue formation at the next follow up assessments, at one month and 3 months postoperatively. Adhesion occurred in 60% of cases at the first week, reduced to 42.9% at one months and the rate was 28.6% after three months. In general, complications were reported in 8.6% of the cases, (**Figure 1**), these complications were orbital complications (one patient developed periorbital

ecchymosis ,one patient developed periorbital oedema and periorbital saline collection along the inferior lid, noted during syringing in one case, due to creation of a false track during canaliculi probing). One case punctal injury (as a result of silicone tubes placed under too much tension).

Table 1. Preoperative characteristics of the studied group (N=35)

Variable	No.	%	
Gender	Male	12	34.3
	Female	23	65.7
	F:M Ratio	1.92	-
Presentation	Epiphora	30	85.7
	Mucocele	3	8.6
	Lacrimal fistula	2	5.7
History of previous lacrimal surgery	5	14.3	
Nasal obstruction	5	14.3	

Mean age (SD): 38.3 ± 10.8 (range: 14 – 60)

SD: Standard deviation

None of the patients had a history nasal trauma None

Table 2. Intra-operative assessment of the studied group (N=35)

Variable		
Operative time (minutes)	<i>Mean ± SD</i>	70.7 ± 12.5
	<i>Range</i>	55 - 95
Bleeding score* n (%)	2	15 (42.8)
	3	17 (48.6)
	4	3 (8.6)

* Bleeding score assessed according to the Modena bleeding score (34)

SD: Standard deviation

Table 3. Findings of subjective post-operative assessment of the studied group at the three assessment times (N=35)

Variable		Postoperative assessment time		
		One week	One month	Three months
		No. (%)	No. (%)	No. (%)
Epiphora improvement	Complete	6 (17.1)	25 (71.4)	26 (74.3)
	Partial	29 (82.9)	10 (28.6)	7 (20.0)
	None	0 (0.0)	0 (0.0)	2 (5.7)
Nasal bleeding	Yes	2 (5.7)	0 (0.0)	0 (0.0)
	No	33 (94.3)	35 (100.0)	35 (100.0)
Nasal obstruction	Complete	3 (8.6)	0 (0.0)	0 (0.0)
	Partial	25 (71.4)	8 (22.9)	6 (17.1)
	None	7 (20.0)	27 (77.1)	29 (82.9)

Epiphora resolution was determined according to Sahlin Score; based on the the final post-operative assessment and scored as followed: (0) complete resolution, (1) partial improvement (2,3) no change or worsen (33).

Table 4. Findings of objective post-operative assessment of the studied group at the three assessment times (N=35)

Variable		Postoperative assessment time		
		One week	One month	Three months
		No. (%)	No. (%)	No. (%)
Stoma patency	Patent	35 (100.0)	31 (88.6)	33 (94.2)
	Obstructed	0 (0.0)	4 (11.4)	2 (5.7)
Granulation tissue	Present	4 (11.4)	0 (0.0)	0 (0.0)
	Absent	31 (88.6)	35 (100.0)	35 (100.0)
Adhesion	Present	21 (60.0)	15 (42.9)	10 (28.6)
	Absent	14 (40.0)	20 (57.1)	25 (71.4)

