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Assessing the Usefulness of Different Silicone Tubes in External Dacryocystorhinostomy

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ABSTRACT

Introduction: External dacryocystorhinostomy is a surgical procedure for the treatment of lacrimal drainage system disorders. **Aim:** To assess the usefulness of different silicone tubes in external dacryocystorhinostomy. **Material and Methods:** This study sampled 97 patients with lacrimal drainage system disorders who underwent the external dacryocystorhinostomy using two different silicone tubes. Forty one patients (Group A) underwent external dacryocystorhinostomy with silicone intubation using Nunchaku-style tubes, while in 56 patients (Group B) dacryocystorhinostomy was performed with O'Donoghue silicone tubes. The data was analyzed using T-test, Chi-squared test and Fisher's test. **Results:** The success rate was evaluated by achieved patency to irrigation and relief of epiphora. Patency in the group with Nunchaku-style tubes was 95.1% compared to 94.6% in the group with O'Donoghue silicone tubes (p>0.05). **Conclusion:** Both tubes in external dacryocystorhinostomy were useful in the management of lacrimal drainage system disorders. Although it is easier and quicker to intubate and extubate Nunchaku-style tubes compared to O'Donoghue silicone tubes, there was no statistically significant difference in success rate between the compared groups.
Keywords: External dacryocystorhinostomy, silicone tubes, Nunchaku-style tubes.

1. INTRODUCTION

External dacryocystorhinostomy (DCR) is a surgical procedure that establishes a low-resistance drainage pathway between the conjunctival tear sac and the nasal cavity, by conversion of the lacrimal sac into part of the lateral nasal wall (1). In 1921, Dupuy-Dutemps and Bourguet (2) described a very successful procedure (94.8 percent success in over 1000 cases) that became the forerunner of contemporary DCR. In this procedure, the lacrimal sac was incised, forming both anterior and posterior flaps, and then carefully anastomosed to the nasal mucosa. Most surgeons routinely intubate silicone tubes during external DCR to improve the outcomes. The use of silicone tubing to facilitate repair of the nasolacrimal system was first described by Gibbs (3), who reported its use in the repair of damaged canaliculi in 1967. Since then, a number of authors have described the use of silicone intubation in the treatment of both congenital and acquired lacrimal drainage disorders. The use of silicone has proven to be nonirritating and flexible, and to provide generally favorable results for intubation of the nasolacrimal duct (4, 5, 6, 7).

2. AIM

The aim of this study was to assess the usefulness of two different silicone tubes in external dacryocystorhinostomy for the treatment of lacrimal drainage system disorders.

3. MATERIAL AND METHODS

This study sampled 97 patients with lacrimal drainage system disorders who underwent the external dacryocystorhinostomy using two different silicone tubes. Forty one patients (Group A) underwent external dacryocystorhinostomy with silicone intubation using Nunchaku-style tubes, while in 56 patients (Group B) dacryocystorhinostomy was performed with O'Donoghue silicone tubes. The data was analyzed using T-test, Chi-squared test and Fisher's test.

3.1. Surgical technique

A straight 15 mm skin incisions placed on the flat area of the nose, beginning just above the level of the medial canthal tendon (MCT); and 10-12 mm nasal to the medial canthus. After skin incision and other steps in surgery, the lacrimal fossa is exposed in its entirety. Afterwards, an osteotomy, approximately 15 x 15 mm wide, in the lateral nasal wall is

created with dental drill and the nasal mucosa exposed. The bony window includes the entire anterior lacrimal crest, lacrimal fossa, and superomedial wall of the nasolacrimal canal.

The next step is to fashion the mucosal flaps. A vertical incision is made in the lacrimal sac to create anterior and posterior flaps, about two-thirds anterior, one-third posterior. The same vertical incision is made in exposed nasal mucosa to create anterior and posterior flaps, about two-thirds anterior, one-third posterior. The modified technique of external DCR that we performed, the posterior nasal and lacrimal sac flaps are excised.

Before suturing anterior flaps we performed bicanalicular silicone intubation in all cases. In group A, we used Nunchaku-style tubes and in Group B, O'Donoghue silicone tubes. Nunchaku-style tubes (NS-T) are special silicone tubes (105 mm in length) consisting of three pieces (three-piece silicone tubing). One piece is the thinner central segment (25 mm long, 0.64 mm outer diameter, 0.30 mm inner diameter), and the other two are thicker bilateral segments (40 mm long, 0.94 mm outer diameter, 0.51 mm inner diameter). To push the tubes from the upper and lower puncta into the lacrimal passage, a thin metal probe (0.4-0.6mm diameter) was inserted into both sides of the tube through a small cut. With this tube, there is no difficult procedure of retrieving the tip of a metal probe from the nasal cavity. After intubation, each metal probe inside the silicone tube was then pulled out, while holding the silicone tube in place with forceps. N-ST requires no suture to secure it in position. In order to be stable in lacrimal passage without fixation, the central thinner segment is soft, very pliable and strong, and the bilateral thicker segments are harder, heavier and thicker than central segment. In addition this tube is easy to remove, by pulling with forceps the middle part of the thinner central segment in the medial canthal area (8, 9).

