Pushed monocanalicular intubation. Pitfalls, deleterious side effects, and complications

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Summary
Purpose. — To present our experience with pushed monocanalicular nasolacrimal intubation in the management of 90 consecutive cases of nasolacrimal outflow obstruction.

Materials and method. — This paper reports a non-randomized study of 90 consecutive cases treated with a pushed Monoka intubation system (Masterka). A metal guide is placed inside a silicone tube rather than being attached at the distal end of the tube, as done with traditional pulled intubations. Three probe lengths are available: 30, 35, and 40 mm.

Surgical procedure. — The silicone stent was pushed into a punctum, canaliculus, and nasolacrimal duct by means of the guide. After passing through the valve of Hasner and reaching the nasal floor, the guide was then delicately withdrawn while remaining oriented along the axis of the lacrimal sac and duct. Throughout this phase, the anchoring plug was held in contact with the punctum. Three study groups were set up chronologically: group 1: endo-DCR procedures done with Masterka insertions under endoscopic observation. Group 2: Masterka insertions done with endoscopic guidance. Group 3: blind Masterka insertions without endoscopic guidance. The patients in groups 2 and 3 were selected on the information obtained by lacrimal probing. Only cases with mucosal nasolacrimal stenoses were included. All patients had surgery under general anesthesia with mechanically assisted ventilation (groups 1 and 2) or spontaneous ventilation (group 3). The anchoring plug was inserted into the punctum and vertical canaliculus, either by pulling on the probe (group 1) or using an inserting instrument.

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Results. — A total of 90 pushed Monoka intubations were done. Endoscopic examination (groups 1 and 2) demonstrated visually that the pushed intubation method was effective. In none of the 28 cases did the silicone bunch up when the guide was withdrawn.

Degree of difficulty. — This was dependent upon proper selection for pushed Monoka intubation; the length of the probe and confirmation that there was no false passage was created. The pushed intubation technique was only slightly more difficult than a simple lacrimal probing. The average operating time, excluding the anesthetic procedures, was respectively 5 min (group 2) and 4 min (group 3).

Complications during surgery. — There were no anesthetic or general problems observed in the three groups. Epistaxis was also not noted.

Postoperative complications. — Fifteen percent (13/90). The 13 complications noted were: two cases of canaliculitis, one intracanalicular migration, eight probes that disappeared, one keratitis, and one case of involuntary removal by the patient.

Deleterious side effects. — Tearing with the probe was in place was noted in 21.1% of the cases (19/90). This tearing disappeared as soon as the probe was removed in 50% of these cases (10/19).

Functional Results. — Overall, the success rate (absence of epiphora, absence of mucous discharge) was 90% (81/90) with an average follow-up period of 19 weeks (Range, 1 day to 60 weeks). Two cases were lost to follow-up at day 1 and day 7. Group 1: 90.9% (20/22 cases; average age: 65 years, with an average follow-up period of 24 weeks). Group 2: 100% (6/6 cases; average age: 3.1 years, with an average follow-up period of 14 weeks). Group 3: 88.3% (53/60 cases excluding the two cases that were lost to follow-up; mean age: 2.3 years, with an average follow-up period of 16 weeks).

Conclusions. — From a technical perspective, pushed nasolacrimal intubation is much simpler than the traditional pulled types of nasolacrimal intubation. The anesthetic procedure required is the same as that for a late probing procedure, but the functional results are better. The Masterka is an alternative to simple late probing in the treatment of mucosal nasolacrimal stenoses in patients of over 12 months of age.

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Complications postopératoires. — Quatre-vingt-cinq pour cent (77/90) des cas n’ont présenté aucune complication. Les 13 complications se répartissaient en : deux canaliculites, une migration intracanaliculaire, huit disparitions de sonde, une kératite et une ablation involontaire par le patient.

Effets indésirables. — Un larmoiement sonde en place a été noté dans 21,1 % des cas (19/90). Ce larmoiement disparaissant dès l’ablation de la sonde, une fois sur deux (10/19).

