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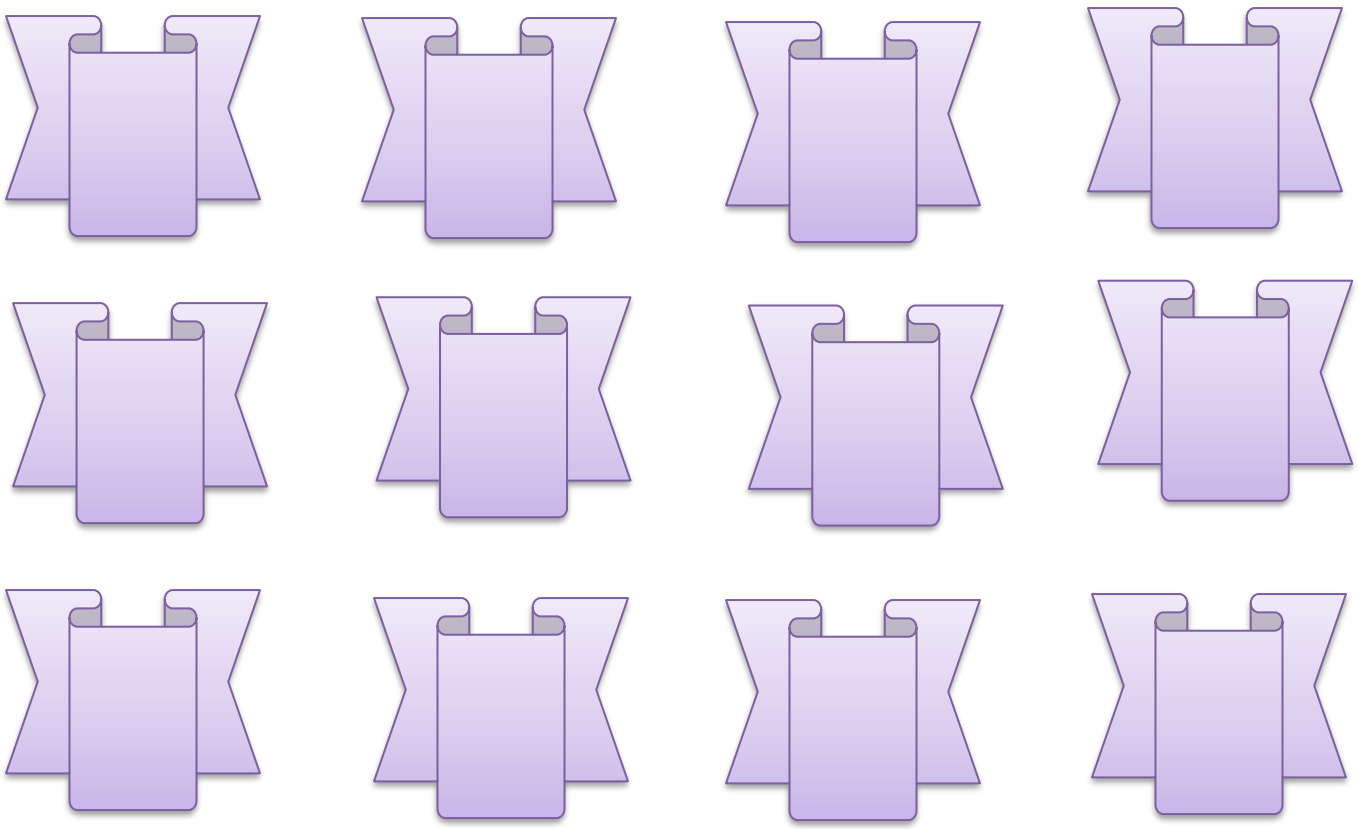

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Original Article

Blind Bi-canalicular Intubation Versus Endoscopic Guided Intubation in Treatment of Nasolacrimal Duct Obstruction in Children

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ABSTRACT

Background: Congenital nasolacrimal duct obstruction is a common cause of epiphora in pediatrics. Probing is the primary treatment option. However, failure rate is high. Thus, many options are introduced without consensus on the optimal management option.

The Aim of the work: The current work aiming to compare blind bicanalicular intubation and endoscopic guided intubation in treatment of pediatric nasolacrimal duct obstruction.