O'Donoghue tubes are solid silicone tubing, 40 cm length x 0.80 mm diameter attached in straight stainless steel probes, 4.5 cm length x 0.90 mm diameter. After the probe has been passed through the lacrimal drainage system, it is necessary to retrieve the tip of the metal probe from the nasal cavity. This can be the most difficult step of the procedure. Fixation of the tubing is necessary after the system has been successfully intubated. Multiple knots are placed in the end of the tubing. For removal, the tube is cut in the medial canthal area and the patient is asked to blow his or her nose into a tissue. If this exercise is not successful, the nostril can be opened with a nasal speculum and the tube ends visualized directly. After it has been visualized, the tubing can be grasped with a small forceps.

After intubation, anterior mucosal flaps are sutured with three interrupted 6.0 Vicryl sutures, passing through the superior, middle and inferior edges of the flaps and tied in three knots with sufficient tension to prevent sagging of the flaps.

In this way, we created an anastomosis by suturing only anterior flaps of the lacrimal sac and nasal mucosa.

Upon completion of the mucosal anastomosis, the periosteum and orbicularis muscle are sutured with 6.0 Vicryl sutures and the skin with prolene 6.0 sutures.

The surgery is considered successful when the patient had no epiphora and a patent lacrimal passage on irrigation.

4. RESULTS

By gender, the majority of treated patients 72 (74.2%) were women, and 25 (25.8%) were men. In Group A, 31 (75.6%) patients were women and 10 (24.4%) were men; while in the Group B, 41 (73.2%) patients were women and 15 (26.8%) were men.

By age, the mean age in the group A was 36.4 years (range 5–58 years) while in group B it was 45.1 years (range 8–59 years), (Table 1). The two-tailed P value equals 0.0016. By conventional criteria, this difference is considered to be highly statistically significant. P<0.01 (T test=3.24; DF=95; P=0.0016*).

Lacrimal drainage system disorders included in this study were chronic dacryocystitis in 51 (52.6%) cases, lacrimal fistula in 4 (4.1%) cases, mucocele in 9 cases (9.3%), previous failed DCR in 8 cases (8.2%), nasolacrimal duct obstruction in 13 cases (13.4%), and medial common canalicular obstruction in 12 (12.4%) cases. Cases of chronic dacryocystitis (52.6%) predominated among operated patients within this research (Table 2).

Age in years	Group A		Group B		Total	
	No.	%	No.	%	No.	%
0-9	3	7.3	1	1.8	4	4.1
10-19	3	7.3	2	3.6	5	5.2
20-29	6	14.6	4	7.1	10	10.3
30-39	9	22	7	12.5	16	16.5
40-49	13	31.7	19	33.9	32	33.0
50+	7	17.1	23	41.1	30	30.9
Total	41	100	56	100.0	97	100.0
Xmax	58	-	59	-	59	-
Xmin	5	-	8	-	5	-
Xb	36.4	-	45.1	-	41.2	-
SD	15.1	-	11.3	-	13.7	-
VC	41.4	-	25.0	-	33.2	-
T test=3.24; DF=95; P=0.0016*						

Table 1. Age distribution by groups

Lacrimal drainage system disorders	Group A		Group B		Total	
	No.	%	No.	%	No.	%
Chronic dacryocystitis	22	53.7	29	51.8	51	52.6
Lacrimal fistula	2	4.9	2	3.6	4	4.1
Mucocele	3	7.3	6	10.7	9	9.3
Previous failed DCR	6	14.6	2	3.6	8	8.2
Nasolacrimal duct obstruction	4	9.8	9	16.0	13	13.4
Medial common canalicular obstruction	4	9.8	8	14.3	12	12.4
Total	41	100.0	56	100.0	97	100.0
χ^2= 5.02; DF=5; P=0.414						

Table 2. Lacrimal drainage system disorders by groups

Duration of tubes (months)	Group A		Group B		Total	
	No.	%	No.	%	No.	%
3	2	4.9	7	12.5	9	9.3
4	3	7.3	15	26.8	18	18.6
5	19	46.3	21	37.5	40	41.2
6	17	41.5	13	23.2	30	30.9
Total	41	100	56	100	97	100
Mean duration of tubes	5.2	-	4.7	-	4.9	-
SD	0.8	-	1.0	-	0.9	-
VC	15.1	-	20.3	-	18.8	-
T test=2.64; DF=95; P=0.0097*						

Table 3. Duration of tubes by groups

Time of follow-up (months)	Group A		Group B		Total	
	No.	%	No.	%	No.	%
12	17	41.5	24	42.9	41	42.3
18	18	43.9	21	37.5	39	40.2
24	6	14.6	11	19.6	17	17.5
Total	41	100.0	56	100.0	97	100.0
Mean time of follow-up	16.4	-	16.6	-	16.5	-
SD	4.2	-	4.5	-	4.4	-
VC	25.6	-	27.3	-	26.6	-
T test=0.22; DF=95; P=0.82						