Résultats fonctionnels. — Globalement le taux de succès (Disparition du larmoiement, absence de sécrétion) est de 90 % (81/90) avec un recul moyen de 19 semaines (Extrêmes : 1 jour et 60 semaines). Groupe 1 : 90,9 % de succès (20/22 cas ; âge moyen : 65 ans ; recul moyen : 24 semaines). Groupe 2 : 100 % de succès (6/6 cas ; âge moyen : 3.1 ans ; recul moyen : 14 semaines). Groupe 3 : 88,3 % de succès (53/60 cas, en excluant deux cas perdus de vue après la visite de j1 et de j7 ; âge moyen : 2,3 ans ; recul moyen : 16 semaines).

Conclusions. — Techniquement, la mise en place d’une intubation lacrymo-nasale poussée est plus simple qu’une intubation lacrymo-nasale classique. La procédure anesthésique nécessaire est la même que celle d’un sondage tardif simple mais les résultats fonctionnels sont meilleurs. Dans le traitement des sténoses lacrymo-nasales muqueuses au-delà de l’âge de 12 mois, la Masterka constitue une alternative aux sondages tardifs.

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Introduction

Monoka™ sont des stents en silicone utilisés dans l’intubation des systèmes nasolacrimal obstrués.

Ils sont composés d’un sas de silicone et d’un plastron, similaire à celui conçu par Freeman [1]. Le plastron remplace les sutures qui étaient souvent considérées comme nécessaire pour sécuriser les monocanaliculaires utilisés dans la réparation traumatique lacrymale [2,3].

Long [4] a tenté d’attacher le probe à l’extrémité du plastron. Ce type de monocanalicular intubation systeme était extrêmement instable car le meatus se dilaterait rapidement et le tube sortirait. En développant un plastron à angle de 90° [5], il améliora la stabilité de l’implant et a été bénéfique pour une monocanalicular intubation (Minimonoka™) et même pour l’intubation nasolacrimal (Monoka™).

Depuis la première description de Monoka (1989), plusieurs améliorations ont été mises en œuvre. Ruban a suggéré d’accroître la longueur de l’anneau de 2 à 4 mm [6]. Cela a réduit la migration intracanaliculaire presque complètement.


Le principe d’intubation nasolacrimal par poussée a été proposé il y a de nombreuses années. La technique était simple mais le guide métallique (Remky, Veirs...) qui restait en place était mal toléré par les patients [9,10]. La tolérance excellente des stents en silicone maintenant disponibles a réduit cela incrément la difficulté associée avec le guide "pulled" lacrymaux nasal intubation procédures.

La conception d’un guide métallique (Masterka™) est rendu la combinaison d’un cathéter veineux (e.g. Cathlon™, QuickCath™...) et d’un Monoka™ traditionnel. Le silicone et le plastron restent présents, mais le guide est placé à l’intérieur du sas de silicone [11]. Cela change pour permettre une monolacrymaux nasal intubation to be done without the added difficulty of retrieving the tube from the nasal fossa. In this paper, we present the results of the first 90 cases using the pushed Monoka, including pitfalls, deleterious side effects and complications.

Materials and methods

Ce papier représente une étude non-randomisée de consécutifs de patients avec epiphora due à obstruction nasolacrimal outflow managed with a pushed type of Monoka intubation secured by an anchoring punctal plug. Les patients, or their families, received written information about lacrimal surgery and gave appropriate informed consent.

Description of the Pushed Monoka

Nous avons utilisé un monocanalicular stent (PM) appelé Masterka™ (Fig. 1). Le plastron de fixation a été retiré.

Figure 1. Instrumentation: The Masterka™ with the guide in place and withdrawn.
Figure 2. Pushed monocanalicular intubation. A. Technique: bony contact, rotation, vertical catheterization. B. The two lengths that are sought: "lacrimal punctum to the floor of the nasal cavity" and "punctum to the site of stenosis". C. Objective: at the end of the catheterization the anchoring plug should be in contact with the lacrimal punctum. The free end should clearly extend beyond the nasolacrimal stenosis and stops when in contact with the floor of the nasal cavity or just before.

is similar to the one on the original Monoka, but the metallic guide is inside the silicone tube. The external diameter of the PM is 0.96 mm (in "contrast to 0.64 mm of the traditional Monoka™"). "There are three lengths: 30, 35 and 40 mm". The probe was described in detail in previous two articles [5,11].