Patients and Methods: Fifty eyes with congenital nasolacrimal duct obstruction [CNLDO] were included. The preoperative assessment include history taking, clinical examination and complete ophthalmological examination. The Munk scale was used for grading of epiphora. Patients were grouped into two equal groups. The first treated by blind bicanalicular intubation, and the second treated by endoscopic guided intubation. Patients were followed up on the first day, first week, first, third and sixth months in the absence of complications. The postoperative evaluation included Munk score, tear meniscus height, fluorescein dye disappearance test, discharge, bleeding, and subjective patient satisfaction.

Results: The study groups were comparable regarding patient age, sex, laterality of the obstruction and assessment scores or tests. However, there was progressive improvement in both groups at the end of follow up compared to preoperative values. The percentage of reduction of Munk score and TMH was higher in endoscopic guided intubation. The improvement of FDDT was achieved for 92.0% in endoscopic group, compared to 88% of the blind bi-canalicular group. Postoperative bleeding was significantly higher among blind than endoscopic groups [24% vs 4.0% respectively]. The recurrence rate was higher among blind than endoscopic groups [12% vs 8%].

Conclusion: Silicone intubation of nasolacrimal duct with nasal endoscopy had favorable results than blind bicanalicular intubation, as a primary treatment of persistent congenital NLDO in children between 2-6 years of age.

Keywords: Probing; Congenital; Nasolacrimal Duct; Bi-canalicular; Endoscopy.

INTRODUCTION

Nasolacrimal duct obstruction is the most common cause of epiphora in children. It is followed by punctal and canalicular stenosis. It is presented in one of two forms; congenital or acquired. In children most nasolacrimal duct obstruction is congenital [1].

In normal newborn infants, the incidence of congenital nasolacrimal duct obstruction is approximately 5%. The valve of Hasner [at the distal end of the duct] is the common site of obstruction. The second most common cause of obstruction is the general stenosis of the duct. The obstruction affects both sexes with no sex or genetic predilection. The blockage may be presented in a unilateral or bilateral form. Within the first year of life, congenital obstruction usually heals spontaneously [about 90% had spontaneous resolution] [2]. On the other side, the acquired nasolacrimal duct obstructions can occur after trauma, infection [viral conjunctivitis, acute dacryocystitis], and use of topical antiviral drugs [3].

The congenital obstruction started by initial observation for spontaneous resolution. Then, followed by probing for persistent obstruction. Aggressive surgical interventional procedures are then applied for cases with probing failures. These procedures include balloon gastroplasty and nasolacrimal duct intubation [endoscopic guided or blind intubation] [4].

The stent insertion is used for a primary procedure after failure of probing. The procedure includes probing by nasolacrimal duct probe with a stent attached to its end. It could be applied in bilateral obstructions. Bicanalicular stents have two probes with an intervening stent. One probe is passed through the upper punctum and the other probe passed through the lower punctum. The probes are removed, and the free ends of the stents are tied in the nose and sometimes secured with a suture [5].

The aim of this work is to compare blind bicanalicular intubation and endoscopic guided intubation in treatment of pediatric nasolacrimal duct obstruction.

PATIENTS AND METHODS

Fifty eyes in 44 patients with congenital nasolacrimal duct obstruction [CNLDO] were included in this study. The diagnosis was based on a history of epiphora with or without discharge dating since birth or shortly thereafter in one eye [38 cases] or both eyes [6 cases], supported by objective evidence of reduced lacrimal outflow using a fluorescein disappearance test [FDT]. Patients were selected from Al-Azhar university hospitals [Al-Hussien and Bab Al-Shaaria hospitals] during the period from February 2021 till January 2023.

The preoperative assessment consisted of history taking and clinical examination. Epiphora was the most common presenting symptom and was assessed for its onset, course and duration. In addition, the Munk scale was used for epiphora grading. A complete ophthalmic examination was performed. This consisted of determination of visual acuity, inspection of eyelid for any masses, biomicroscopy by slit-lamp, measurement of tear meniscus height, and 2% fluorescein dye disappearance test was performed. Finally, a syringing and probing test was performed to exclude any associated lacrimal pathway obstruction. A preoperative photography was performed for documentation. A pre-formed sheet was used for collection of data.

Ethical considerations: An informed consent was signed by the legal guardian before surgery and after full explanation of the study procedures, potential benefits and complications. The study protocol was approved by the local research and ethics committee.

Grouping: According to planned treatment intervention, fifty eyes were randomly assigned into one of the groups [each included 25 eyes]. The first group treated by blind bicanalicular intubation, and the second group treated by endoscopic guided intubation.