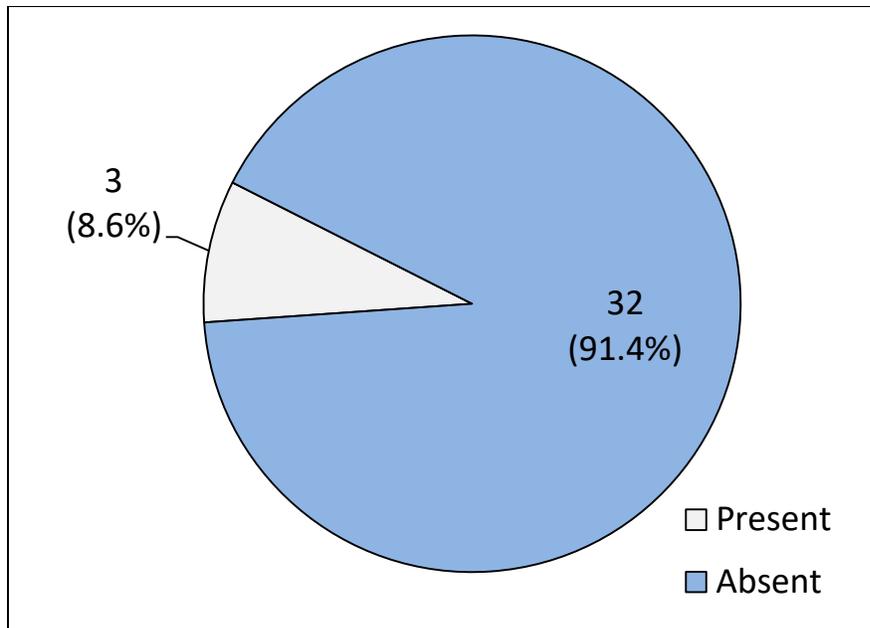


Figure 1. Distribution of patients according to orbital complication

4. DISCUSSION

Epiphora is a significant and annoying health problem that impact the patient socially and functionally. Epiphora occurs as a result of a obstruction of the nasolacrimal duct managed usually with that two methods; external and endoscopic DCR. For the treatment of nasolacrimal obstruction, endoscopic DCR documented to be a reliable and efficient procedure with results that are comparable to traditional external methods. Some otolaryngologists recommend endoscopic DCR as a primary method for the treatment of nasolacrimal duct obstruction (4). When endoscopy DCR compared to external DCR, it has cosmetic acceptability advantages the acceptability; less operative time; minimal blood loss; less risk of disrupting the physiological mechanism of lacrimal pump; simultaneous treatment of internal pathology and possible biopsy, if necessary, because the lacrimal sac is opened and directly visualized (35). Wormald (36) supported the idea that the size of the bony ostium and extent of sac exposure are important for the patency of the newly performed ostium after surgery. The goal of mucosal flaps creation and preservation with primary juxtaposition of the mucosal margins, is the healing by primary intention. This method is shown to produce large and stable ostium with excellent functional performance.

However, failure is not uncommon with DCR and the commonest cause of failure is re-closure of the nasolacrimal stomas with granulation tissue and synechiae (37). Another common belief is that the maintenance of nasal mucosal flap can assist in reduction of granulation formation of synechiae. Additionally, there is no strong evidence of increased frequency of complications with mucosal preserving method (38). The current study aimed to assess the outcomes of endoscopic endonasal DCR with nasal and lacrimal flaps preservations among group of Iraqi patients, hence, a total of 35 patients were enrolled in this study with a mean age of 38.3 ± 10.3 years. Almost two thirds of the patients were females with female to male ratio of 1.9 to one , these findings agreed that reported in previous studies (21,39,40), the higher rate of females among these patients could be explained by the fact that females have narrower bony nasolacrimal canal lumen than males (41). From other point of view, it has been noted that chronic dacryocystitis is more common in women of low socio-economic status because of their bad personal habits, exposure to smoke and dust in the external environment. Besides that, the use of cosmetics increases the likelihood of transmission of infection (42). Regarding the mean age and range, our findings are consistent with the studies of Ibrahim et al. (40) and Kamal et al. (43) who showed an average age of almost 34 years with a range of 4 - 75 years. Al-Helo et al. (44) found an average age of (30.5) year. This suggests that the development of lacrimal duct obstruction can occur in any age but more common in the middle age groups; nonetheless, there is a tendency to be lower in both extreme ages. This may be due to the fact that the amount of lacrimal secretion is at least in these age groups (45). The mean operation time was 70.71 ± 12.49 (range: 55 – 95) minutes. Which was higher than that found in Moras et al. study in 2011 [60] , and Al-Abbasi et al.(46). Who reported a mean time of 45 and 35 minutes, respectively. This difference may be due to differences in the facilities and existing problems with stenting in some cases. In our study, limited septoplasty was performed in five cases to allow good access for this method. In (15%) of the patients, nasal pathologies were managed surgically, at the same time as DCR. Variant proportions of surgically managed nasal pathologies were reported in previous studies ranged between 8.3%-33.3% (35,47,48) In our study, at the end of this procedure we used silicone tubes in seven patients. As there is no consensus, many authors suggested using the tubes in revision cases with narrow nasal