Technique

The upper lacrimal punctum was carefully dilated. The PM was pushed through the upper canaliculus all the way to the "hard stop" or bony contact (sauf pour les DCR). While maintaining bony contact, the PM was rotated inferiorly to catheterize the lacrimal sac and the nasolacrimal duct (just as done as for routine probing) until the nasal floor was reached (Fig. 2). Once the vertical catheterization was finished, the distance between the lacrimal punctum and the nasal floor was measured as well as the distance between the punctum and the site of nasolacrimal stenosis. Removal of the guide was carried out very carefully (Fig. 3a–c). The anchoring plug was secured against the upper lid tissue while carefully extracting the introducer. The guide was removed by gently pulling it from the external section of the tube, millimetre by millimetre. Simultaneously, small rotational movements were made with the guide, which helped to slide it out from the silastic sleeve. Throughout this phase, the anchoring plug was held in firm contact with the lid tissues. If the anchoring plug tended to extrude, the PM was then pushed down again until the anchoring plug was secured in the punctal meatus. Removal of the guide was then continued. Once the metallic guide was completely removed, the anchoring plug was inserted into the vertical canaliculus, either by pulling on the probe or with a single use plug introducer as is done for routine punctal plug insertions (Fig. 3d).

Study Groups

Study groups was (Table 1):

- group 1: Endo-DCR. Endo-DCR;
- group 2: Nasolacrimal intubation with endoscopic guidance as a treatment for infant nasolacrimal duct imperforations under general anesthesia;
- group 3: Blind" nasolacrimal intubation as a treatment for infant nasolacrimal imperforations without endoscopic observation under general anesthesia.

The patients in groups 2 and 3 were selected by initial nasolacrimal probing when under general anesthesia. This probing was done to establish the location and complexity of stenosis or obstruction in the outflow system (Fig. 4). The probe was passed inferiorly until a popping sensation could be noted (Hasner’s membrane) and then the nasal floor reached. To confirm proper passage of the probe beneath the inferior turbinate, a larger blunt probe (Bowman 2/0, for example) was very carefully guided into the lower nasal meatus until a "metal-to-metal contact" could be palpated. Only cases with simple stenosis and positive metal contact confirmation were included in the study. All then had "pushed" Monoka intubations done at the time of initial probing.

For the patients in group 2, this nasolacrimal probing was carried out "blindly" at first. Later on during this same operation, endoscopic examination was used to determine where the lacrimal stent entered the lower nasal meatus. This endoscopic examination was then used to observe the successful placement of the silicon stent.

Exclusions

For other more complex cases discovered at the time of probing under general anesthesia, a classical "Pulled"
Monoka was inserted under general anaesthesia with mechanically assisted ventilation and laryngeal protection with an endotracheal tube. All such cases were excluded from the present study.

**Anesthesia**

The same preoperative, intraoperative and postoperative precautions were utilized for the three groups: cardio scope monitoring, monitoring of $O_2$ saturation, monitoring of blood pressure by a sphygmomanometer cuff, intravenous line control and postoperative management in a recovery room. The patients in groups 1 & 2 were operated upon under general anaesthesia with mechanically assisted ventilation. The patients in group 3 were operated upon under general anaesthesia with spontaneous ventilation.

**Postoperative treatment**

Eye drops combining neomycin and dexamethasone were prescribed three times daily for 7 days. Postoperative examinations were scheduled on day 1, day 7 and on day 21, for the removal of the stent, and thereafter upon request.

We paid careful attention to the way that the stent could be easily separated from the guide, evaluated the technical difficulties encountered, and analyzed all of the local and general complications that arose between the time of the Masterka™ insertion and at the time of its removal.

**Results**

Ninety Masterka were inserted in 79 patients. The results of these procedures can be found in Tables 1–3.

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**Table 1** Study groups.

