·Clinical Research·

Bicanalicular versus monocanalicular intubation after failed probing in congenital nasolacrimal duct obstruction

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Abstract

• AIM: To investigate the clinical outcomes of different intubation techniques in the cases of failed primary probing.

• METHODS: This retrospective study was performed on 338 patients with the diagnosis of congenital nasolacrimal duct obstruction with age 1–4y that had failed primary probing. Intubation was performed under light sedation in operating room and the stent was left 3mo in place. Clinical outcome was investigated 3mo after tube removal.

• RESULTS: Bicanalicular intubation method had higher complete and relative success rates compared to monocanalicular intubation (P=0.00). In addition, Monoka intubation had better outcomes compared to Masterka technique (P=0.046). No difference was found between genders but the higher the age, the better the outcomes with bicanalicular technique rather than monocanalicular.

• CONCLUSION: Overall success rate of bicanalicular intubation is superior to monocanalicular technique especially in older ages. Also, based upon our clinical outcomes, Masterka intubation is not recommended in cases of failed probing.

• KEYWORDS: congenital nasolacrimal duct obstruction; intubation; failed probing

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INTRODUCTION

Congenital nasolacrimal duct obstruction (CNLDO) with an estimated prevalence of 20%, is the most common cause of epiphora during the first year of life; approximately 96% of the CNLDOs resolve spontaneously or with conservative management before the age of one year [1]; the remainder of the cases need further interventions such as probing, intubation and balloon dacryoplasty.

In the terms of epiphora after age of one year, as the primary approach, pediatric ophthalmologists perform nasolacrimal duct probing under general anesthesia or office probing is considered[2-3].

When primary intervention is deferred to a later age, or after failed primary probing, second stage intervention is considered. The best choices are silicone tube intubation [3] and balloon dacryoplasty[2,4-5]. Selection of these two depends on the experience of the ophthalmologist; many prefer intubation and many perform balloon dacryoplasty. The conventional intubation used prevalently is the bicanalicular technique that is used in our patients and the outcomes are investigated.

Kaufman and Guay-Bhatia [6] in 1998 introduced monocanalicular silicone tube intubation as an alternative procedure to bicanalicular method (BCI). Two types of monocanalicular intubation (MCI) have been described; in Monoka Crawford type, the metallic guide is retrieved with Crawford hook in nasal vestibule [7]. The other type is pushed MCI (Masterka intubation) in which, the tube is gently pushed from the punctum and no intranasal retrieval of the stent is required[8].

Although facility of MCI technique, makes it a favourable method of intubation over BCI technique [2], there are few studies in this field to compare the clinical outcomes; also there is only one study that compared outcome of Monoka versus Masterka intubation in the treatment of CNLDO [9], therefore, we decided to analyze the outcome in our patients that underwent one of the intubation techniques to assess the advantages and complications of BCI versus MCI as well as the success rate of Monoka Crawford versus Masterka intubation in children treated for CNLDO, after primary failed probing.

SUBJECTS AND METHODS

Subjects This retrospective interventional study was performed in Orbit and Oculoplasty Department of the Farabi Eye Hospital, Tehran, Iran. Ethics Committee of Tehran University of Medical Sciences approved the study and it was performed in accordance with the Declaration of Helsinki. Written informed consent is obtained routinely in our hospital from all parents before the initiation of any procedure after thorough explanation. All children in the age range of 1-4 years old, with CNLDO and failed previous probing, defined as cases with unresolved CNLDO symptoms, epiphora or recurrent mucopurulant discharge that underwent one of the intubation techniques were included in the study. Children with previous eyelid or lacrimal apparatus surgery, bony obstacles in previous probing, eyelid malposition, punctal or canalicular obstruction, maxillofacial anomalies, history of trauma to the nasolacrimal system except probing, previous canalicular intubation and Down syndrome were excluded from data analysis. The technique of intubation was randomly selected for each patient after discussing with parents. Upon the method of intubation, the outcomes were categorized into two groups, BCI and MCI groups. In the cases of bilateral CNLDO, we considered only the right eye.

All nasolacrimal intubations were performed by a single oculoplastic surgeon (Rajabi MT) under general anesthesia with laryngeal mask. Patients were divided into three groups according to the age; 12 to 24mo, 24 to 36mo, 36 to 48mo and comparative analysis was performed between these age groups.

As a routine, all the patients had been administered prophylactic antibiotic eye drop, Chloramphenicole (Clobiotic ®, Sinadarou, Iran) and corticosteroid eye drop, Betamethasone (Betasonite ®, Sinadarou, Iran). They had been examined within 1wk after intubation for seeking early complications such as corneal abrasion or tube extrusion that were recorded in their profiles. All stents were removed 3mo after intubation and patients were examined 3mo after tube removal for clinical outcome evaluation. Routine methods of intubation in our hospital are as follows, the same methods were performed in our cases.

