Changes in Tear Meniscus Height after Transconjunctival Dacryocystorhinostomy for Management of Primary Acquired Nasolacrimal Duct Obstruction

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Abstract

This prospective interventional case series study was conducted in Cairo University Hospitals in which 20 patients with primary acquired nasolacrimal duct obstruction were included.

The aim of the work was to study the changes in tear meniscus height after transconjunctival dacryocystorhinostomy. All patients underwent the surgery under general anaesthesia and were performed by highly experienced lacrimal surgeons. Tear meniscus height changes were recorded for six months at least postoperatively.

Key Words: Primary acquired nasolacrimal duct obstruction – Tear meniscus height – Transconjunctival dacryocystorhinostomy.

Introduction

EXTERNAL dacryocystorhinostomy was first described in 1904 by Toti for treatment of primary nasolacrimal duct obstruction. It remained the traditional surgical approach for treating such condition since then with multiple suggested modifications. The success rate is more than 90%. However, it leaves a visible scar [1].

To avoid facial scarring, endonasal and transcanaclicular techniques are used with or without lasers with a success rate ranging between 60% and 100%. Supporters of the endoscopic route argue that it is faster, has rapid recovery, and better cosmesis. Several reports mentioned that endoscopic DCR has similar success rate like the external one. Endonasal techniques necessitate additional surgical equipments and visualization systems and may be difficult in patients with narrow nasal cavities [2].

In 2003, a retrocanalicular approach for dacryocystorhinostomy was introduced by Adenis and Robert to avoid facial scarring, with 82% success rate [2].

New approach for scarless dacryocystorhinostomy through inferomedial conjunctival incision was introduced in 2011. The procedure could be successfully performed in 76% of the studied group with complete resolution of the epiphora [3].

Aim of work: To study the changes in tear meniscus height after transconjunctival dacryocystorhinostomy.

Patients and Methods

This is a prospective interventional case series that took place at Cairo University, Ophthalmology Department between May 2014 to January 2015. It included 20 eyes suffering from nasolacrimal duct obstruction that needed DCR.

Patient selection:

Adult patients with epiphora due to primary acquired nasolacrimal duct obstruction were included in the study provided they had good general condition and adequate coagulation profile.

We excluded:

• Cases associated with upper system obstruction as punctual atresia and canalicular obstruction.
• Congenital nasolacrimal duct obstruction.
• Causes of tearing not due to lacrimal drainage disorder as eyelid abnormalities, ocular surface disorders, dry eye, patients on glaucoma medications and patients with facial palsy.
• Recurrent cases.
Patients not fit for surgery as patients with poor general condition and patients with bleeding tendency.

Patient counseling and consent:

Patient expectations and wishes were discussed. An informed consent was obtained from the studied patients after discussing the surgical details of the technique and elaborating expected results and any possible complications.

Pre-operative evaluation:

A thorough ocular and medical history as well as detailed ophthalmic examination were obtained for all patients. This included:

A- Ocular history:

Onset, course and duration of epiphora, history of previous acute dacryocystitis as well as history of previous lacrimal intubation or DCR.

B- Evaluation of general health condition:

1- History of:

- Diabetes, hypertension, coagulation disorders or other systemic diseases.
- Drug intake especially blood thinners or history of drug allergy.
- General anesthesia problems.

2- Laboratory investigations: Complete blood picture, coagulation profile, blood sugar and liver and kidney functions tests.

C- Routine ophthalmological examination with special emphasis on:

- Lid margin position for any malpositions or irregularities.
- Ocular surface for any disorders associated with tearing.
- Tear meniscus and signs of dry eye.
- Orbicularis function to exclude facial palsy.

D- Evaluation of lacrimal drainage system:

- Punctal examination: By slit lamp to detect punctal stenosis or atresia.