<table>
<thead>
<tr>
<th></th>
<th>Age (mean extremes)</th>
<th>General anesthesia</th>
<th>Selection by lacrimal probing</th>
<th>Pushed monoka (length) (mm)</th>
<th>Intervention</th>
<th>Endoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group 1</strong> ($n=22$)</td>
<td>65 years (44–77)</td>
<td>Mechanical ventilation</td>
<td>None</td>
<td>40</td>
<td>Endo DCR</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Group 2</strong> ($n=6$)</td>
<td>3,1 years (1–9)</td>
<td>Mechanical ventilation</td>
<td>Simple nasolacrimal duct impatency</td>
<td>40</td>
<td>Monocanalicular intubation</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Group 3</strong> ($n=62$)</td>
<td>2,3 years (1–6)</td>
<td>Spontaneous ventilation</td>
<td>Simple nasolacrimal duct impatency &amp; metal to metal positive</td>
<td>30, 35, 40</td>
<td>Monocanalicular intubation</td>
<td>No</td>
</tr>
</tbody>
</table>
Figure 4. Selection by lacrimal probing: A. Simple or extensive nasolacrimal duct impatency. B. Selection of the proper Stent. The length of the stent should be greater than the distance between the lacrimal punctum and the location of nasolacrimal obstruction and also be inferior or equal to the distance between the lacrimal punctum and the floor of the nasal cavity. C. Confirmation of proper location of guide in nasolacrimal duct: a second blunt probe is guided beneath the inferior turbinate achieving metal-to-metal contact.

Table 2 Results.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n = 22)</th>
<th>Group 2 (n = 6)</th>
<th>Group 3 (n = 62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of operation</td>
<td>Not recorded</td>
<td>5 minutes (5–6)</td>
<td>4 minutes (2–9)</td>
</tr>
<tr>
<td>(mean, range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local complications</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>(epistaxis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General complications</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Complications with the</td>
<td>18% (4/22)</td>
<td>0</td>
<td>14,5% (9/62)</td>
</tr>
<tr>
<td>masterka™</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration intubation</td>
<td>51 (7–176)</td>
<td>39 (19–97)</td>
<td>29 (1–69)</td>
</tr>
<tr>
<td>(days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Success failures</td>
<td>90% (20/22)</td>
<td>100% (6/6)</td>
<td>88,3% (53/60)†</td>
</tr>
<tr>
<td>Follow up (mean, range)</td>
<td>24 weeks (5–60)</td>
<td>14 weeks (3–30)</td>
<td>16 weeks (3–74)†</td>
</tr>
</tbody>
</table>

† Two patients lost to follow up after Day 1 and Day 7.

Endoscopic guidance

Group 1: endoscopic guidance during the DCR operations revealed that in the 22 cases the silicone did not bunch up when the guide was removed. Group 2: endoscopic examination of the lower nasal meatus revealed that a positive metallic contact corresponded to direct catheterization without false passage. This correlation was revealed to be satisfactory in all six cases. The probe easily moved through the mucosal nasolacrimal stenosis. The stent remained in position and did not bunch up when the guide was removed. Group 3: insertion was done without endoscopic guidance.

Local and general complications

Postoperatively none of the children showed any epistaxis. No intraoperative or postoperative systemic complications were reported.

Anatomic tolerance of the stent

85.5% (77/90) of the patients had no complications in regard to the stent. There were 13 postoperative complications (13/90 — summarized in Table 3), which included canaliculitis, intracanalicular migration, keratitis, partial extrusion or spontaneous loss of tube.

Deleterious side effects and results

21.1% (19/90) showed persistent tearing with the stent in place but without associated secretion and with a normal corneal examination.

Given the good anatomical tolerance, the stent was left in place for the planned time. This tearing disappeared as soon as the stent was removed in 50% of these cases.

The overall the success rate (absence of epiphora, absence of mucous discharge) was 90% (81/90) (Table 3).
Table 3 MasterKA Complicationsa.

