Pushed Monocanalicular Intubation for Primary Management of Congenital Nasolacrimal Duct Obstruction

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Abstract


Methods: A prospective study that included 30 eyes (of 30 patients), performed intubation using Masterka tube as a primary treatment for congenital nasolacrimal duct obstruction.

Children were aged 6 to <36 months at the time of surgery, with no prior nasolacrimal surgical procedure, and had at least one of the following clinical signs of NLDO: Epiphora, mucous discharge and/or increased tear lake.

Results: Treatment success was defined as absence of epiphora, mucous discharge and increased tear lake at the outcome visit three month after tube removal. The overall success rate was 83.3%.

Conclusion: Pushed monocanalicular intubation (Masterka) is an effective and simple method for treatment of CNLDO and it requires only Mask inhalation anesthesia.

Key Words: Nasolacrimal duct obstruction – Epiphora – Pushed monocanalicular intubation.

Introduction

70% of neonates present with CNDO at delivery. However, only 6-20% of all neonates have symptoms, because the obstruction usually resolves spontaneously before lacrimal secretion begins [1]. The characteristic presentation of congenital lacrimal obstruction is watering (epiphora) and mucopurulent discharge observed from the first month of life. This usually affects only one eye, although both eyes may be affected in up to 20% of cases [2].

There is considerable controversy surrounding the management—both conservative and surgical—of childhood epiphora. The treatment of congenital nasolacrimal duct obstruction (CNLDO) includes observation, topical antibiotics with tear duct massage, and surgical interventions ranging from simple probing to more invasive procedures, such as stent intubation and dacryocystorhinostomy [3].

Silicone intubation of the lacrimal system has become very popular in the treatment of CNLDO resistant to conservative therapy and/or probing [4-6]. Increasing experience with the technique and the introduction of monocanalicular intubation has led to the use of intubation as a primary procedure for NLDO in younger children [4,6].

We conducted a prospective study to assess the use of pushed monocanalicular intubation (Masterka) for primary management of CNLDO.

Patients and Methods

Prospective interventional study that included 30 eyes; patients were selected from the outpatient Ophthalmology Clinic of Abo El-Reesh Teaching Hospital, Cairo University. Informed written consent was obtained from all parents/guardians before the initiation of any procedure.

The study was carried out from September 2012 to December 2013.

Patient selection:

Inclusion criteria: Children aged between 6 and 36 months with primary CNLDO symptoms resistant to conservative therapy were included in the study. The diagnosis of CNLDO was based on a history of tearing, repeated infections, the fluorescein dye disappearance test (FDT).

Exclusion criteria: Children younger than 6 months of age were excluded because of known self-resolution during maturation of the nasolacrimal
duct. Patients with previous eyelid and/or lacrimal surgery, punctal and/or canalicular obstructions, eyelid mal-positioning were excluded.

**Preoperative evaluation:**

Complete ophthalmological evaluation was done with detailed history taking.

The drainage function of the lacrimal system was assessed by:

- History of onset of symptoms, severity of lacrimation, symptoms of repeated infections as discharge and itching, history of previous medical therapy or nasolacrimal massage.
- **Clinical examinations:** Tear retention and conjunctival sac evaluation, medial canthus observation and/or palpation.
- **Modified fluorescein dye disappearance time:** A drop of fluorescein is instilled in the conjunctival sac and the amount of dye remaining after 5 minutes is recorded.

The history and the modified fluorescein dye disappearance time were considered to be the major endpoints.

**Grading of the patients:**

Grade 0: No lacrimation or tear lake, complete fluorescein clearance.

Grade 1: Occasional lacrimation ≤5 times/day, 25% dye present after 5 minutes.

Grade 2: Lacrimation 5-10 times/day, 25-50% dye after 5 minutes.

Grade 3: Lacrimation 10 times daily, 50-75% dye after 5 minutes.

Grade 4: Excessive lacrimation >10 times daily, 75-100% of the dye after 5 minutes.