  - Tear meniscus height: By narrow beam slit lamp with low light intensity, high magnification and direct focal illumination to measure tear meniscus height in primary gaze. A grading system (Table 1) was used to express the detected values.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tear meniscus height</th>
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<tbody>
<tr>
<td>0</td>
<td>No tear meniscus</td>
</tr>
<tr>
<td>1</td>
<td>Low (less than 0.1 mm)</td>
</tr>
<tr>
<td>2</td>
<td>Moderate (between 0.1 and 0.25 mm)</td>
</tr>
<tr>
<td>3</td>
<td>High (more than 0.25 mm)</td>
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- Regurg test: Positive regurge of pus or tears is diagnostic of nasolacrimal duct obstruction, however in absence of positive regurge the following are helpful.

- Dye disappearance test: One drop of 2% fluorescein is instilled into the lower fornix of each eye. The patient is instructed not to touch the eye and to blink normally. Both the intensity of the color and the volume of tears are assessed after 5 minutes by slit lamp using cobalt blue filter. A residual of 0 or +1 dye indicates probable normal drainage outflow; where a residual of +2 or +3 indicates partial or complete obstruction or pump failure.

- Syringing and irrigation test: After instillation of topical anesthesia, the lacrimal punctum is dilated with lacrimal dilator if needed, then lacrimal irrigation cannula attached to 1mm syringe filled with normal saline was inserted into the punctum to go through the corresponding canaliculus. To avoid canalicular kinking, lateral traction was applied to the eyelid. Reaching hard stop of medial wall of lacrimal sac means no canaliculr obstruction. Then, the saline is injected slowly and the result is recorded. Reflux thorough the other punctum with no saline tasted by the patient is suggestive of nasolacrimal or common canalicular obstruction.

Surgical technique:

Under general hypotensive anesthesia, the nose was packed with ribbon gauze soaked with 1 % lidocaine and 0.0001mg/ml adrenaline solution. The patient was positioned in the reverse Trendelberg position, supine with head high 10-20 degree. Illumination of the surgical field was augmented by using overhead light.

The lower eyelid was retracted gently away from the eyeball and everted with a Desmarre lid retractor. About 4ml 1% lidocaine and 0.0001mg/ml adrenaline was injected subconjunctivally just below the tarsus. A cornea protective shell was placed.

After applying of mild cautery to papebral conjunctiva about 10mm from the lid margin, an inferomedial transconjunctival incision (10-mm) was done with no. 15 blade starting from a point 4-5mm below the caruncle.

Then, the medial pad of fat and inferior oblique muscle were exposed and laterally retracted to reach the anterior lacrimal crest using a blunt-tipped Wescott scissor. One traction suture with 4-0 silk was used to provide better exposure.
The periosteum was incised with the blade just anterior to the anterior lacrimal crest then was widely elevated anteriorly alongside of the nose, and posteriorly to elevate the lacrimal sac laterally from the lacrimal fossa. The thin bone at the suture between the lacrimal bone and the frontal process of the maxilla was then breached with a Traquaire’s periosteal elevator.

The bony ostium was created by using Karrison bone nippler to create a rhinostomy. The blunt end of the punch was used to push the nasal mucosa away to prevent accidental injury and intraoperative bleeding. The osteotomy was extended from the fundus of the sac at the skull base, approximately up to 10 mm in front of the anterior lacrimal crest, and inferiorly to expose the upper part of the nasolacrimal duct. The bone at the neck of the sac and the beginning of the nasolacrimal duct (inferiorly) was removed. The average size of the osteotomy ranged from 10 to 15 mm in vertical and horizontal dimensions respectively.

The nasal mucosa was then identified and injected with 1 ml 1% lidocaine and 0.0001 mg/ml adrenaline. Then, an H-shaped incision was created via incising the nasal mucosa with the blade in a superior-inferior direction. The nasal mucosal flaps were fashioned by placing a vertical incision and other two incisions pass antero-posterior along the edges of the osteotomy to create the posterior and anterior flaps. The posterior flap was completely excised, while the anterior flap was hanged with double armed vicryl 6/0 suture (vicryl polyglactin 910: Ethicon Inc., Somerville, New Jersey, USA).