Operative techniques: All surgical procedures were performed under general anesthesia. In blind bicanalicular intubation, the lacrimal probing and syringing test was performed at first to exclude concomitant punctual or canalicular stenosis. Then, the punctum was dilated by a Nettleship punctal dilator [Figure 1]. The size of the probe passed through punctum ranged from 0.70 to 1.10 mm in diameter [Figure 2]. The probe was advanced along the canaliculus while exerting gentle lateral traction on the lid until it reached the nasal bone. Then the probe was rotated 90° and gently introduced into the nasolacrimal duct and advanced into the nose [Figure 3].

During probing, a gritty feeling could be felt along the stenotic duct and in case of presence of a distal membrane, a distinct "pop" was felt when the membrane was breached. When indication, the inferior turbinate was infractured medially to open the area underneath it. Nasolacrimal duct patency was confirmed by several methods. The end of the probe sometimes directly observed, palpated with another probe, A small bolus of saline irrigated through the duct [colored with fluorescein typically] and aspirated with suction. Bicanalicular stents have two probes with an intervening stent. One probe is passed through the upper punctum [Figure 4] and the other through the lower punctum. The probes were removed, and the free ends of the stent were tied in the nose [Figure 5] and sometimes secured with a suture.

Patients were followed-up for 6 months after the surgery. During the follow up period, the surgeon investigated the improvement of subjective epiphora symptoms based on Munk score, fluorescein disappearance test, tear meniscus height and incidence of complications.

Figure [1]: Dilatation of the punctum with a Nettleship punctal dilator

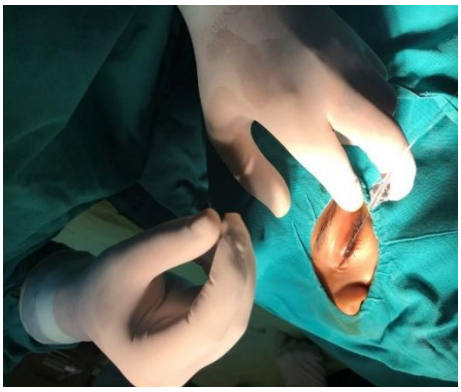

Figure [2]: The probe passed through punctum

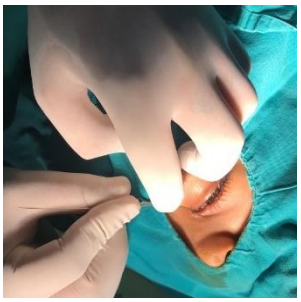

Figure [3]: The probe was rotated 90 degrees and gently introduced into the nasolacrimal duct and advanced into the nose

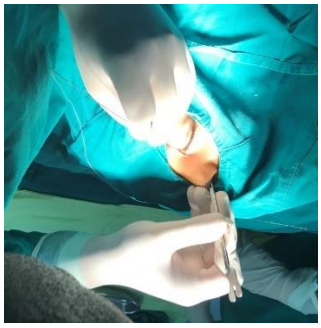

Figure [4]: One probe is passed through the upper punctum

Figure [5]: The probes were removed, and the free ends of the stent were tied in the nose

In the second group [Endoscopic guided intubation], the syringing and probing test was performed to exclude concomitant punctal or canalicular stenosis. The upper punctum was dilated by a Nettleship punctal dilator. The Bowman's probe was used to carry out probing. The probe was then introduced vertically into the punctum and rotated horizontally 90° while pulling the outer canthus laterally in the same plane to enter the canaliculus. The probe was advanced until it reached the nasal wall of the lacrimal sac [hard stop] and rotated vertically and guided without force [to avoid false passage] through the NLD. At this point the nasal endoscopy was applied to the nasal cavity under the inferior turbinate to assess probing by visualization around the inferior meatus. Finally, topical antibiotic eye drops four times/day, and xylometazoline hydrochloride 0.05% nasal drops were applied for 1 week.

The resolution of obstruction was defined as the absence of watering or discharge with a normal Tear meniscus height [TMH] and Fluorescein dye disappearance test [FDDT]. Failure was defined as persistent watering or discharge, persistent high TMH value and delayed FDDT. Cases are followed for 6 months after probing.

Postoperatively, patients were prescribed topical antibiotic eye drops every 4 hours for the

early postoperative period. Then, medication intervals were then adjusted according to postoperative discharge and epiphora. Patients were followed up primarily on the first day, first week, first month, third month and 6th months in the absence of complications. Complicated patients required closer follow up intervals.