Bicanalicular Intubation Technique After standard dilation and probing through the lower punctum, patency of the punctum is confirmed and then bicanalicular intubation is performed using Crawford stent with an olive tip (FCI, Paris, France) through the lower and upper punctums. The tube is retrieved in the nasal cavity with a Crawford hook and the distal end of the silicone tube is cut; the two end tails of the tubes are tied together in the nose with two knots one centimeter in between, meanwhile by checking and adjusting the traction on the punctum to prevent cheese wiring. A loop is made at the end of the tube with 5/0 silk thread to facilitate the removal of the tube.

Monoka Intubation Technique In Monoka insertion, the lower punctum is gently dilated with a bowman probe with the diameter of 1.1 mm (the Storz No, 0 probe), then Monoka tube (FCI, Fayet and Bernard) is passed through the lower canaliculus and the tube is retrieved in the nasal cavity with metallic hook; then the distal end of the tube is cut and the end of the tube is fixed to the nasal wall by 5/0 silk thread, the upper portion is fixed in the inferior punctum with a plug inserter.

Masterka Intubation Technique For Masterka (FCI, designer Fayet B) MCI technique (pushed stent intubation system), we have stents in 3 sizes of 30, 35 and 40 mm. The lower punctum is gently dilated, then proper length of the stent is selected and pushed into the lower canaliculus, then the Masterka tube is rotated to a vertical direction toward the nasal floor; at this moment, the metal introducer is removed gently by pulling it outside the silicone tube millimeter by millimeter; meanwhile, the anchoring plug is held in firm contact with the lacrimal punctum and finally it is fixated in the vertical canaliculus. Tube removal was performed in operating room in Crawford intubation under light sedation and Monoka or Masterka tubes were removed in the office by the same person that performed the intubation. A follow up visit, 3mo after tube removal was scheduled and it was reminded by phone call; the clinical improvement was evaluated in this session. Clinical outcome was defined in three groups. Complete therapeutic success was defined as no sign and symptom of tearing or discharge. Partial success was defined as substantial improvement with some residual symptoms and failure was defined as the absence of improvement or the worsening of the symptoms.

Statistical Analysis The data were analyzed with the SPSS statistical package (Version 20; SPSS, Inc, Chicago, IL, USA). Data analysis was conducted by first testing for normal distribution of the variables. Descriptive statistics, including the mean and standard deviation were calculated for different variables. Clinical outcomes were compared using Chi-square and Mann-Whitney tests. The P value of less than 0.05 was considered statistically significant.

RESULTS

There were 347 eyes of 347 patients with congenital NLDO with previous failed probing, first recruited in this study. There were 4 cases excluded because of bony obstacles in previous probing, 1 case because of blepharophimosis syndrome, 3 cases with Down syndrome, and 1 case of previous eyelid trauma were excluded from the study population. The 338 eyes of 338 patients were considered in data analysis.

Intubation (BCI) was performed in 248 eyes and MCI in 90 eyes. There were 43.9% of patients female and 56.1% were male.

Table 1 Comparison of success and failure rates in Crawford, Monoka and Masterka intubation *n* (%)

Age groups (mo)	No. of cases	Crawford	Monoka	*P*	Masterka	*P*
12-24	83	58	14	0.045	11	0.002
	Complete success	50 (86.2)	7 (50.0)		3 (27.3)	
	Relative success	6 (10.3)	5 (35.7)		2 (18.2)	
	Failure	2 (3.5)	2 (14.3)		6 (54.5)	
24-36	155	114	24	0.030	17	0.015
	Complete success	95 (83.3)	11 (45.8)		6 (35.3)	
	Relative success	16 (14.1)	4 (16.7)		3 (17.6)	
	Failure	3 (2.6)	9 (37.5)		8 (47.1)	
36-48	100	76	14	0.007	10	0.000
	Complete success	54 (71.1)	7 (50.0)		3 (30.0)	
	Relative success	18 (23.7)	3 (21.4)		1 (10.0)	
	Failure	4 (5.2)	4 (28.6)		6 (60.0)	

In BCI group, complete resolution of symptoms was observed in 199 eyes (80.2%), partial resolution in 40 (16.2%), and failure in 9 eyes (3.6%) (P=0.000) (Table 1).

In patients with MCIs treatment, the complete resolution of symptoms was observed in 37 eyes (41.1%), partial success in 18 eyes (20.0%), and failure in 35 eyes (38.9%). Therefore, the complete success rate in BCI was significantly higher than that of MCI treatment (P=0.000).

Data showed that in BCI method, the complete success rate was significantly the highest in patients in the age range of 12-24mo (86.2%) (P=0.045).

In both BCI and MCI groups, rate of complete and relative success was not statistically significant in two genders (P= 0.433). However, complete success rate in patients with BCI treatment was significantly higher in both genders compared to MCI (P=0.002). The success and failure rates analyzed in comparison of each group of MCI with BCI are shown in the Table 1.

In this study, a total number of 90 eyes underwent MCI which divided into 2 groups: Monoka MCI (n=52 eyes) and Masterka MCI (n=38 eyes). Complete and relative success rate was achieved in 37 of 52 eyes (71.2%) in the Monoka group compared with 18 of 38 eyes (47.3%) in the Masterka group, the difference between the 2 groups was statistically significant (P=0.046) (Table 2), with no significant difference in two genders.

