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ORIGINAL RESEARCH—SINONASAL DISORDERS

Long-term results in endoscopic dacryocystorhinostomy: Is intubation really required?

Halis H. Unlu, MD, Kivanc Gunhan, MD, Esin F. Baser, MD, and **Murat Songu, MD,** Manisa, Turkey

OBJECTIVE: The long-term (median follow-up eight years) results of endoscopic dacryocystorhinostomy approach and silicone intubation were evaluated by various aspects.

STUDY DESIGN: Case series with planned data collection of 38 procedures for postsaccal stenosis were analyzed.

SUBJECTS AND METHODS: Silicone intubation was not used in 19 of the randomly selected procedures. Anatomical and functional surgical success was evaluated subjectively and objectively.

RESULTS: The patients' complaints improved in 84.2 percent of eyes in the intubation group, and in 94.7 percent of the group without intubation, with a mean follow-up of 112 and 96 months after surgery, respectively. Postoperative endoscopic examinations revealed that the rhinostomy opening was visible in 17 sides with intubation (89.5%) and 18 sides without intubation (94.7%).

CONCLUSIONS: Considering the similar surgical success rates, and disadvantageous factors such as granulation formation, patient discomfort, and cost related to intubation, we recommend endoscopic dacryocystorhinostomy without intubation as the treatment of choice in cases of chronic epiphora due to postsaccal stenosis of the lacrimal drainage system.

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Epiphora is a socially and functionally bothersome symptom, and usually has to be corrected surgically when caused by lacrimal drainage obstruction. Initial surgical approaches to treating nasolacrimal duct obstruction (NLDO) that were described by Caldwell and West in the late 1800s and early 1900s were endonasal.[1,2] Sabuncuoglu has colored drawings of the instruments and surgical procedures for endonasal lacrimal surgery in his book, Cerrahiyyetu'l-Haniyye (Imperial Surgery), back in the 1450s.[3] In the twentieth century external dacryocystorhinostomy (Ex-DCR) has been the most commonly used approach to treating NLDO. This technique has been through various modifications by the concept of nasal and lacrimal mucosal flaps to create an epithelium-lined fistula. Ex-DCR remains the gold standard in the treatment of acquired NLDO.

The advent of high-resolution endoscopes and instrumentation for paranasal surgery revolutionized rhinologic procedures as precise mucosa-preserving surgical techniques were introduced under excellent visualization. After endoscopic dacryocystorhinostomy (En-DCR) was first reported by Rice, endonasal DCR gained a renewed popularity.[4] It has been proposed as an alternative surgery to Ex-DCR in cases of NLDO.[5]

Closure of the rhinostomy opening is considered a main factor in surgical failure in Ex-DCR.[6] In Ex-DCR, several methods such as use of silicone tubing, application of mitomycin C to the rhinostomy opening, and suturing of the mucosal flaps have been suggested to maintain a permanent rhinostomy opening after completion of mucosal healing.[7-9] However, since the application of mitomycin C is controversial and no mucosal flaps are created and sutured in En-DCR, bicanalicular insertion of silicone tubing into the lacrimal duct is the most commonly preferred procedure to prevent the closure of the rhinostomy. It has been claimed that silicone tubing would improve surgical outcomes of En-DCR.[6,9] Our experience with En-DCR without silicone intubation revealed that the surgical success rate was about 90% in primary cases—similar to the rate in several reports from different clinics.[10,11] This high success rate raises the question of to what extent additional benefit can be obtained by using silicone tubing. Therefore, the aim of this study is to analyze the long-term outcomes of En-DCR and compare silicon intubation (SIT) with no intubation (NIT).