The postoperative evaluation included Munk score, tear meniscus height, fluorescein dye disappearance test, discharge, bleeding, and subjective patient satisfaction.

The statistical analysis of data: The collected data were anonymized and fed to the Statistical Package for Social Science [SPSS] [IBM®, Armonk, USA] version 23. The quantitative variables were presented as mean, standard deviations [SD], range, median and interquartile range [IQR] according to normality of the data. The qualitative variables were presented as numbers and percentages. Chi square and t-tests were used to test associations for qualitative and quantitative variables, respectively. The repeated ANOVA or Friedman tests were used to test progress of the values over time. The confidence interval was set to 95% and the margin of error accepted was set to 5%. Thus, p value < 0.05 was considered significant.

RESULTS

Fifty eyes in 44 patients with epiphora were included in this study 23 patients were included in group A [2 patients of them had bilateral epiphora] and 21 patients were included in Group B [4 patients of them had bilateral epiphora].

The patient age ranged between 2 and 6 years, and males represented 52% of all patients and operation was on the right side in 50%. There were no significant differences between two groups regarding age, sex or laterality [Table 1].

Munk score was comparable between two groups preoperatively and at each follow up visit after operation. The score significantly and progressively reduced in both groups at the end of follow up when compared to preoperative values [Table 2].

In addition, there was no significant differences between groups A and B regarding tear meniscus height [TMH] in preoperative and all postoperative follow up visits. However, there was significant progressive reduction of TMH in both groups at the end of follow up when compared to preoperative values [Table 3].

The positive fluorescein dye disappearance test [FDDT] was positive in all children before intervention. At the end of follow up the positive test was reported among 3 and 2 children in groups A and B, respectively, with no significant differences between groups at any time of postoperative follow up visits. However, the progressive reduction of positive test was reported in both groups [Table 4].

Regarding overall outcome, the percentage of reduction Munk score and TMH was higher in endoscopic guided intubation. However, these differences did not reach statistical significance. The improvement of FDDT was achieved for 92.0% in endoscopic group, compared to 88% of the blind bi-canalicular group. However, the difference is not significant from the statistical point of view. The discharge also was comparable between both groups at all points of postoperative follow up. The tube was removed in 3 to 6 months postoperatively with no significant difference between groups. PO bleeding was significantly higher among blind than endoscopic groups [24% vs 4.0% respectively]. The recurrence rate was higher among blind than endoscopic groups [12% vs 8%]. But the difference did not reach statistical significance [Table 5].

Table [1]: Patient demographics among study groups

Variable		Group A [Blind bicanalicular N=25]	Group B [Endoscopic Guided; n=25]	Total [n=50]	Test	P
Age [years]	Mean±SD	3.40±1.12	3.44±1.04	3.42±1.07	0.131	0.897
	Min.-Max.	2-5	2-6	2-6		
Sex [n, %]	Male	13[52.0%]	13[52.0%]	26[52.0%]	0.001	1.00
	Female	12[48.0%]	12[48.0%]	24[48.0%]		
Side [n, %]	Right	10[40.0%]	15 [60.0%]	25[50.0%]	2.00	0.157
	Left	15 [60.0%]	10[40.0%]	25[50.0%]		

Table [2]: Preoperative and postoperative Munk score among study groups

			Group A	Group B	Test	P value
Munk Score	Preoperative	Median [IQR]	3 [3 – 4]	3 [3 – 4]	1.118	0.264
		Min.-Max.	2 – 4	3 – 4		
	Postoperative First day	Median [IQR]	1 [1 – 2]	1 [1 – 1]	1.888	0.059
		Min.-Max.	0 – 4	0 – 4		
	Postoperative One week	Median [IQR]	1 [0 – 1]	1 [0 – 1]	0.669	0.503
		Min.-Max.	0 – 4	0 – 4		
	Postoperative One month	Median [IQR]	0 [0 – 1]	0 [0 – 1]	0.579	0.563
		Min.-Max.	0 – 3	0 – 4		
	Postoperative Third month	Median [IQR]	0 [0 – 1]	0 [0 – 0]	0.616	0.538
		Min.-Max.	0 – 3	0 – 3		
	Postoperative Sixth month	Median [IQR]	0 [0 – 1]	0 [0 – 1]	0.602	0.547
		Min.-Max.	0 – 3	0 – 3		
Repeated ANOVA			test=97.84, p<0.001*	test=99.3, p<0.001*		