<table>
<thead>
<tr>
<th>Side</th>
<th>Age</th>
<th>Duration of operation (minutes)</th>
<th>Complication</th>
<th>Duration of intubationb (days)</th>
<th>Results</th>
<th>Follow up (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>48 years</td>
<td>40</td>
<td>Not recorded</td>
<td>Canaliculitis</td>
<td>106</td>
<td>Success</td>
</tr>
<tr>
<td>OD</td>
<td>81 years</td>
<td>40</td>
<td>Not recorded</td>
<td>Canaliculitis</td>
<td>83</td>
<td>Success</td>
</tr>
<tr>
<td>OS</td>
<td>62 years</td>
<td>40</td>
<td>Not recorded</td>
<td>Intracanalicular migration</td>
<td>7</td>
<td>Failure</td>
</tr>
<tr>
<td>OS</td>
<td>67 years</td>
<td>40</td>
<td>Not recorded</td>
<td>Involuntary extrusion</td>
<td>30</td>
<td>Failure</td>
</tr>
<tr>
<td>OS</td>
<td>14 months</td>
<td>35</td>
<td>6</td>
<td>Loss of tube</td>
<td>1</td>
<td>Success</td>
</tr>
<tr>
<td>OD</td>
<td>17 months</td>
<td>40</td>
<td>7</td>
<td>Loss of tube</td>
<td>1</td>
<td>Success</td>
</tr>
<tr>
<td>OS</td>
<td>34 months</td>
<td>35</td>
<td>7</td>
<td>Keratitis</td>
<td>1</td>
<td>Success</td>
</tr>
<tr>
<td>OS</td>
<td>27 months</td>
<td>35</td>
<td>7</td>
<td>Loss of tube</td>
<td>1</td>
<td>Success</td>
</tr>
<tr>
<td>OD</td>
<td>12 months</td>
<td>40</td>
<td>9</td>
<td>Loss of tube</td>
<td>7</td>
<td>Failure</td>
</tr>
<tr>
<td>OS</td>
<td>12 months</td>
<td>40</td>
<td>2</td>
<td>Loss of tube</td>
<td>1</td>
<td>Failure</td>
</tr>
<tr>
<td>OS</td>
<td>24 months</td>
<td>40</td>
<td>2</td>
<td>Loss of tube</td>
<td>1</td>
<td>Failure</td>
</tr>
<tr>
<td>OS</td>
<td>12 months</td>
<td>40</td>
<td>2</td>
<td>Loss of tube</td>
<td>1</td>
<td>Failure</td>
</tr>
<tr>
<td>OS</td>
<td>24 months</td>
<td>40</td>
<td>2</td>
<td>Loss of tube</td>
<td>1</td>
<td>Success</td>
</tr>
</tbody>
</table>

a Group 2 had no complications.
b The duration indicates the last observation of the probe in position.

Discussion

Potential Pitfalls

Pushed nasolacrimal intubation is simpler than pulled intubation because the frequently difficult step for recovery of the guide inside the nasal cavity is no longer necessary. The removal of the Masterka guide at the medial canthus is easily learned. This pushed monocanalicular stent technique is no more difficult under general anaesthesia with mechanically assisted breathing than with spontaneous ventilation [12].

The duration of the operation for groups 2 and 3 is quick and not significantly different. This technical simplification does not eliminate the importance of significant surgical experience with managing congenital nasolacrimal obstruction. Mastery of various options of lacrimal catheterization is a prerequisite in order to have the flexibility for selecting and utilizing the most appropriate technique in any given situation.

Pitfalls

Locating the site of the obstruction is the first potential pitfall in the use of pushed intubation.

Nasolacrimal obstruction can result from a combination of various anomalies present in the maxillary bone and/or lower nasal concha and/or the nasal mucosa (Figs. 4 and 5). One generally lists nine anatomical varieties [13] (Fig. 4a). In practice, however, we proceed with lacrimal probing to evaluate the nature of the nasolacrimal obstruction [14–16]. The tactile sensation of passing through a mucosal obstruction is characteristic [15–17]. The same hold true for complex obstructions and/or false passages. Between these two extremes, however, documenting a specific tactile sensation is not always easy to document. These tactile sensations felt during the probing are learned over time and in this area sufficient experience is irreplaceable. Complex obstructions are inappropriate cases to be treated with pushed intubation [11]. The risk is that the guide can pass through the obstruction but not the silicone stent. If there is any doubt as to the nature of the obstruction it is more prudent to use the more traditional pulled form of intubation (Figs 4a and 5d).

Selection of the proper stent is the second pitfall.