Complications were rare but occurred in both groups; premature removal due to tube dislodging and extrusion occurred in 21 of 292 eyes of BCI group and spontaneous extrusion was seen in two of 90 eyes of MCI group during the first month; of these eyes, resolution of symptoms was observed in 15 eyes in BCI group and in one eye in MCI cases. Corneal abrasion occurred in one eye in BCI group that completely resolved, with conservative management with lubricants and prophylactic topical antibiotic eye drops in a few days. Punctual slitting caused by cheese wiring effect was seen in four eyes in BCI group. None of the eyes in MCI group had this complication. In one of the cases of MCI group, punctal plug migration to canaliculus occurred at the time of extubation and as it was not asymptomatic, no manipulation was performed.

Table 2 Comparison of success and failure rates in Masterka and Monoka intubation *n* (%)

Age groups (mo)	No. of cases	Monoka	Masterka	*P*
12-24	25	14	11	0.065
	Complete success	7 (50.0)	3 (27.3)	
	Relative success	5 (35.7)	2 (18.2)	
	Failure	2 (14.3)	6 (54.5)	
24-36	41	24	17	0.103
	Complete success	11 (45.8)	6 (35.3)	
	Relative success	4 (16.7)	3 (17.6)	
	Failure	9 (37.5)	8 (47.1)	
36-48	24	14	10	0.172
	Complete success	7 (50.0)	3 (30.0)	
	Relative success	3 (21.4)	1 (10.0)	
	Failure	4 (28.6)	6 (60.0)	

DISCUSSION

BCI was first introduced by Guibor [10] and Crawford [11] to augment the effect of sole probing with providing a pathway for epithelial cells to migrate and form a lumen around the tube in long term. The success rate of this procedure has been declared to be from 83% to 100% in various studies[12-13]. The French firm FCI introduced Monoka in 1992 and the first study on the clinical outcomes and complications of Monoka intubation method was done by Kaufman and Guay-Bhatia[6] in 1998. In this MCI method, the difficulty of passing the tube through the two punctums and canaliculi is simplified and abbreviated to a briefer technique.

Few studies were designed to investigate the clinical outcomes and complications of MCI in comparison to BCI. Fayet *et al* [8] reported complete symptom resolution in 62.4% of BCI group and 67.7% with Monoka intubation technique. In 1998 Kaufman and Guay-Bhatia [6] reported a 68% overall success rate in BCI group and 79% in Monoka

group in a retrospective study with 73 patients.

In the prospective randomized study of Andalib *et al*[14], and another study by Kominek *et al*[15], no statistically significant difference was found between bicanalicular and MCI techniques. In the current study overall success rate was 96.4% in BCI and 71.5% in Monoka group and 47.3% in Masterka group. Actually there is no definite explanation to demonstrate the reason of this finding; we suppose that in BCI technique, as two parallel tubes are located beside each other, the diameter of the epithelial lumen that forms around the tubes is larger in this technique. The external diameter of the Crawford silicone tube is 0.8 mm and it returns to the nasal cavity after a U-turn in the punctal region compared to one-way pass of Monoka intubation with the external diameter of 0.64 mm. Similar to the previous reports[7,13,16-19] our data showed lower success rate with increased age in BCI group; although age had no effect on the success rate in MCI group comparable to previous studies [13,15-16]. Compared to other studies that showed different rates of success from 86%-100% in MCI method [8-9,15], our study showed lower success rate in this technique with both methods, Monoka & Masterka.

In comparison of Monoka versus Masterka intubation for the treatment of CNLDO, there is little data in the literature. In 2014, Andalib and Mansoori[9] obtained higher success rate of intubation in Monoka (90%) compared to Masterka intubation (50%) in a prospective study (n =53 eyes).

In our study, 90 eyes were in monocanalicular group, and overall success rate was 71.15% in Monoka group and 47.3% in Masterka group with statistically significant difference.

Besides the one time pass through the nasolacrimal system in Masterka intubation, this technique also does not have the stage of probe retrieval when reached to the nasal floor. In spite that it seems very quicker to perform, however, meanwhile the metal guide is removed, the silicone tube has the opportunity to bunch up and come into the lacrimal sac, and the efficacy drops to a large extent, to a level similar to sole probing.

In previous studies, premature tube removal because of tube dislodging has been reported from 3% to 41% overall[14,20-23]. Lower unplanned tube removal rates in Monoka group in our study is probably due to the tie made to the nasal wall. The Monoka was tied in the nasal cavity and so that the rate of extrusion was small in our series.

We had corneal abrasion in one eye in 338 cases that was comparable to previous studies declared by Kominek *et al*[15], Engel *et al*[16] and Andalib *et al*[14].

In conclusion, based on our observations, we do not suggest Masterka intubation in children with failed probing and long lasting effect can not be expected with this procedure. Also in older ages, any of the monocanalicular procedures are not suggested and bicanalicular Crawford intubation is the method of choice; however, the older the case, the more the success rate is decreased.

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