Table [3]: Preoperative and postoperative Tear meniscus height [TMH] among study groups

			Group A	Group B	Test	P value
TMH	Preoperative	Mean±SD	0.57 ± 0.08	0.56 ± 0.06	0.393	0.696
		Min.-Max.	0.4 –0.7	0.4 – 0.6		
	Postoperative First day	Mean±SD	0.38 ± 0.12	0.35 ± 0.09	0.825	0.414
		Min.-Max.	0.2 – 0.7	0.2 – 0.6		
	Postoperative One week	Mean±SD	0.33 ± 0.10	0.29 ± 0.10	1.425	0.161
		Min.-Max.	0.2 – 0.6	0.2 – 0.6		
	Postoperative One month	Mean±SD	0.28 ± 0.12	0.26 ± 0.11	0.739	0.464
		Min.-Max.	0.2 – 0.6	0.2 – 0.6		
	Postoperative Third month	Mean±SD	0.27 ± 0.12	0.26 ± 0.11	0.243	0.809
		Min.-Max.	0.2 – 0.6	0.2 – 0.6		
	Postoperative Sixth month	Mean±SD	0.27 ± 0.12	0.26 ± 0.11	0.243	0.809
		Min.-Max.	0.2 –0.6	0.2 – 0.6		
Repeated ANOVA			test=88.07, p<0.001*	test=126.9, p<0.001*		

Table [4]: Preoperative and postoperative Fluorescein dye disappearance test [FDDT] among study groups

			Group A	Group B	Test	P value
FDDT	Preoperative	Negative	0 [0.0%]	0 [0.0%]	-	-
		Positive	25 [100.0%]	25 [100.0%]		
	Postoperative First day	Negative	18 [72.0%]	18 [72.0%]	0.000	1.000
		Positive	7 [28.0%]	7 [28.0%]		
	Postoperative One week	Negative	18 [72.0%]	18 [72.0%]	0.000	1.000
		Positive	7 [28.0%]	7 [28.0%]		
	Postoperative One month	Negative	21 [84.0%]	22 [88.0%]	0.166	0.684
		Positive	4 [16.0%]	3 [12.0%]		
	Postoperative Third month	Negative	22 [88.0%]	23 [92.0%]	0.222	0.637
		Positive	3 [12.0%]	2 [8.0%]		
	Postoperative Sixth month	Negative	22 [88.0%]	23 [92.0%]	0.222	0.637
		Positive	3 [12.0%]	2 [8.0%]		
Repeated analysis			test=72.28, p<0.001*	test=83.54, p<0.001*		

Table [5]: Outcome among study groups

			Blind Bi-canalicular Intubation	Endoscopic guided Intubation	Test value	P-value
			No. = 25	No. = 25		
Percentage of reduction	Munk	Mean ± SD	82.67 ± 27.94	88.33 ± 22.31	-0.775	0.438
		Range	0 – 100	25 – 100		
	TMH	Mean ± SD	51.99 ± 19.92	53.20 ± 18.19	0.070	0.944
		Range	0 – 71.43	0 – 66.67		
	FDDT	Not improved	3 [12.0%]	2 [8.0%]	0.222	0.637
		Improved	22 [88.0%]	23 [92.0%]		
Discharge	After 1 day		16 [64.0%]	15 [60.0%]	0.085	0.771
	After 1 week		6 [24.0%]	4 [16.0%]	0.5	0.48
	After 1 month		3 [12.0%]	2 [8.0%]	0.222	0.637
	After 3 months		3 [12.0%]	2 [8.0%]	0.222	0.637
	After 6 months		3 [12.0%]	2 [8.0%]	0.222	0.637
Tube removal [months]	Mean ±SD		3.48 ± 0.59	3.56 ± 0.82	0.397	0.693
	Min.- Max.		3 – 5	3 – 6		
PO bleeding			6 [24.0%]	1 [4.0%]	**4.153**	**0.042***
Recurrence			3 [12.0%]	2 [8.0%]	0.222	0.637

DISCUSSION

The current work aimed to compare between blind bicanalicular intubation and endoscopic guided intubation in treatment of nasolacrimal duct obstruction in children and follow up for up to 6 months. The functional outcomes in both techniques were compared. The functional outcomes included postoperative Munk score, tear meniscus height, fluorescein dye disappearance test, discharge, bleeding and patient satisfaction. Both groups were comparable regarding patient gender, age, and laterality. In addition, both groups were comparable [no significant differences] regarding Munk score, tear meniscus height, fluorescein dye disappearance test and discharge. However, postoperative bleeding was significantly lower in endoscopic guided than blinded intubation [4% versus 24% respectively]. The overall recurrence was lower in endoscopic-guided than blinded intubation [8.0% versus 12.0% respectively]. But the difference did not reach statistical significance. This was the same situation for Munk score, TMH, FDDT and discharge.