cavity, or canalicular stenosis (37). Other factors contributing to silicon intubation, may include a previous acute dacryocystitis, excessive bleeding, bad flaps inflammation, and small lacrimal sac(49). The role of using a silicone stent in endoscopic DCR surgery is not well recognized as a very promising, because it is not improve the outcomes; But it has been noted that patients with stent were more likely to develop granulation, which can lead to failure of procedure. It is also add cost to the surgery, complex operation and can irritate patients and sometimes very painful on removal (47). Some authors found that the success rate is better without stenting while other authors found no significant difference (50,51) other authors did not reported difference in the success rates between cases with or without stenting (52,53). Subjective improvement of epiphora and anatomical patency was observed in 94.2%, two patients (5.7%) had no improvement, one patient developed adhesion between the flaps and the stoma, while another patient developed granulation tissue around the stoma that is prohibited drainage of tears and stenosis of the stoma and is considered failed surgery. Our success rate falls within the range reported in the literatures; Tsirbas and Wormald (21) reported an anatomical success rate of 95% of mucosal preservation for the construction of flaps, which is comparable to external DCR and better than other endoscopic techniques. In previous studies, the success rates ranged between 90.9% to 98.4% (42,46,54,55). Khalifa et al. (56) reported that endoscopic DCR with mucosal flaps, had a higher success rate of (92.1%) compared to endoscopic surgery DCR without mucosal flap (87.4%), and this is also consistent with our results. In our study, 4 Patients (11.4%) had granulation tissue around DCR stomas. In many of them, the granulation tissue was removed under local anesthesia. In this study, we believe that this complication occurred due to the silicone tube, which promotes granulation and thus increases the failure rate; It is believed that a silicone stent helps maintain the patency of the of the ostium. Sonkhya et al. (57) reported 2% of patients developed granulation tissue around the neo ostium, in flap preservation technique. Nasal synechiae between the nasal septum and the lateral nasal wall was the commonest complication among our cases and was contributed for (28.6%). Nasal synechiae could be attributed to the irritation caused by the presence of silicone tube, additionally, also it may be due to trauma to the septum and middle turbinate during operation. Although a significant proportion (28.6%) of our patients developed

adhesions, but the patency of the opening was not affected they will not affect the permeability was easily and removed during the routine post-operative follow up, however, failure of EDCR documented in two cases, due to the adhesion between the lateral nasal wall and the middle turbinate. Hasan et al. (52) reported synechiae in 15 cases (20.8%). Mann and Wormald (58) assumed that DCR ostium shrinks a small but remarkable in the first four weeks postoperatively, and then stabilized. Our findings supported that of Wormald (36) where a large bony ostium and a complete exposure of the lacrimal sac are essential for achieving post-operation ostium, and is thus comparable to the external DCR. In our study, (8.6%) patients had orbital complications (periorbital ecchymosis & periorbital edema) however the edema subsided after one day and ecchymosis disappeared in few days. One patient developed lower canaliculus laceration. Ananth et al reported 6.4% incidence of lid edema (59)

5. CONCLUSIONS

A high success rate of 94.2% was obtained with endoscopic endonasal DCR approach for the treatment of Epiphora. Endoscopic endonasal DCR was a reliable alternative to the external DCR with low complication rate and good outcomes. Therefore, we strongly supported the idea that Endoscopic endonasal DCR can emulate the external technique as it is less invasive and a bare minimal giving a better outcomes. This method requires experience in endoscopic surgery. We take advantage of the fact that the combination of large bony ostium and covering exposed lacrimal bone, with the preservation of the nasal mucosa, at the end of the operation, are essential to achieve good outcomes. We recommend the preservation of mucosal flaps to achieve a successful clinical outcome, based on the reserving and normal anatomical and physiological functions of the nasal mucosa. The question of introducing a silicone tube, which is still under debate, it is better to use it in some cases to increase the probability of success. Further studies in multiple centers are still suggested for more precise evaluation and comparison

Ethical Approval:

All ethical issues were approved by the author. Data collection and patients enrollment were in accordance with Declaration of Helsinki of World Medical Association , 2013 for the ethical principles of researches involving human. Signed informed consent was obtained from each participant and data were kept confidentially.

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