MATERIALS AND METHODS

En-DCR was applied to 42 adult patients between December 1995 and December 2000. Six of the patients were lost to follow-up because they moved to other cities. These patients mentioned no epiphora complaints in a telephone survey. Prospectively planned data collection of 38 sides of 36 patients who had a follow-up period longer than seven years (8.1 years in average, which is the longest duration for statistical evaluation in our case series) after En-DCR were

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evaluated in the study. Institutional review board approval was obtained. All patients were reviewed for potentially comorbid disorders and past medical history for previous lacrimal or facial surgery or trauma, facial nerve palsy, paranasal sinus surgery, suspicion of malignancy and radiochemotherapy, and chronic systemic inflammatory diseases, and underwent complete preoperative ophthalmologic (for other causes of epiphora such as hypersecretion or lacrimal pump failure) and endoscopic nasal examination (to rule out structural, inflammatory, or neoplasmic disorders of the nasal passages). The duration of epiphora was 1 to 3 years in all patients. NLDO was investigated by Jones I and II tests. Active transport dacryocystography was performed to determine the site of obstruction as described in earlier reports and chronic sinonasal disease.[12] Patients with acquired postsaccal stenosis that had normal or dilated lacrimal sacs underwent En-DCR. Patients with scarred or atrophic sac were referred to the Department of Ophthalmology for Ex-DCR.

All procedures were performed by a joint team headed by the senior otorhinolaryngologist (HHU) and the referring ophthalmologist. The decision of SIT or NIT was assigned randomly. These two groups of patients were fairly homogeneous regarding their preoperative clinical findings.

The surgical technique of En-DCR was described in detail and summarized as follows.[11] The nasal mucosa was decongested using neurosurgical patties soaked with a mixture of 4 mL 1 percent lidocaine hydrochloride with 1:100,000 epinephrine bitartrate solution, diluted with 4 mL saline. After general anesthesia was induced the other half of this solution was infiltrated above and anterior to the middle turbinate. A posterior incision using a sharp sickle knife was placed 5 mm anterior and superior to the middle turbinate attachment (so-called axilla) and 10 mm anterior to the free border of the uncinate process. These two incisions were combined with a vertical incision 5 mm anterior to the axilla, to create a rectangular mucosal window of 5 × 10 mm