**Procedure technique:**

**Masterka intubation:** The Masterka is a pre-loaded device made up of silicone tubing and a metallic guide. It consists of a pushed lacrimal intubation stent with a self-retaining meatic fixation; the Masterka is a "pushed" type of lacrimal intubation stent. It consists of a fixation device in the shape of a punctal plug connected to a length of silicone tubing with a metallic guide that assists insertion by pushing the tubing into the canaliculus and nasolacrimal duct. It is actually possible to remove the guide completely and to reinsert it without altering the stability and shape of the Masterka tubing Fig. (1).

Fig. (1): Masterka tube.

Done under face mask anesthesia. Preliminary lacrimal exploration by probing of upper canaliculus as described above, allowing to:

- Identify the location and severity of the obstruction, only cases of simple obstruction were included.
- Avoid potential sub mucosal and false passages.
- **Choose the appropriate Masterka length:** Done by measuring the distance between the punctum and the nasal floor by inserting the probe and marking the distal end with an artery, and the distance is measured on the probe by a ruler. The proper stent is chosen and it should be always longer the distance measured.

**Insertion of masterka tube:**

- The upper lacrimal punctum is carefully dilated. The Masterka is pushed through the upper canaliculus all the way to the “hard stop” or bony contact. We chose the upper punctum to keep the lower one virgin if further interventions were required.
- While maintaining bony contact, the Masterka is rotated inferiorly to catheterize the lacrimal sac and the nasolacrimal duct, just as done in routine probing, until the nasal floor is reached. At this moment, the plug may be against the punctum, or may be a little bit close to the punctum. Metal to metal contact is searched at the nasal fossa floor using a larger, blunt probe, positive metal-to-metal contact confirms proper placement (no submucosal and/or or false passage).

- Removal of the metal guide is done very carefully, the anchoring plug is held secure against the punctual opening while the guide/introducer is carefully removed. The guide/introducer is removed by gently pulling it from the external section of the tube, while rotating it to help slide it out of the tube. Throughout this phase the anchoring plug is held in firm contact with the lacrimal punctum with a non-toothed forceps. Once the introducer is completely removed, the anchoring plug is inserted into the canaliculus taking care that the collarette of the plug/fixation head is flush against the lid margin.
Post-operative care:

Patients were given combined antibiotic steroid eye drops for 5 days. Follow-up at 1, 2, 4 weeks and 2, 3 months. Tubes were removed at 4 weeks in most patients as the original designers of Masterka advised [14]. The stent is removed as an office procedure with a forceps instrument by pulling on the collaret. The removal is painless and does not require ant anesthetic.

Complete therapeutic success was defined as FDT grade 0, and this result had to correspond with a complete resolution of previous symptoms. Partial success was defined as FDT 1 with substantial improvement and some residual symptoms. Failure was defined as the absence of improvement or the worsening of the symptoms.

Results

A total of 30 patients, 14 males and 16 females, age ranged between 7 and 34 months with a mean of 18.13 months.

Preoperative data:

The table below shows the distribution of patients according to the grade of nasolacrimal duct obstruction using modified dye disappearance test, only patients with simple obstruction at the level of the Hasner valve were included diagnosed intraoperative during the initial probing.

Table (1): Preoperative grading.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of patients</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td>2</td>
<td>5 (16.6%)</td>
</tr>
<tr>
<td>3</td>
<td>14 (46.7%)</td>
</tr>
<tr>
<td>4</td>
<td>10 (33.3%)</td>
</tr>
</tbody>
</table>

Post operative data:

Follow-up of the patients was done at 1 week, 1 month, 2 and 3 months post operative.

First week post operative:

First week post-operative examination of patients showed 3 patients (10%) with epistaxis and one patient showed a central corneal ulcer. Successful cases were 25 cases (83.4%).

One month post procedure:

24 eyes (80%) were successful the tube was removed from 24 eyes, 7 eyes (23.3%) removal of tube was delayed for 2 weeks and one case (3.3%) the tube was lost. p-value: 0.754.

Three months post procedure:

25 cases were successful (83.3%).