Searching the literature, we found scarce studies comparing both procedures as in the current study. However, literature is rich by assessment of the outcome of each procedure alone or in comparison to other procedures.

Espinoza and Lachmund [6] wrote a narrative review about different treatment options for nasolacrimal duct obstruction. They reported that, endoscopy may-assisted probing or intubation help to confirm position of the probes and recognize intranasal abnormalities that may reduce the success rate. However, earlier studied had not found increased success rate with endoscopy.

In **1998, Kaufman and Guay-Bhatia** [7] introduced Monocanalicular intubation [MCI] with a single silicone tube and reported comparable success with both MCI and bicanalicular intubation [BCI]. However, **Rajabi *et al.*** [8] compared both tubes in children younger than4 years. The overall success rate was 96.4%, 71.5%, and 47.3% in bicanalicular, Monoka [monocanalicular], and Masterka [monocanalicular] stents, respectively. They explained the higher success rate of bicanalicular tubes to the combined diameter of bicanalicular stents and hence BCI are recommend, and used in the current work. **Singh *et al.*** [9] also believes that, the bicanalicular intubation is superior than monocanalicular intubation due to its larger combined diameter, knot placement in inferior meatus [ensures the presence of stent in the NLD] and better dynamicity with the blink of both eyelids. **Nakamura *et al.*** [10] also confirmed the higher success rate with increased tube size in their study. They compared tubes of 1.0 and 1.5 mm. They reported a higher patency rate of 85.7% with 1.5 mm tubes compared to 73.9% in the 1.0 mm tube.

A study by **Pelit *et al.*** [11] using bicanalicular intubation reported a 100% success in 33 eyes with NLDO.

Previous research works also have shown high success rates of silicone intubation in the treatment of CNLDO in children under the age of 7 years with the help of nasal endoscopy in younger children [18–48 months]. They found a 100% success rate, when the follow up period ranged between 4 and 24 months [12]. **Pediatric Eye Disease Investigator Group** reported a 90% success rate in children aged 6 to 45 months with no previous nasolacrimal surgical intervention [13]. **Andalib *et al.*** [14] achieved an 86.2% success rate for monocanalicular and an 89% success rate for bicanalicular silicone intubation in children younger than 7 years of age. **Okumuş *et al.*** [15] reported a success rate slightly lower [73.3%]. In our study we achieved an 88% success rate for blind silicone intubation in children aged 2 to 6 years and a 92% success rate for endoscopic guided silicone intubation.

We used direct intranasal endoscopic visualization intraoperatively for the retrieval of the silicone tubes. Retrieval of metal probes through the inferior meatus can be difficult and complicated by the traumatic mucosal injuries around the inferior turbinate. Direct endoscopic viewing reduces the risk of nasal mucosal trauma. In addition, it avoids the development of iatrogenic false passages and diminishes the requirement for inferior turbinate infracture, as reported previously [15].

Kurna *et al.* [16] also reported a 100% success rate and concluded that, ritleng lacrimal intubation system is an effective technique for the treatment of congenital NLDO for short and long term.

In a retrospective review reporting on the results of the intubations for a total of 168 eyes with congenital NLDO between 2005 and 2014, the success rate for bicanalicular application was 78.75%, while it was 93.18% in mono-canalicular application [17].

Another review and meta-analysis reported that balloon dacryocystoplasty and silicone intubation had comparable success rates [79.8% vs. 77.8%] and it monocanalicular and bi-canalicular intubation achieved similar success rates [88.3% vs. 88.0%] [18].

In conclusion, silicone intubation of nasolacrimal duct with nasal endoscopy had favorable results as a primary treatment of persistent congenital NLDO in children between 2-6 years of age. It can be used to reduce complications, recurrence rate and the need for DCR, a more invasive procedure. However, the current work had a limitation of small sample size and short follow up durations. Thus, future large scale with longer duration of follow up are recommended.

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