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Evaluation of Intranasal Ostium in External Dacryocystorhinostomy

Özlem Yalçın Tök[1], Fatma Akbaş Kocaoğlu[2], İlhan Ünlü[3], M. Necati Demir[2], Uğur Koşar[4], Firdevs Örnek[2]

[1]Department of Ophthalmology, Faculty of Medicine, Süleyman Demirel University, Isparta, Turkey
[2]Eye Clinics 2, Health Ministry of Health Ankara Training and Research Hospital, Ankara, Turkey
[3]Ear Nose Throat Clinics 1, Health Ministry of Health Ankara Training and Research Hospital, Ankara, Turkey
[4]Department of Radiology, Health Ministry of Health Ankara Training and Research Hospital, Ankara, Turkey

ABSTRACT

Objective: The investigation of factors affecting the dimension and configuration of the intranasal ostium in successful external dacryocystorhinostomy (DCR).

Material and Methods: Fifty-one patients were enrolled within this study. During operation, dimensions of bone window were measured. In the postoperative sixth month, changes in bone window size were evaluated using spiral paranasal tomography, and the intranasal ostium was examined with nasal endoscopy.

Results: There were 19 patients who underwent DCR and 32 patients who underwent DCR+silicone tube intubations (SI). The mean bone window size was 214.37 mm^2 during operation and 214.87 mm^2 after six months. The mean intranasal ostium size was measured as 51.42 mm^2 for patients who had undergone DCR and 28.66 mm^2 for the DCR+SI cases. The endoscopic appearance of the ostium was observed as oval or round for the DCR cases and in slit form for the DCR+SI cases. A multiple logistic regression model showed that silicon tube intubation posed an 11 times greater risk for configuration distortion in the intranasal ostium (p=0.0079).

Conclusion: Postoperative intranasal ostium size has a relation with the intraoperative bone window size. The difference of mean intranasal ostium sizes of DCR and DCR+SI cases was not statistically significant. However, because SI gives rise to ostium configuration by triggering fibrosis, it should not be carried out unless absolutely necessary.

Key Words: External dacryocystorhinostomy, intranasal ostium, rhinostomy, endonasal dacryocystorhinostomy

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Introduction

Dacryocystorhinostomy (DCR) involves formation of an alternative (bypass) channel from the lacrimal sac to the middle meatus of the nose for the drainage of lacrimal secretions. The creation of patent mucosal anastomosis is the basis for success in DCR. Dacryocystorhinostomy was defined by Adde Totti in 1904 (1). In 1921, Dupuy-Dutemps and Bourguet made some modifications of the technique (2).

The success of external DCR varies between 80 and 99% depending on the experience of the surgeon (3-5). The most common reasons for failure of external DCR are canalicular obstruction and incorrect size or location of the bone window (6, 7). Intranasal pathologies, obstruction of the bone window by means of granulation tissue, and the formation of new bone have also been reported as causes (6-8).

In the present study, we evaluated the intranasal ostium creating factors that may influence the size and configuration after a successful external dacryocystorhinostomy.

Patients and Methods

This prospective study examines 51consecutive patients who underwent successful external DCR for acquired dacryostenosis. Before operation, a detailed history was elicited from all patients. Lacrimal irrigation, dacryocystography, as well as ear, nose, and throat (ENT) consultations were conducted. The criterion used to decide on DCR was the presence of a large lacrimal sac. In all other cases, such as small and fibrotic lacrimal sac, narrowed nasal cavity, inadvertent nasal mucosal tears, a silicone tube was inserted. Patients with obstructions at the canalicular level, with nasal pathology preventing the internal ostium from being seen in ENT examination, with recurrence and those who could not be followed and refused postoperative paranasal tomography or ENT examination were excluded from the study.

Surgical technique

All patients were operated on by two surgeons (OYT, FA) under general anesthesia. After necessary cleaning of the operating field, a vertical skin incision of 1.5 to 2 cm was made at 8 mm to 1 cm of the nasal medial canthus. The incision was advanced to the subcutaneous tissue by blunt dissection. The periosteum and the lower half of the anterior limb of the medial canthal tendon were incised and reflected with a periostal elevator to expose the lacrimal sac fossa. A bone window was formed using a drill. The vertical and anteroposterior dimensions of the bone window were measured with calipers.