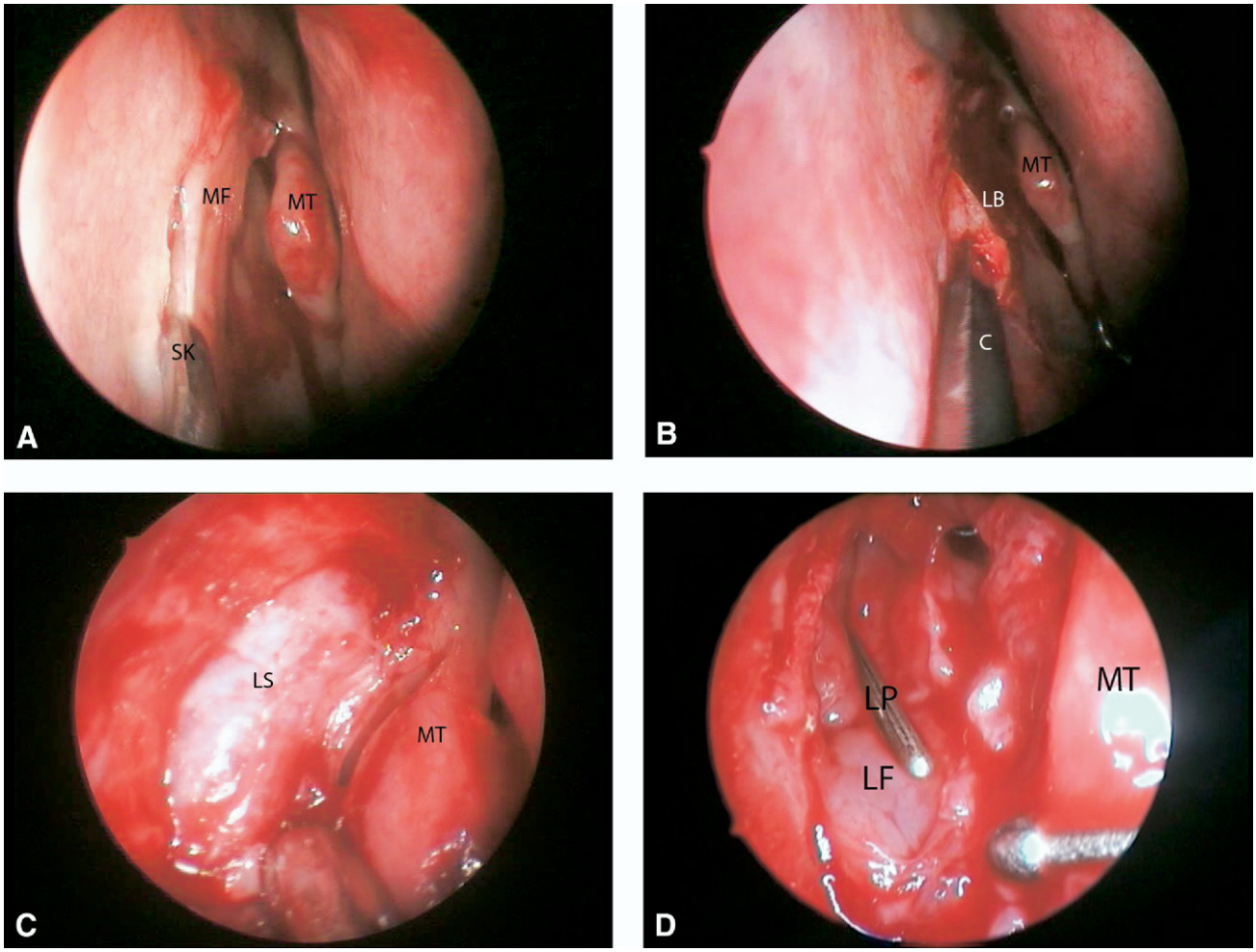

Figure 1 Surgical steps of En-DCR procedure. **(A)** A rectangular mucosal flap is formed. **(B)** Removal of the lacrimal bone using a 2-mm chisel. **(C)** Exposure and tenting up the medial wall of the lacrimal sac with a lacrimal probe. Projection of the sac no larger than the skeletonized bone. **(D)** Final appearance of the lacrimal fistula after removal of the medial wall of the lacrimal sac with a through-cutting forceps. MF, mucosal flap; SK, sickle knife; MT, middle turbinate; LB, lacrimal bone; C, chisel; LS, lacrimal sac; LP, lacrimal probe; LF, lacrimal fistula.

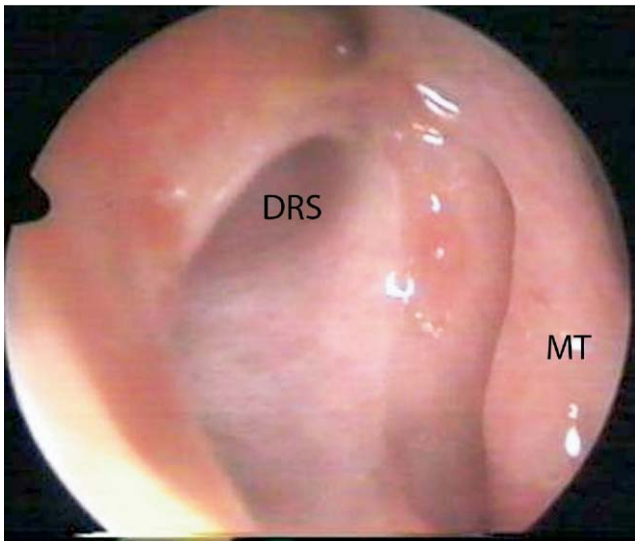

Figure 2 Normal rhinostomy opening of a right sided En-DCR without silicone intubation (postop 8.7 years). DRS, dacryorhinostomy site; MT, middle turbinate.

in dimension (Fig 1A). The mucosa elevated from the bone was trimmed with a forceps. The lacrimal bone was removed with a micro-chisel and hammer (Fig 1B). Kerrison punch was used to smoothen the edges when required. Attention was paid to the size of bone removed to be no larger than the projection of the sac and the lacrimal system; since the more skeletonized bone was exposed the more granulation tissue was seen postoperatively, as mentioned in our anatomical study.[13] The resulting osteotomy was approximately 5 × 10 mm in diameter (Fig 1C). The medial sac wall was tented up with a probe. A vertical incision was made on the wall of the sac by a sharp sickle knife, and a section of the medial wall approximately 5 to 10 mm in diameter was resected with a through-cutting forceps (Fig 1D). The lacrimal canal was irrigated with saline solution for verification of the patency. When silicone intubation was placed, the tubes were cut free from stainless steel probes, advanced into the opened sac carefully under magnified endoscopic view, and knotted together intranasally, ensuring that there was no tension on the loop of the lacrimal tubes in the medial canthal region.