Two Bowman probes were used to tent the medial wall of the lacrimal sac which was then incised with a blade over the two ends of the probes. The incision was extended from the fundus to the opening of the nasolacrimal duct. The incision was placed as posterior as possible to create a large anterior flap. The posterior flap was completely excised.

Silicone tubes were passed through the upper and lower canaliculi and retrieved from the nose using a groove director. The tubes were tied in a square knot over a haemostat without excessive traction on the punctae.

The anterior flaps (nasal mucosa and lacrimal sac) were then sutured with the double armed 6-0 vicryl sutures. If there were no anterior nasal mucosal flap, the anterior lacrimal flap was hanged to the orbicularis muscle with ensuring that no soft tissue obstructing the ostium. The traction sutures were removed.

The medial conjunctiva was approximated and left unsutured. Tobramycin and dexamethasone combination ointment was applied into the conjunctival sac followed by pressure dressing. Surgical time, intra-operative difficulties and complications were recorded.

Patients received topical antibiotic-steroid combination, decongestant nasal drop and systemic antibiotic for one week post-operatively.

**Post-operative evaluation:**

Patients were examined on the 1st day postoperatively, after 1 week, 1 month, 3 months and 6 months. In follow-up visits, the incision site was examined, tear meniscus level (in millimeters) was assessed by slit lamp.

**Results**

**Patient demographics:**
- **Age:** Mean age was 39.8 ± 14.2 years.
- **Sex:** The study included 12 females and 8 males.

**Operative time:** Mean operative time was 57 ± 12.5 minutes. It was also noted that patients below 35 years had longer mean operative time (58.33 minutes) than older ones (55.9 minutes) but this difference was of no statistical significance (p-value 0.8).

**Operative complications:** The complication rate was 50% including fat prolapse, loss of nasal mucosa and canalicular injury as shown in Chart (1).

**Outcome:**

17 cases with total success, 2 cases with partial success, and failure in only one case.

**Tear meniscus height:**

Tear meniscus height improved i.e. reduced after the surgery compared to the preoperative condition. No statistical change in tear meniscus height between 1st week and 1st month was detected. However, there was statistical change in tear meniscus height at the 3rd & 6th month visits compared to the 1st week. No obvious change was noted between the last two visits. These changes are shown in Chart (2).
Changes in Tear Meniscus Height after Transconjunctival Dacryocystorhinostomy

Discussion

In our study, most of the patients were middle aged females. This matches the fact that primary NLDO is more common in middle aged females, having smaller lower lacrimal fossa and middle nasolacrimal duct as detected by CT scans. Also, females undergo changes in the anteroposterior dimensions of the bony nasolacrimal canal with ongoing osteoporosis. The prevalence in the middle and old age may be explained by menstrual and hormonal changes with immune status abnormality [4].

In the current study, transconjunctival DCR had a long mean operative time (57 minutes). The long operation time was also noticed in Kaynak study (mean 65.1 minutes). That may be due to limited surgical field in the new method and the familiarity with the surgical anatomy and the need for a learning curve compared to the familiar surgical steps in external DCR [5].

It was also noted that transconjunctival DCR patients below 35 years in our study has longer mean operative time (58.33 minutes) than older ones (55.9 minutes) but this difference was of no statistical significance. This could be due to the tightness of lower lid in the young age as well as the compact tissue nature requiring more maneuvers for better exposure. However, Kaynak reported shorter operative time for the younger patients (56.1 minutes) than older ones (61.1 minutes) with no statistically significant difference with no explanation in his published data. We presume that these results could be due to operating on younger patients in a later stage with improvement of the learning curve [5].

Fat prolapse occurred in 5 cases (25%) compared to 4 cases (12.12%) in Kayanak study. Although, orbital fat prolapse is one of the causes of DCR failure, in our cases fat was retracted, cauterized and cleared from the ostium with no reported failure in such cases. Similarly, in Kayanak study, fat was retracted from the site of osteotomy with no late failure [5].