The stent must be long enough so that its free end clearly extends beyond the area of nasolacrimal stenosis (Figs 4b and 5a,b). The stent must not be too long as this will make its positioning more difficult. Initially we added 5 mm to the distance from the lacrimal punctum to the floor of the nasal cavity. This has proven to be excessive, however, and has sometimes complicated the intubation (Fig. 5c). Often, at the end of the catheterization the anchoring plug was not in contact with the punctum while at the same time the free end was up against the floor of the nasal cavity. The catheterization was completed, step-by-step, by means of a forceps. The part of the silicon stent sticking out of the meatus was pressed against the lacrimal punctum while the guide was withdrawn one or two centimetres. The pressure on the forceps was then released so as to allow the guide to push the silicon into the lacrimal passage. These back and forth movements were repeated until the anchoring plug finally came into contact with the lacrimal punctum. At times a disposable punctal plug inserter (FCI — S1. 3090) was used to insert the remaining few millimetres of stent into the canaliculus. Caution here is important, however, as the intracanalicular compression of the stent is not desirable from a mechanical point of view. The increase in pressure, like the pressure upon a spring, can cause an enlargement of the lacrimal punctum. The efficiency of the anchoring plugs...
Figure 5. Technical errors. A. Stents that are too short. The estimated distance between the punctum and the nasolacrimal stenosis is longer than the length of the stent. B. Stents that are too long. The free end of the stent rubs against the floor of the nasal cavity while at the same time the anchoring plug remains above the punctum. C. Poorly positioned stent and punctual plug: the guide is fully withdrawn and the anchoring plug remains 2 or 3 mm above the punctum. One should not try to in force push the stent by means of the applicator. One should check the length of the stent and begin the procedure again from the beginning. D. Complex stenosis: the guide may pass through the nasolacrimal stenosis but the silicone usually bunches up without passing through. E. False passages: No metal-to-metal contact is encountered using a second probe that has been introduced in the lower nasal meatus.

Local or systemic complications during the surgical procedure

The general or systemic complications associated with lacrimal surgery or probing in children are extremely few [15,21,23–28]. We have been unable to find any information in the documentation concerning prospective studies that consistently compare late probing with "pulled" nasolacrimal intubation. In this series of cases no difference was observed between stents implanted under general anaesthesia with mechanically assisted ventilation or under general anaesthesia with spontaneous ventilation. Epistaxis following pulled nasolacrimal intubation can complicate the recovery of the guide. Its frequency is not well documented, but we believe is about 5%. In any event, it is very rare that nasal packing is required. Serious epistaxis subsequent to probing is very rare and may be associated with hematologic pathology.

We observed no epistaxis in the 90 cases presented here. The diameter of the implant, which at 0.96 mm, much larger than traditional lacrimal stents, does not appear to cause any difficulties, even for the patients in group 3. The use of metallic contact to confirm probe placement is traditionally criticized as being the cause of injury to the nasal mucous membrane. This risk has been minimized through the use of a stent with a blunt ending having a larger diameter. The blind examination of the lower nasal meatus must be carried out very carefully.

is dependent upon the anatomical integrity of the lacrimal punctum.

At present we select the stent differently. The length of the stent should be greater than the distance between the lacrimal punctum and the location of nasolacrimal obstruction and also be inferior or equal to the distance between the lacrimal punctum and the floor of the nasal cavity. It is always possible to recheck that the nasolacrimal obstruction has been passed through doing metal-to-metal contact procedure.

The third pitfall to avoid is the creation of a false passage

This depends on the anatomy of the nasolacrimal stenosis and also on the practitioner’s experience with lacrimal catheterization (Figs. 4c and 5e). The technique is the same for probing as for intubation. The identification of false passages through the seeking of metallic contact is simple [18–22]. Its usefulness needs further study. In six cases in the present study, the possibility of having created a false passage was inconclusive. Appropriate documentation concerning lacrimal false passages objectively analysed by nasal endoscopy has not been well reported. If the examination leaves any doubt regarding the possibility of a false passage, then it would be wiser to proceed with traditional intubation if possible. The Fig. 5 summarized the technical errors.
Postoperative considerations

Anatomic tolerance of the Masterka

The complications associated with the anchoring plug of the Masterka are similar in nature and in frequency to those of the large-scale Monoka series [29,30] (Table 3). This is logical since the design of the anchoring plug is the same. This technique has been used for nearly 20 years. The external diameter of the stent is different, 0.96 mm rather than 0.64 mm. This could explain the temporary tearing that would be the result of excessive blockage of the common canaliculus. The hypothesis of a low grade canaliculitis would appear less plausible. The removed stents had not been clogged by pus and culture-based analyses provided no positive results.

The loss of stents (Group 3) would appear to be misidentified external losses rather than intracanalicular migrations. Of seven cases, the functional result was still good in 4 of the children. Subsequent rhinoscopy for the other three did not reveal signs of the stent in the lower nasal meatus. The high frequency of these disappearances appears to be associated with a poor choice of stent length. Among our seven cases of stent loss, six did not occur when we measured the distance of the punctum to the floor of the nasal cavity to which we added 5 mm [5,11]. The duration of the operations was only slightly greater than average when these measurements were carefully done. One might expect a more laborious intubation (see above) but this was not the reality. A reduction in the number of premature losses should improve the functional results.