Address for Correspondence: *Dr. Özlem Yalçın Tök, Department of Ophthalmology, Faculty of Medicine, Süleyman Demirel University, Isparta, Turkey*
Phone: +90 246 211 23 10 E-mail: esattok@yahoo.com

In patients assigned to anterior and posterior flaps anastomosis, a horizontal H-shape incision was made in the lacrimal sac and nasal mucosa. The posterior flap of the lacrimal sac was then sutured interruptedly to the posterior flap of the nasal mucosa using 6-0 polyglactin sutures. In cases where silicon tube intubation was performed, the posterior nasal and lacrimal sac flaps were sutured together, and then a silicone tube was placed from the lower to upper canalicula. The free ends of the inserted silicone tube were then tied together multiple times with a 5-0 black silk suture and the silicon tube was pulled inside the nose. The anterior flap of the lacrimal sac was sutured interruptedly to three different points of the nasal mucosal anterior flap using 6-0 polyglactin sutures. Surgery was completed by closing the orbicularis muscle and skin separately.

Postoperative medication included oral antibiotics and anti-inflammatory drugs administered for 7 days, topical antibiotics administered for 15 days, and steroid nasal spray administered for 5 days. Patients were recalled for the control on the first day, first week, third month, and sixth month after surgery. Skin sutures were removed on the seventh day. If silicone tube intubation had been performed, the tube would be removed 6 months after DCR. Removal of the tube was accomplished by cutting its interpunctal portion, and allowing its loose ends to fall from the nose. During follow-up visits, the disappearance of epiphora in daily life was assessed, and the patency of passage was checked by the lacrimal irrigation and the dye disappearance test.

In order to evaluate the intranasal ostium, nasal endoscopy was carried out six months after operation by the same ENT specialist (IU). The intranasal ostium size was measured using the technique defined by Linberg et al. (9) at the sixth postoperative month. Patients underwent spiral paranasal tomography in order to evaluate changes in the dimensions of the bone window. In the craniocaudal and anteroposterior planes, bone window size was measured by the same radiologist (UK). These measurements were compared with those measured during operation.

Informed consent was obtained from all patients. The clinical trial was approved by the Helsinki Committee of the Medical Center.

Statistical analysis

Paired and independent t-tests were used to compare all mean values. Linear regression analysis and Pearson correlation coefficients were used to examine the association between variables. A binary logistic model was built to calculate odds ratios (OR) and 95% confidence intervals were set for the existence of configuration distortion. Statistical significance in this study was defined as $p<0.05$. All statistical analyses were performed using SPSS.

Results

The study included 51 patients. 39 of them were female and 12 were male. The mean age±SD was 44.76±13.54 years (16 to 74 years). There were 28 patients who received operations on their right eyes and 23 patients who received operations on their left eyes. There were 19 patients who underwent DCR and 32 patients who underwent DCR+silicone tube intubation (SI). Demographic and clinical characteristics of the 2 patient groups (DCR and DCR+SI) are shown in Table 1.

In all 51 patients, the mean intraoperative bone window size±SD was 214.37±54.64 mm^2 (96 to 322 mm^2). In the paranasal tomography carried out at the sixth postoperative month, the mean bone window size±SD was 214.87±58.70 mm^2 (96 to 322 mm^2). The mean difference of bone window sizes between the intraoperative period and postoperative six-months was investigated using the paired t-test and was not found to be statistically significant (p=0.768). In all 51 patients, the mean intranasal ostium size±SD was 37.14±44.23 mm^2 (3.14 to 175.92 mm^2). The mean intraoperative bone window size±SD and the mean intranasal ostium size±SD of patients who underwent DCR were 230.78±48.72 mm^2 (156 to 322 mm^2) and 51.42±50.12 mm^2 (6.28 to 157.08 mm^2), respectively. The mean intraoperative bone window size±SD and the mean intranasal ostium size±SD of patients who underwent DCR+SI were 204.63±56.34 mm^2 (96 to 300 mm^2) and 28.66±38.69 mm^2 (3.14 to 175.92 mm^2), respectively. The mean intraoperative bone window sizes of DCR and DCR+SI cases were compared using an independent t-test and a statistically significant difference was not found (p=0.099). Similarly, there was no statistically significant difference between mean intranasal ostium size (p=0.075).