All patients received broad-spectrum oral antibiotic therapy for 10 days, nasal lavage with saline, and intranasal corticosteroid spray for four weeks. The patients were examined once a week in the first month postoperatively. Fibrin clots and crusts were removed endoscopically, in case they caused discomfort to the patient. Thereafter, the examinations were made every two weeks until mucosal healing was complete. The silicone tubes were removed in the eighth postoperative week. The presence of silicone tubing impeded us from doing a thorough endoscopic cleaning of the rhinostomy site. Follow-up examinations were conducted every two months for the first year, and then once yearly.

Success has been determined either by postoperative anatomic patency of the nasolacrimal duct system or by relief of epiphora.[14] In this study the surgical outcome was evaluated both subjectively and objectively before the surgery was declared successful. In the subjective assessment, the patients were asked to grade the degree of epiphora relief on a 5-point Likert scale: a score of 1 for symptom-free, 2 for significant improvement, 3 for slight improvement, 4 for no improvement, and 5 for worsening of the symptoms. Any declaration of improvement by the patient (1, 2, or 3) was considered successful. They were asked whether they were disturbed by the silicone tubes, or by the frequent postoperative nasal examinations. Overall satisfaction was questioned as to whether they would have the same operation if required.

The objective assessment examined the visibility of the rhinostomy opening (Fig 2), the presence of granulation tissue or scarring at the rhinostomy opening (Fig 3), and the functionality of the lacrimal pump system by fluorescein dye test (via Jones I test) (Fig 4). Also, the performance of additional surgery and the presence of intranasal synechiae were recorded.

The statistical significance was analyzed with Mann-Whitney U test for subjective assessment and Pearson χ^2 test was used for all other categorical variables using SPSS 11.0 (SPSS Inc., Chicago, IL) software.

RESULTS

A prospective interventional case series with an average of eight years (7-13 years) of follow-up was undertaken. The study included 38 En-DCR procedures in 36 patients. The demographic and operational characteristics of the patients

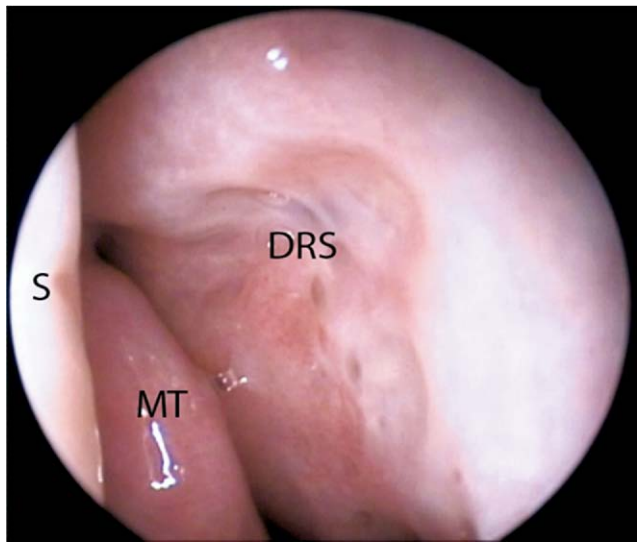

Figure 3 Scarring and closed apperance at the dacryorhinostomy site of a left-sided En-DCR without silicone intubation (postop 11.4 years) of a patient that is subjectively reported as functional by the patient and nonfunctional by the examiner. DRS, dacryorhinostomy site; S, septum; MT, middle turbinate.