Table 4. The patients time of follow-up by groups

Intraoperative complications	Group A		Group B		Total	
	No.	%	No.	%	No.	%
Bleeding	2	4.9	2	3.6	4	4.2
Inappropriate place of the osteotomy	-	0.0	2	3.6	2	2.0
Difficulty fashioning the mucosal flaps	1	2.4	2	3.6	3	3.0
Nasal mucosal tearing	2	4.9	3	5.3	5	5.1
Uneventful	36	87.8	47	83.9	83	85.6
Total	41	100.0	56	100.0	97	100.0
Fisher's test; P value=1.0; DF=1						

Table 5. Intraoperative complications by groups

With the relevant Chi-squared-test the difference was not statistically significant (χ^2= 5.02; DF=5; P=0.414).

The mean duration of tubes for both groups was 4.9 months (range 3 – 6 months). The mean duration of tubes for the group A was 5.2±0.8SD months, whereas for the group B it was 4.7±1.0SD months (Table 3). The two-tailed P value equals 0.0097. By conventional criteria, this difference is considered to be highly statistically significant. P<0.01 (T test=2.64; DF=95; P=0.0097*).

The mean time of follow-up for both groups was 16.5 months (range 12 – 24 months). The mean time of follow-up for the group A was 16.4±4.2SD, whereas for the group B it was 16.6±4.5SD months (Table 4). The difference was not statistically significant (T test=0.22; DF=95; P=0.82).

Intraoperatively the surgery was uneventful in 83 (87.7%) out of 97 cases, while in 8 cases (7.6%) we had bleeding and in 4 cases (4.2%), inappropriate place of osteotomy in 2 cases (2.0%), difficulty fashioning the mucosal flaps in 3 cases (3.0%) and nasal mucosal tearing in 5 cases (5.1%), (Table 5). The difference between the groups was not statistically significant (Fisher's test; P value=1.0; DF=1).

The postoperative complication–closure of the anastomosis–in the group A was in 2 cases (4.9%), and in 3 cases (5.4%) in the group B. The difference was not statistically significant (Fisher's test; P value=1.0; DF=1).

The success rate was evaluated by lacrimal patency to irrigation and relief of epiphora. Patency was achieved in 92 cases (94.9%), whereas epiphora recurred in 5 cases (5.1%). By groups, patency in the group A was in 39 cases (95.1%) a bit higher compared to the group B where it was in 53 cases (94.6%). Recurrence of epiphora in the group A was in 2 cases (4.9%), and in 3 cases (5.4%) in the group B. With the relevant Fisher's test there was no statistically significant difference in success rate between the groups (P value=1.0; DF=1).

5. DISCUSSION

Many surgical techniques and instruments for stent placement have been described. The material of choice for stenting in the lacrimal system is silicone, which is generally inert within the system. Stents implanted within nasolacrimal system prevent adherence of the mucosal lining of the ducts during healing and maintain long-term patency after removal (10).

Bicanalicular silicone tube placement aims to maintain the anastomotic patency and stability of the epithelium of the canaliculus. However, numerous studies have reported that the long-term efficacy of the silicone intubation for the treatment of stenotic or obstructed canaliculi is not high, especially in adults (11, 12, 13, 14). In order to improve the success rate of silicone intubation in adults with canalicular obstruction, Demirci and Elner (11), Hwang et al. (12), and Kim and Kim (14) performed double silicone intubation and have reported high final rates of success in long-term follow-up. They concluded that double silicone intubation is an effective minimally invasive technique for the treatment of partial obstruction of the lacrimal apparatus.

In this study, we used two different silicone tubes to assess their usefulness in external dacryocystorhinostomy for the treatment of lacrimal drainage system disorders. Bicanalicular intubation using Nunchaku-style tubes (8, 9) has several advantages over O'Donoghue silicone tubes as follows: It avoids the most difficult step of retrieving a hard probe from the nasal cavity; it avoids the step of fixation; it is easier to remove than O'Donoghue silicone tubes, by pulling with forceps the middle part of the thinner central segment.

6. CONCLUSION

Both tubes that we used in external dacryocystorhinostomy were useful in the management of lacrimal drainage system disorders. Although it is easier and

quicker to intubate and extubate Nunchaku-style tubes compared to O'Donoghue silicone tubes, there was no statistically significant difference in success rate between the compared groups.

- Author's Contribution: A.A.A. and M.A.A. gave substantial contribution to the conception or design of the work and in the acquisition, analysis and interpretation of data for the work. Each author had role in drafting the work and revising it critically for important intellectual content. Each authorgave final approval of the version to be published and they are agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- Conflicts of interest: There are no conflicts of interest.
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