The effects of age, sex, operation type (DCR +/- silicon tube intubation), and intraoperative bone window size were examined using a multiple linear regression model. Sex and operation type were defined as dummy variables. None of the independent factors were found to be statistically significant (all $p>0.05$, $r^2=14\%$; see Table 2). Although the intraoperative bone window size was not a statistically significant factor in the multiple regression model, the association between intraoperative bone window size and intranasal ostium size was positively correlated and statistically significant ($p<0.05$; see Table 3). Ac-

Table 1. Characteristics of patients underwent dacryocystorhinostomy and external dacryocystorhinostomy+silicone tube intubation

Variables	DCR	DCR+SI	p value*
Age, mean±SD (range), year	49.32±11.13 (22-74)	42.06±14.27 (16-69)	0.064
Sex, F/M	13/6	26/6	…
Laterality, Right/Left	12/7	16/16	…
Intraoperative bone window size, mean±SD (range), mm^2	230±48.72 (156-322)	204.63±56.34 (96-300)	0.099
Intranasal ostium size, mean±SD (range), mm^2	51.42±50.12 (6.28-157.08)	28.66±38.69 (3.14-175.92)	0.075
Number of intranasal ostium configuration distortion	0/19	15/32	0.0079**

*: Calculated using the independent t-test
**: Significant at the 0.05 level
DCR: Dacryocystorhinostomy, SI: Silicone tube intubation

cording to nasal endoscopy, the intranasal ostium appeared to be narrowed in all 51 patients. However, fluid passed freely without reflux on lacrimal irrigation, and epiphora complaints were not present. The ostium configuration was oval or round for all patients who underwent DCR (Figure 1) and was in the form of slits or double canal in the 15 patients who underwent DCR+SI (Figure 2). In five cases who underwent SI, it was detected that granuloma was adjacent to but not obstructing the ostium.

To determine the possible risk factors influencing configuration problems; age, sex, type of operation, and intraoperative bone window size were considered as independent variables in a multiple logistic regression model. Only the operation type was found to be a significant risk factor for configuration distortion (OR=11.33, p=0.0079; see Table 4).

Discussion

External DCR is the gold standard in the treatment of nasolacrimal duct obstruction. The success of this technique relies on the patency of mucosal anastomosis and the direct draining of tears into the nose. However, the status of the intranasal ostium after operation and the effect of the bone window formed during operation on recurrences remain controversial.

Linberg et al. (9) used a nasal endoscope following successful DCR and found a mean intraoperative bone window size of 11.84 mm and a mean intranasal ostium size of 1.8 mm. In a study using B-scan ultrasonography, the mean anastomosis of 235 mm^2 decreased to 98 mm^2 after two weeks and 71mm^2 after 6 months (10). You and Fang (11) endoscopically established that the mean intranasal ostium size was 50.6±8.9 mm^2 immediately after DCR and 22.2±5 mm^2 after 35 months. Yazici et al. (12) used digital substraction macrodacryocystography to assess the intranasal ostium and reported mean ostium height of 3.1 mm. In the present study, the mean intraoperative bone window size was 214.37±54.64 mm^2, while the mean intranasal ostium size±SD was 37.14±44.23 mm^2 at the sixth postoperative month. The size and configuration of the intranasal ostium varied considerably after DCR; factors influencing this condition are not completely understood. Moreover in these studies no statistically valid correlation between the size of the bone window and the final intranasal ostium size could be established (9-12).

In contrast to the existing literature (1, 9-12), in our study the correlation between intraoperative bone window size and intranasal ostium size six months later was significant (p=0.03). The surgical nasolacrimal anastomosis contracts into a relatively small intranasal ostium, but a larger anastomosis or bone window results in a significantly larger permanent intranasal ostium. This finding was solidified by creating the bone window different from the standard size. In the patients with the smallest bone window (96 mm^2), intranasal ostium size was 3.14 mm^2. For patients with a bone window size of 322 mm^2, it was 157.08 mm^2. A large bone window enables more comfortable movement and facilitates the formation of mucosal flaps and suturing. However, no difference was found between patients with small and large intranasal ostia in the final stage in terms of the improvement of clinical symptoms.