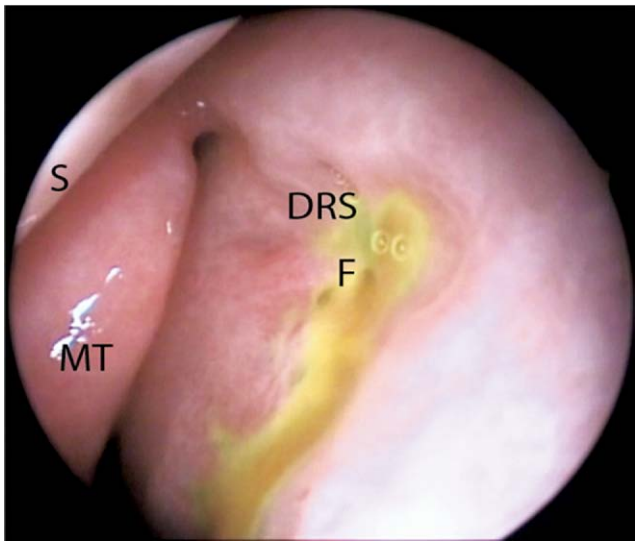

Figure 4 Same patient's positive Jones I fluorescein dye test showing the functionality of the dacryorhinostomy opening. S, septum; MT, middle turbinate; DRS, dacryorhinostomy site; F, fluorescein dye.

Table 2
Subjective assessment

	SIT		NIT		
	#	%	#	%	*P*
Subjective assessment					0.146
Symptom free	12	63.1	16	84.2	
Significant improvement	3	15.8	2	10.5	
Slight improvement	4		—	—	
No improvement	—	21.1	1	5.3	
Worse	—		—	—	
Outcome					0.123
Success	16	84.2	18	94.7	
Failure	3	15.8	1	5.3	
Discomfort from SIT					
No	15	78.9			
Yes	4	21.1			
Overall comfort					0.290
Positive	16	84.2	18	94.7	
Negative	3	15.8	1	5.3	

SIT, silicon intubation; *NIT*, no intubation.

are presented in Table 1. Silicone intubation was used in 19 of the eyes, and no stenting device was used in 19 eyes. Two of the cases with SIT and two of the cases in NIT groups included additional procedures. The indications for additional procedures are shown in Table 1. The average follow-up duration was 103.8 ± 9.3 months (ranging from 86 to 150 months) in the SIT group, whereas it was 97.4 ± 8.6 months (ranging from 84 to 137 months) for the NIT group.

The outcomes of subjective assessment of the surgery are shown in Table 2. Surgery was successful in 16 sides with SIT (84.2%). Two cases in this group were revision surgery. The success rate was 94.7 percent (18/19) for patients in the NIT group. One patient underwent revision surgery in this group. The secondary success rate after revision surgery was 89.5% (14/16) for patients in the SIT group. There was no statistically significant difference between the surgical outcomes of the groups on the basis of the subjective evaluation.

The data from the objective assessment are presented in Table 3. Four of the patients with SIT (21.1%) had some form of scarring at the rhinostomy opening, whereas two of the patients without tubing (10.5%) also had scarring. This difference did not reach statistical significance ($P = 0.209$). The functionality of the lacrimal system with an open rhinostomy as assessed by 2 percent fluorescein solution and Jones I test was evaluated as 84.2 percent and 89.5 percent,

Table 1
Descriptive characteristics

	Silicone intubation	No silicone intubation	All sides
Sex			
Male	5 (26.3%)	4 (21.1%)	9 (23.7%)
Female	14 (73.7%)	15 (78.9%)	29 (76.3%)
Age (y)			
Mean	53.5 ± 7.6	57.2 ± 11.8	55.4 ± 14.7
Range	38-73	32-70	32-73
Follow-up (mo)			
Mean ± SD	103.8 ± 9.3	97.4 ± 8.6	99.6 ± 9.1
Range	86-150	84-137	84-150
Laterality			
Right	13 (68.4%)	12 (63.1%)	25 (65.8%)
Left	6 (31.6%)	7 (36.8%)	13 (34.2%)
Additional procedure			
Septoplasty	2 (10.5%)	1 (5.2%)	3 (7.9%)
Septoplasty +middle turbinoplasty	—	1 (5.2%)	1 (2.6%)
Revision	2 (10.5%)	1 (5.2%)	3 (7.9%)

Table 3
Objective assessment by the examiner

	SIT		NIT		
	#	%	#	%	*P*
Rhinostomy (anatomically)					0.290
Visible (open)	17	89.5	18	94.7	
Invisible (closed)	2	10.5	1	5.3	
Fluorescein flow (functional)					0.631
Spontaneous	15	78.9	16	84.2	
Forced	1	5.3	1	5.3	
No flow	3	15.8	2	10.5	
Scarring on rhinostomy site					0.209
No	15	78.9	17	89.5	
Yes	4	21.1	2	10.5	

SIT, silicon intubation; *NIT,* no intubation.

respectively. One patient from each surgery group failed to show evidence of spontaneous fluorescein flow on endoscopy, but neither had subjective complaints.