Table (2): Distribution of post operative grading 3 month post procedure.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>22 (73.3%)</td>
</tr>
<tr>
<td>1</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>2</td>
<td>5 (16.7%)</td>
</tr>
<tr>
<td>3</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig. (2): Three months post procedure results.

Outcome of the procedure:

Cases were considered successful if reached grade 0 or 1.

25 eyes (83.3%) were successful and 5 cases (16.7%) required further intervention; with 73.3% of cases showing complete resolution of symptoms (Grade 0).

Fig. (3): Distributions of successful cases.

Discussion

There is an extensive literature advocating treatments for CNLDO, Opinions have diverged for more than 2 centuries as to the appropriate treatment regarding nature and timing. Probing has traditionally been advocated as a first-line management of CNLDO; after conservative treatment has failed. Most specialists perform probing as the subsequent interventional therapy [7-11].
Recently, however, some authors prefer to stent all patients at initial probing, regardless of complexity as it is thought to be associated with a high success and a low complication rate [6]. Silicon intubation has been recommended by some authors as the primary procedure in patients who are older than 18-24 months, because of the presumed reduced success rate of probing with age [12]. Also a small proportion of newborns with CNLDO have anatomical variations that are unlikely to resolve spontaneously or be relieved by simple probing [13].

In the present study we attempted to assess the role of the newly designed pushed monocanalicular intubation (Masterka) as a primary treatment for congenital nasolacrimal obstruction.

Our study included 30 patients with CNLDO between the ages of 6-36 months. The overall success rate in the intubation group was 83.3%.

Success in the intubation group was achieved in 83.3% of cases (25 cases) this success is comparable with the original design of Masterka tube Fayet and co workers (2012) in a study that assessed the role of pushed monocanalicular intubation using Masterka tube as a primary management of CNLDO, the trial included 110 eyes, success was achieved in 94 eyes (85%) [14].

Comparing our results to other trials that assessed the role of silicon intubation in primary management of CNLDO but with a different type of tube showed that our success rate is less than that reported by Pediatric eye disease investigator group in 2008 in a non randomized non comparative trial that included 182 eyes of children between 6-48 months, they found that intubation is successful as a primary management in 90% of cases, they used MCI in 70% of cases [15].

Engel and colleagues reported in a retrospective case series of 635 patients (6 to 104 months) in whom they found an overall success rate of 96%. The success rate for treatment performed in infants younger than 24 months of age (684 eyes) was 97%, declining to 90% when surgery was performed in infants older than 24 months of age. This difference in success rate could be attributed to the larger number of cases or different type of tube used [6].

Kaufman and coworkers showed in a retrospective study on 50 eyes treated with monocanalicular intubation with Monoka tube (36 as primary treatment) with an overall success rate of 79% [4].

Complication that occurred in the intubation group included a case of one corneal ulcer and one lost tube. In our study in which monocanalicular tubes were inserted into the superior canaliculus, corneal abrasion was observed in only one child (2.8%) a few days after the surgery. The abrasion was central and healed within 3 days without premature removal of the tube.

Fayet and coworkers observed only three (1.5%) corneal ulcers in 223 eyes with MCI, whereas no corneal ulcers were observed in 1,620 BCI placements. They assumed that the placement of the MCI in the superior canaliculus is a predisposing factor for corneal irritation, especially if the size and length of the collaret is larger. On the other hand, Engel and coworkers 2007 recommend performing MCI through the superior canaliculus, and found only a 2% risk of conjunctival or corneal abrasions in their series of 635 eyes. If MCI is used, corneal abrasions or ulcers can be caused by the ocular end of the MCI. The abrasions usually occur in the inferior nasal quadrant (if the tube is fixed in the inferior canaliculus), and usually heal in a few days after local treatment [16].

We had one case of lost tube before the intended time of removal, premature removal of tube may result in the recurrence of obstruction [15,17].

Advantages of the pushed monocanalicular intubation includes the type of anesthesia used; a "pulled" self-threading monocanalicular stent requires placing the patient under general anesthesia for adequate intranasal stent retrieval, and laryngeal protection usually is recommended as well. The pushed stent is inserted by using a metallic guide that is retracted from the stent lumen upon intubation. Because there is no intranasal retrieval of the stent required with this procedure, insertion of the stent can be accomplished with masked airway anesthesia alone.