It is no surprise that the large mucosal anastomosis formed by DCR shrinks. Primary wound healing consists of four successive phases: hemostasis (platelet aggregation), inflammation (leukocyte invasion), proliferation (collagen synthesis) and remodeling (collagen maturation). In the first one to two days, inflammatory response develops, fibroblasts migrate to the location of the wound, and collagen synthesis begins. After one to three weeks, collagen maturation and remodeling is observed (13). During healing, contraction occurs at the site of wound and may last for years. Therefore, while the success rate is high at the sixth postoperative month, it falls in subsequent years. In a study by Huang (14), the success rate was 100% at three to six months postoperatively; success was obtained in 23 of 28 patients at four to six years postoperatively. Antiproliferative agents were administered to the bone

Table 2. Multiple linear regression model for postoperative intranasal ostium size

Variables	Coefficients	Standard error	p value
Constant	35.030	53.256	0.514
Female/ ref. male	7.734	14.289	0.591
Age	-0.348	0.476	0.468
Intraoperative bone window size	0.185	0.117	0.120
DCR+SI/ ref. DCR	-19.437	13.501	0.157
r^2=0.143			

Table 3. Pearson correlation coefficients between continuous variables

	Intraoperative bone window size	Postoperative bone window size	Intranasal ostium size	Age
Intraoperative bone window size	1.000	0.980** (p=0.000)	0.304* (p=0.030)	-0.161 (p=0.258)
Postoperative bone window size	-	1.000	0.301* (p=0.032)	-0.222 (p=0.118)
Intranasal ostium size	-	-	1.000	-0.088 (p=0.541)
Age	-	-	-	1.000

*Correlation is significant at the 0.05 level (Two-Tailed)
**Correlation is significant at the 0.01 level (Two-Tailed)