The only complications were in two patients who had ecchymosis around the medial canthal area and one patient who had prolapse of the silicone tube. This was resolved by pulling the tube to the nasal cavity by intranasal endoscopy.

DISCUSSION

Recently, En-DCR has gained popularity, but the limited long-term evaluations vary from 60 percent to 90 percent success with a paucity of NIT results.[8,11] Some of the common advantages of En-DCR are avoidance of the external scar; preservation of the pumping mechanism of the orbicularis muscle and avoidance of possible injury to the medial canthus; correction of associated intranasal pathology, such as septal deviation or chronic rhinosinusitis that might be a causative factor in lacrimal obstruction; and shorter duration of operation under better visualization.[15]

The patient demographics in this study were similar in both randomly formed groups in terms of age, gender, duration of epiphora and morbidities, follow-up period, required additional procedure and revision, absence of chronic inflammatory diseases, dacryoliths, and exclusion criteria of various other NLDO etiologies. Although the sample size is moderate, the characteristics of the patients are fairly homogenous by means of anatomical differences and severity of the disease to detect a clinically important difference statistically with a long follow-up (minimum of seven years).

En-DCR procedure has been in our practice for the last 13 years. We have reported our research about the anatomy, imaging, and surgical procedures of the lacrimal system.[10-13] Our clinical experience revealed that there are two major factors to attain success in En-DCR: indication and marsupialization.

Firstly, one of the keys to success in En-DCR is the indication. Transnasal endoscopic approach to the lacrimal system obstruction is indicated mainly in patients with postsaccal stenosis and a normal or dilated lacrimal sac. In cases with an atrophic sac, intubation may be used alone in order to enlarge the epithelial lining, or combined with a mucosal flap.[9] Mannor et al reported that patients with a normal or dilated lacrimal sac had a success rate of 82 percent, whereas those with a scarred sac had a much lesser likelihood of success with En-DCR.[16] We have not applied En-DCR on patients with fibrotic or atonic sacs and the results of this study do not indicate the elimination of the usage of silicone intubation in such patients.

Secondly, another important key to success is to marsupialize the sac largely and clearly into the nasal cavity. To achieve this goal, removing sufficient bone to adequately expose the lacrimal sac completely is required. The sac that is fully exposed should be marsupialized via cutting forceps into the lateral nasal wall with nasal mucosa and lacrimal mucosa apposition. This reduces the risk of closure of the rhinostomy with granulation or cicatrix tissue. Inadequate bone removal constitutes a common cause of surgical failure that decreases the long-term success rate due to fibrosis at the osteotomy site.[9,17] It is concluded that the use of drills or laser to form or enlarge the osteotomy might cause thermal injury and resulting abnormal bone regeneration and stenosis due to fibrosis.[17] In addition, having a precise removal of bone in the lacrimal fossa followed by an exact anastomosis of the nasal mucosa and lacrimal sac is reported to increase success.[18] There are also some recent data suggesting that powered DCR without the preservation of mucosal flaps is quite successful as well.[19] In our procedure no mucosal flaps were preserved, but the nasal and lacrimal sac mucosa were approximated.

Silicone tubing has been proposed to maintain the patency of the fistula by impeding fibrous closure during the postoperative healing period.[5] Silicone intubation is a commonly suggested procedure in Ex-DCR, especially in cases that have small lacrimal sac, canalicular disease, or poor mucosal flap formation, or because of surgeon preference.[6] It is also recommended for all En-DCR procedures, because the surgical ostium created during En-DCR heals secondarily with granulation, and it is not technically possible to create an epithelium-lined fistula.[9,15]