In our study we were able to insert the tube in selected cases (3 cases) under sedation only using chloral hydrate as an outpatient procedure without the need for admission to the surgical facility.

Another advantage is the simplicity of insertion in comparison to other monocanalicular and binasal tubes. Many intubation stents are composed of a silicone rod attached to a malleable stainless steel probe or to a nylon suture that can be pushed through the lacrimal ducts into the nose. The probe or suture must be identified beneath the inferior turbinate and then drawn out the nostril. The recovery of the probe or suture in the nasal cavity can be difficult and can potentially cause
significant bleeding. In the Masterka, the probe guide or introducer is placed inside the silicone stent rather than attached at the end as in conventional pulled intubations stents. The silicone is thus pushed into the lacrimal ducts with catheterization. The removal of the introducer is accomplished via an “upper” route, thus avoiding the nasal recovery step of pulled intubations. Thus the use of a pushed intubation method resembles a simple probing technique more than does pulled intubation.

The manipulation in only one canaliculus is also advantageous because the risk of possible iatrogenic traumatisation of the lacrimal system is lower [18] and the tube is fixated in the punctum without the need of anchoring sutures, there is no risk of cheese wiring of the puncta due to excessive tension as in cases of bicanalicular intubation [18,19]. Although we chose to intubate the upper canaliculus only with no manipulation in the lower one, there was a high success rate.

Finally removal of the tube is simple and done under light sedation as an office procedure. The relative early removal of the tube in comparison to other tube types didn’t show an increase in the recurrence rate as it was the same 1 and 2 months after removal of the tube.

One of the main drawbacks of the use of Masterka for treatment is that it’s only effective for simple mucosal obstructions of the nasolacrimal duct, unlike other typers of silicon intubations. Complex cases with a stenotic nasolacrimal duct is determined by absence of metallic contact, difficulty during insertion of the tube and the silicon bunches up around the introducer without passing the stenosis, if this is found then the Masterka is not indicated.

Another problem is that during pulled intubation, most cases of false passage can be corrected to a certain extent, during recovery of the stent by the lower nasal approach; a variable length of nasal mucosa will be damaged. In contrast, with pushed intubation, removal of the metallic guide by the upper approach will not correct the false passage. This may be reduced by detecting the metallic contact within the nasal fossa to confirm the presence of a ductal opening below the inferior turbinate.

**Conclusion:**

Pushed Monocanalicular intubation is effective in primary management of congenital nasolacrimal duct obstruction, proved to be a simple method for intubation with a fast learning curve, minimal complication and it requires mask ventilation anesthesia and could be even done under light sedation with chloral hydrate in the outpatient facility.

**References**


The Arabic text reads:

المؤشرات العربية

في هذا البحث درسنا استخدام الأنبوب الأحادية بطريقة الدفع كعلاج أولي للأطفال بإنسداد خلقى في الفوات الدمعية.

إنسداد الفوات الدمعية الخلقى مشائع في الأطفال حديثي الولادة، يصيب 5% من المواليد، وهذا الأمر يثير القلق.

لقد بحثنا عن الأنبوب المدمج في 20 حالة، عمر الأطفال كان يتراوح بين 1 إلى 3 أشهر ولم يبدوا أي تدخل من قبل، وازالت الأنبوب بعد شهر واحد، وناتجا المستفيض لمدة سنة بعد إزالة الأنبوب وقد وجدنا نسبة التحسن في الأطفال 83.2%.

من الطرق الشائعة في علاج الإنسداد استخدام التسليك كعلاج أولي ولكن هناك من يوصى بوضع أنبوب أولي لتحسين نسب التحسين وتقليل الحاجة لعمليات أخرى.

أن استخدام الأنبوب الدموي قد يؤدي إلى إزالة حذف للمرض ووقوع في حالات الأنسداد، التركيب ولا يحتاج سوى لتخدير خفيف للمريض وهو فعال في علاج حالات الأنسداد.