The inability to identify the nasal mucosa and failure to create adequate flaps was one of the major problems in trans-conjunctival DCR. This complication was encountered in 4 cases (20%) however, Kayanak reported such difficulty in (18.2%) i.e. 6 out of 33 eyes where he converted to external approach. He showed that this rate decreased from 38.5% in the first 13 cases to 8% in the last 12 cases, denoting the importance of the learning curve to avoid such technical difficulty [5].

In our study, this complication was not managed by conversion to external approach. Alternatively, complete removal of any remnants of nasal mucosa with creation of larger anterior lacrimal sac canal that was sutured to the orbicularis muscle in addition to complete excision of the posterior lacrimal flap were done to ensure no soft tissue obstructing the ostium. Total success was obtained in these 4 eyes.

Lower canalicular injury occurred in one case (5%) as a result of excessive traction on the lower lid. Lacrimal tube was inserted and the ends of the lacrimal canaliculus were identified and repaired with vicryl 8/0 sutures. Postoperatively, the patient complained of bothersome epiphora, with high tear meniscus. Forced irrigation was needed to feel the saline in the nose probably due to partial canalicular stenosis. This was considered failure according to our success criteria and the patient was followed-up for persistent bothersome symptoms and possibility of conjunctivo-dacroysto-rhinostomy. Kaynak described a vertical 2mm full thickness lid laceration due to excessive traction which was repaired intra-operatively with complete healing leaving no visible scar [5].

Conjunctival wounds healed completely with no conjunctival granuloma. Kaynak study showed granuloma formation at the conjunctival incision in 2 cases (7.4%) and were removed under local anesthesia.

Tear meniscus height decreased in all patients after surgery, then remained stationary between 1st week and 1st month. It decreased again after the 1st month throughout the study. Decrease in TMH postoperatively is achieved due to patent drainage system. TMH might had slightly decreased between 1st week and 1st month yet could not be
evaluated clinically by the slit lamp. Persistence of the new passage edema could be a factor. However, anterior segment OCT could detect minor changes in Tear Meniscus Volume (TMV) as previously stated by Ohtomo. In his work, he evaluated this parameter at 2 weeks and 2 months after surgery without evaluating changes between the 1st week and 1st month. Hence, further studies by anterior segment OCT to assess both TMH & TMV over the follow-up period and they may reveal subclinical changes [6].

In the current study, a complete success rate of 85% was reported in trans-conjunctival DCR group while partial success and failure were 10% & 5% respectively. Very few studies are available, however, Kaynak study in 2011 that included 33 eyes (6 of them were converted to external DCR) showed success rate of 92.6% of the remaining 27 eyes with complete relief of the epiphora and patency to irrigation while 7.4% showed partial relief of epiphora and failure to irrigation at 4th month. Accordingly, the success rate of trans-conjunctival DCR in the studied sample including the converted cases will be 75.8% (25 out of 33) [5].

The mild difference in the success rate between our study and kaynak's may be attributed to age difference; mean age of 43 in his study compared to 39.8 in our study and the fact that he was the first to describe the technique and the possibility of faster learning curve in our work based on his technique description. Both studies had comparable success rates that may be attributed to relatively similar exclusion criteria, excluding recurrent cases and any other associated pathology as canalicular obstruction and in both studies, the surgeries were done by highly trained and specialized surgeons.

Conclusion:
The new trans-conjunctival approach has a longer surgical time, associated with higher rate of intraoperative complications and higher tear meniscus height. However, the trans-conjunctival approach may be considered as a new tool that can be used in specific patients as skin diseases, tendency for keloid formation or patient preference with comparable results to external DCR. Also, it can be converted into external approach when needed.

The trans-conjunctival approach is more technically difficult with limited surgical exposure and longer operative time. Long learning curve is needed to master it and minimize the higher rate of complications in comparison to external DCR.

References