The common target of the DCR modifications is creating a fistulous tract between the lacrimal sac and the nasal cavity. Patency of this fistula is claimed to be responsible for the surgical success.[6] Some other reasons for failure are preoperative misdiagnosis, inadequate surgical technique (tearing of the nasal mucosa instead of cutting, over-resection), fenestration of the nasolacrimal duct instead of the sac, and long silicone intubation period.[15,20] The primary anatomical success rates in the present study are 84.2 percent in SIT and 89.5 percent in NIT; and 89.5 percent and

94.7 percent, respectively, at the final examination after revision after eight years on average. There is not a significant difference between these success rates. The reported success rates of shorter-term follow-up En-DCR results vary between 75 percent and 95 percent.[5,6,8,15] The high success rate in patients without intubation in this study raises the question of the necessity of intubation in En-DCR. There is a dearth of comparative studies of the surgical results of En-DCR with and without silicone tubing. However, our findings indicate that creation of a patent opening with adequate epithelialization is possible without the use of tubing in patients with normal or dilated lacrimal sacs who undergo En-DCR. It can be stated that intubation might not improve the surgical results significantly.[15]

Besides their advantages, the silicone tubes have some disadvantages that exert an influence on the outcome of surgery. First, they are not free of complications. They may cause granulation, chronic infection, or canalicular laceration, and they may be dislodged.[6] Secondly, they may cause discomfort.

We found that four patients in the SIT group (21.1%) and two of the patients in the NIT group (10.5%) had some form of cicatrix or synechiae. Four of these patients (4/6; 66.7%) had concomitant paranasal sinus or septal surgery. In the majority of the cases, granulation tissue appeared around three weeks after the operation.

Silicone tubing seemed to provoke the formation of granulation tissue due to a foreign material reaction. Weber et al explained three possible mechanisms leading to granulation tissue and scar formation at the nasofrontal duct.[20] The first is through persistent blockage of the duct with blood and fibrin in the early postoperative period. The second is through pronounced swelling beginning in the third postoperative week, leading to zones of contact with adjacent or opposed areas of the nasofrontal duct. The third is through reorientation of collagen fibers in the remodeling phase beginning in the third postoperative week. This last cause supports our observations, in which granulation tissue appeared three weeks after the operation.

There is no definitive agreement among authors on the duration of stenting, which might have an effect on patency. We kept the stents for eight weeks, and four of the patients (21%) reported discomfort from the tube.

As stated above, the surgical outcome is thought to be related to the patency of the rhinostomy opening. It has been believed that the patency is highly related to the size of the surgically created fistula. Nevertheless, the size of the epithelialized ostium necessary for patency is controversial. Bumsted et al[6] have shown that in a series of patients who underwent Ex-DCR there was no correlation between the size of the surgical anastomosis and the healed nasal ostium. We also have observed that although exact location of the smallest opening in the lateral nasal wall was not apparent until fluorescein dye test in three of the patients, lacrimal drainage system was functional in one patient in each group. On the other hand, anatomically open ostia were nonfunctional in two patients in each group.

The success of the surgery seems not to be directly related to the size of the healed ostium. It has been shown that even the smallest ostium, once healed and patent, has continued to provide good lacrimal drainage.[6] In our study two patients in each group with visible rhinostomy opening were nonfunctional. Therefore, success of DCR should be assessed not only by anatomic patency or functionally as relief of epiphora but by a combination of both.

CONCLUSION

The evolution of endonasal DCR continues, as in many of the relatively new techniques. Surgeon's preference, patient selection, availability of equipment, and economic constraints will determine the choice of approach. The collaborative surgical team formed by both the otorhinolaryngologist and ophthalmologist and the patient must discuss and evaluate the options of approaches to accomplish the relief from tearing. The two critical factors to attain success in En-DCR are proper indication (postsaccal stenosis with normal or dilated sac) and proper marsupialization. Further studies with larger case series will enlighten the place of stenting in En-DCR. Given that the long-term surgical results of En-DCR with and without silicone intubation are comparable, and considering the risks of stenting, together with patient discomfort and the additional cost of the tube material, we recommend En-DCR without silicone intubation as the treatment of choice in cases of chronic epiphora due to postsaccal NLDO.

AUTHOR INFORMATION

From the Departments of Otorhinolaryngology and Head-Neck Surgery (Drs Unlu, Gunhan, and Songu) and Ophthalmology (Dr Baser), Celal Bayar University.