We observed one case of intra canalicul migration in group 1. The flange was not visible but the Masterka still extended from the ostium of the DCR. By means of a forceps the Masterka was extracted in one piece. The fixation point-silicon connection withstood this procedure.

The reason for this migration was probably the insertion of the anchoring plug by pulling on the stent from within the nasal cavity through a more widely dilated punctum. This procedure had certainly placed the stent under tension between the canalicular stenosis and the lacrimal punctum. The pressure on the flange most likely enlarged the punctum to the point where the plug could easily be passed through. This tension, like the tension of a spring or conversely like that of an elastic band, has a negative effect on the stability of the anchoring plug [31]. We recommend placing the anchoring plug in contact with the lacrimal punctum, then checking that the anchor has not been too deeply inserted, and lastly use a punctum plug inserter.

What can be achieved by using pushed monocanalicular intubation?

In endoscopic-guided surgery, pushed monocanalicular stents are not particularly necessary in comparison to traditional pulled intubations. The time saved is negligible because endoscopic guidance removes the random nature of guide recovery [32–34]. Nevertheless, the observation of groups 1 and 2 allowed us to corroborate pushed monocanalicular nasal intubation with this stent.

The most significant potential benefit is perhaps to be found in the late treatment of nasolacrimal imperforations in infants over 12 months of age. The current therapeutic approach is “pulled” canalicular-nasal intubation under general anaesthesia, mechanically assisted ventilation and larynx protection. The success rate is 95% without any anatomical selection [35]. This is based on observation alone. The aesthetic consideration required is a constraint and the operating methods are at times excessive.

Some authors view the complexity of nasolacrimal stenosis as a more important concern than the age of the child [12,15,16,21,36,37]. One should take advantage of the general anaesthesia and spontaneous ventilation to evaluate the nature of the stenosis before selecting a specific probing procedure:

Should the stenosis be complex, the practitioner can choose the pulled monocanalicular procedure. General anaesthesia is lengthy and the traditional procedure can take place during the same operation.

In the case of a simple mucosal stenosis, probing until the age of 3 or even 5 years is recommended by some authors [15–17,19,22,36–40]. Of course the constraints associated with anaesthesia are simpler, but the success rate at an older age is highly debatable [12,35,41–45]. This rate varies between 39 and 90% according to the series examined.

In this situation, if the obstruction is mucosal, then pushed intubation is an excellent alternative to late and very late probing. The constraints associated with anaesthesia are the same. Operating procedures and durations vary little. The cost of the Masterka is offset by a higher success rate and statistically fewer second operations as compared to multiple repeat probing alone without use of a silicone stent (Table 4).

Conclusions

From a technical perspective, pushed nasolacrimal intubation is much simpler than the traditional pulled types of

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Table 4 - Comparisons.

<table>
<thead>
<tr>
<th>Intubation (bika; monoka™)</th>
<th>Mechanical Ventilation</th>
<th>Larynx protect</th>
<th>Selection of cases</th>
<th>Duration</th>
<th>Recovery room</th>
<th>Failures (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pushed monoka (masterka™)</td>
<td>Spontaneous Ventilation</td>
<td>Yes</td>
<td>No</td>
<td>Variable</td>
<td>Prolonged</td>
<td>5a</td>
</tr>
<tr>
<td>Late &amp; very late probing</td>
<td>Spontaneous Ventilation</td>
<td>None</td>
<td>Yes</td>
<td>Rapid</td>
<td>Rapid</td>
<td>11,6b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10–70c</td>
</tr>
</tbody>
</table>

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*a References: [30,35].
*b This study.
*c References: [12,15–17,19–23,34–44].
nasolacrimal intubation. The anesthetic procedure required is the same as that for a late probing procedure, but the functional results are better. The Masterka represents an alternative to simple late probing in the treatment of mucosal nasolacrimal stenoses in patients of over 12 months of age.

Disclosure of interest

BF holds the patent for the “Masterka”. None of the authors has financial interest in any of the products mentioned.

References

Pushed monocanicular intubation. Pitfalls, deleterious side effects, and complications