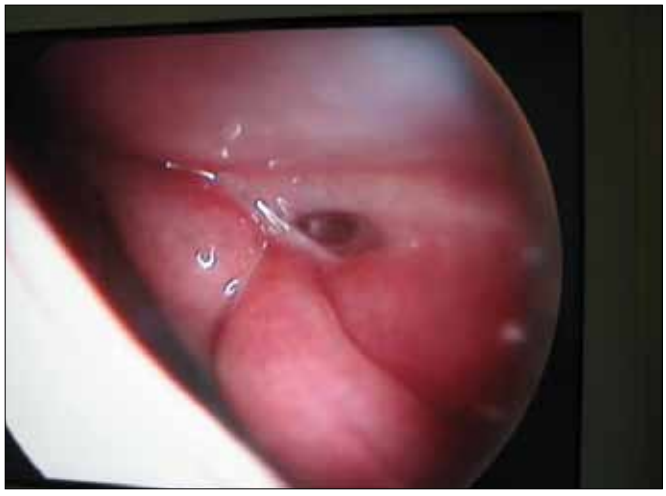

Figure 1. Intranasal ostium configuration in a case who underwent DCR

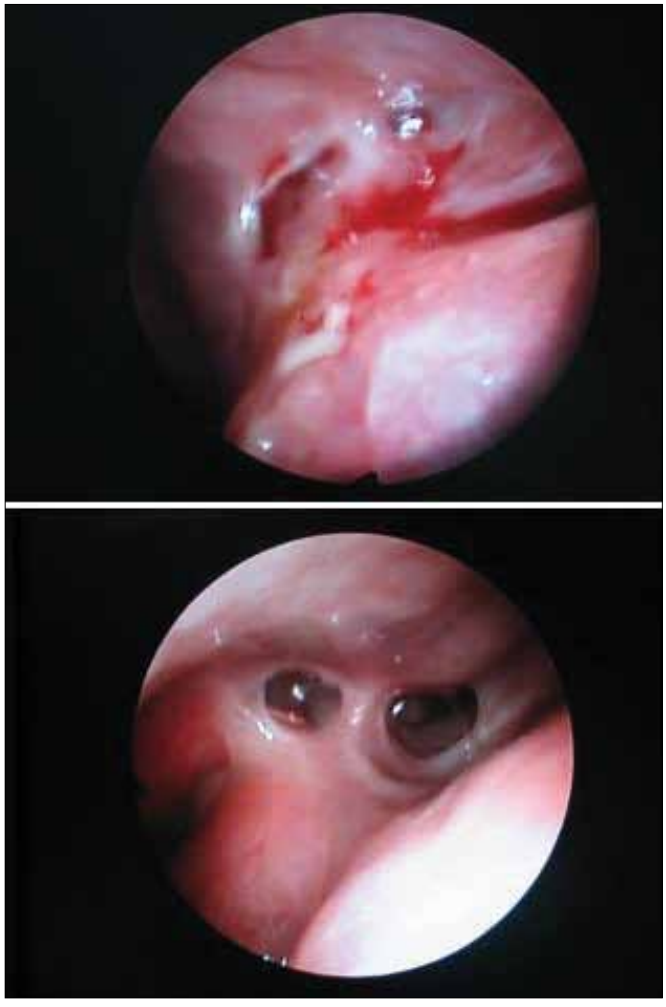

Figure 2. Intranasal ostium configuration after silicone tube was removed in 2 different cases who underwent DCR+SI

window site and to the anastomosed flaps in order to prevent fibrosis. In a study by Kao et al. (15), the mean intranasal ostium size was 10.8 mm^2 in the control groups and 27.1 mm^2 in the groups who received mitomycin C.

Table 4. Binary logistic regression model for intranasal ostium configuration

Variables	Coefficients	OR	95% C.I.	p value
Constant	-7.114	-	-	0.0059
Age	0.046	1.048	0.993-1.105	0.087
Intraoperative bone window size	0.011	1.011	0.997-1.024	0.103
DCR+SI/ref. DCR	2.427	11.330	1.890-67.913	0.0079*

*: Significant at the 0.05 level
OR: Odds Ratio, C.I.: Confidence Interval

There are conflicting opinions on silicone tube implantation as well. Silicone tube intubation may lead to peripunctal granulation, chronic infection, canalicular laceration, stent prolapse, and discomfort (16, 17). In a study by Allen and Berlin (18), the success rate was lower in DCR+S. In contrast, Walland and Rose (16) did not find any difference with respect to infection and success rates. In the treatment of the patients with acquired nasolacrimal duct obstruction, while Yaman et al. (19) reported a 94.4% success rate for DCR and 89.1% success rate for DCR+SI treatment, Evereklioğlu et al. (20) found an equal success rate for DCR and DCR+SI. In this study, the mean intranasal ostium size±SD was 51.42±50.12 mm^2 for those who underwent DCR and 28.66±38.69 mm^2 for those who underwent DCR+SI. The difference was not statistically significant (p=0.075). However, internal ostium configuration was distorted in 15 patients who received silicone tube intubation. Patients in whom silicone tube was inserted, were 11.33 times more likely to suffer from the distortion in configuration (p=0.0079). In our opinion, the silicone tube may stimulate fibrosis and scar formation during the healing of the intranasal ostium. Fibrosis may develop around the silicone tube, leading to double canal formation. Therefore, in cases where anterior and posterior flaps are sutured separately, silicone tube intubation is not necessary. Silicone tube intubation should be carried out only in cases of canalicular stenosis, nasal mucosa, and lacrimal mucosa that cannot be sutured to each other.

In conclusion, intraoperative bone window size does not significantly decrease after surgery, and it has an effect on final intranasal ostium size. A large intraoperative bone window facilitates suturing and results in a large intranasal ostium. In this study, silicone tube intubation was applied to risky, small and fibrotic lacrimal sacs. At this point, even if the intraoperative bone window sizes and, parallel to this, intranasal ostium were not statistically different, they were found narrower as compared to cases with DCR. However, detected distortions in the ostium configuration and granuloma formation caused us to consider possible silicone triggered fibrosis. In the light of all findings, silicone tube intubation should be carried out only in cases where it is indicated. Since distortion of ostium configuration in patients with silicone tube intubation may increase the risk of recurrence, more comprehensive studies, with longer follow up periods, should be made.

Conflict of Interest
No conflict of interest was declared by the authors.

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