Corresponding author: Kivanc Gunhan, MD, Celal Bayar Universite Hastanesi, Kulak Burun Bogaz Hst. Anabilim Dali, Dogu Cad. No:5 45020, Manisa, Turkey.

E-mail address: kivanc.gunhan@bayar.edu.tr.

AUTHOR CONTRIBUTIONS

Kivanc Gunhan, study design, data collection, writer; **Halis H. Unlu**, study design, reduction of the manuscript; **Esin F. Baser**, reduction of the manuscript; **Murat Songu**, data collection.

FINANCIAL DISCLOSURE

None.

REFERENCES

1. Caldwell GW. Two new operations for obstruction of the nasal duct, with preservation of the canaliculi. Am J Ophthalmol 1893;10:189–92.
2. West JM. A window resection of the nasal duct in cases of stenosis. Trans Am Ophthalmol Soc 1910;12:654–8.
3. Oguz H, San I, Verit A, et al. Ophthalmic techniques described by Serefeddin Sabuncuoglu (1385-1468 AD). Clin Experiment Ophthalmol 2004;32(2):192–5.
4. Rice DH. Endoscopic intranasal dacryocystorhinostomy results in four patients. Arch Otolaryngol Head Neck Surg 1990;116:1061.
5. Watkins LM, Janfaza P, Rubin PAD. The evolution of endonasal dacryocystorhinostomy. Surv Ophthalmol 2003;48:73–84.
6. Bumsted RM, Linberg JV, Anderson RL, et al. External dacryocystorhinostomy. A prospective study comparing the size of the operative and healed ostium. Arch Otolaryngol 1982;108:407–10.
7. Camara JG, Bengzon AU, Henson RD. The safety and efficacy of mitomycin C in endonasal endoscopic laser-assisted dacryocystorhinostomy. Ophthal Plast Reconstr Surg 2000;16:114–8.
8. Demarco R, Strose A, Araujo M, et al. Endoscopic revision of external dacryocystrorhinostomy. Otolaryngol Head Neck Surg 2007;137:487–9.
9. Tsirbas A, Wormald PJ. Endonasal dacryocystorhinostomy with mucosal flaps. Am J Ophthalmol 2003;135:76–83.
10. Unlu HH, Toprak B, Aslan A, et al. Comparison of surgical outcomes in primary endoscopic dacryocystorhinostomy with and without silicone intubation. Ann Otol Rhinol Laryngol 2002;111:704–9.
11. Unlu HH, Ozturk F, Mutlu C, et al. Endoscopic dacryocystorhinostomy without stents. Auris Nasus Larynx 2000;27:65–71.
12. Unlu HH, Caylan R, Kutlu N, et al. Active transport dacryocystography in evaluating lacrimal drainage system after rhinoplasty. Am J Rhinol 1996;10:87–91.
13. Unlu HH, Govsa F, Mutlu C, et al. Anatomical guidelines for intranasal surgery of the lacrimal drainage system. Rhinology 1997;35:11–5.
14. Royal College of Ophthalmologists. Guideline for clinical governance in ophthalmology. London: RCO; April 1999.
15. Onerci M, Orhan M, Ogretmenoglu O, et al. Long-term results and reasons for failure of intranasal endoscopic dacryocystorhinostomy. Acta Otolaryngol 2000,120:319–22.
16. Mannor GE, Millman AL. The prognostic value of preoperative dacryocystography in endoscopic intranasal dacryocystorhinostomy. Am J Ophthalmol 1992;113:114–7.
17. Wormald PJ. Powered endonasal dacryocystorhinostomy. Laryngoscope 2002;112:69–72.
18. Yung MW, Hardman-Lea S. Analysis of the results of surgical endoscopic dacryocystorhinostomy: effect of the level of obstruction. Br J Ophthalmol 2002;86:792–4.
19. Ramkrishnan VR, Hink EM, Durairaj VD, et al. Outcomes after endoscopic dacryocystorhinostomy without mucosal flap preservation. Am J Rhinol 2007;21(6):753–7.
20. Weber R, Hochapfel F, Draf W. Packing and stents in endonasal surgery. Rhinology 2000:38:49–62.