

Retrospective analysis of silicon intubation by Ritleng probe and sutupak suture fixed in silicone tube in congenital nasolacrimal duct obstruction

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Purpose: The aim of this study was to perform a retrospective review of the outcome of silicon intubation using the Ritleng's probe and a modified braided silk suture (Ethicon sutupack) fixed in a silicone tube in children with congenital nasolacrimal duct obstruction (CNLDO). **Methods:** Records of all children between 1 and 12 years of age who underwent silicone tube intubation with the Ritleng probe and Ethicon sutupack suture (2-0) fixed in silicone tube for CNLDO with a minimum of 1-year follow-up were identified. The hollow Ritleng probe was inserted via the canaliculus into the inferior meatus. The sutupac thread-guide, attached to the silicone tube, was advanced through the probe lumen and retrieved using a hook under endoscopic visualization. The tube ends were tied to each other and tube removal was planned after 3 months. Absence of watering, discharge, and matted lashes after removal of silicone tube was defined as success. **Results:** One hundred and fifty-two eyes of 152 children with a mean age of 3.26 ± 2.3 years were included in the study. The procedure was successful in 145 eyes (95%) after removal of the silicone intubation with relief of symptoms observed in most patients by fifth-day follow-up ($n = 120$ eyes, 83%). The mean duration of follow-up was 3.48 ± 1.3 years. No other significant differences were observed between patients who did ($n = 47$) and did not ($n = 105$) have previous probing including success rates (95% vs. 96%, $P = 0.89$). **Conclusion:** Silicone intubation with Ritleng's probe and sutupac suture fixed in silicone tube was successful in resolution of symptoms of CNLDO in majority of patients. Using a low-cost suture did not affect success rates.

Key words: Congenital nasolacrimal duct obstruction, nasal endoscopy, ritleng probe, silicon intubation set

Congenital nasolacrimal duct obstruction (CNLDO) is a relatively common condition characterized by persistent watering and discharge from the affected eye since birth.^[1] Fortunately, CNLDO resolves spontaneously in majority of children within the first 6 months of life.^[1-3] In those without spontaneous resolution, a stepwise approach is used in management, starting with digital massage over the lacrimal sac region, which leads to resolution in a few months.^[3,4] It has been shown in the past that children with mucoid or purulent regurgitation on pressure over lacrimal sac (ROPLAS) are more prone to sac massage failure and require other means of treatment.^[5] In those with continued CNLDO beyond 1 year of age, probing is undertaken in an attempt to widen the canaliculi and the nasolacrimal duct to improve the drainage.^[6] If this fails, or of the child presents beyond 2 years of age, advanced treatment options such as balloon catheter dilation or silicone tube intubation may be considered.^[4,7] Dacryocystorhinostomy (DCR) is usually reserved for those with persistent CNLDO despite prior treatments or in much older children, presenting usually after 3 years of age.^[3,4]

Silicone tube intubation using the Ritleng system has been described before in the treatment of persistent CNLDO in children.^[8-15] The Ritleng probe is a long and hollow metallic tube

and allows passage of a suture through it easily. Most authors claim a high success rate of resolution using this technique obviating the need for DCR, which is a more invasive procedure and is best avoided if possible. However, despite a high success rate, this procedure has not gained widespread acceptance, one reason being that the commercially available Ritleng suture (monofilament guide made of polypropylene material) is very costly. To address this we have used a different suture with similar tensile strength (the Ethicon sutupack suture). In this study, we present the results of performing silicone intubation using this modified Ritleng's technique in children with CNLDO in an Indian setting.

Methods

This was a retrospective study performed at a tertiary care eye center in Maharashtra, India between August 2008 and April 2014. The study was approved by the institutional ethics committee and was conducted as per the tenets of the Declaration of Helsinki. Informed consent was taken from all parents before taking the children for the procedure.

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Records of all children between 1 and 12 years of age who underwent silicone tube intubation with the Ritleng system and the Ethicon sutupack suture fixed in silicone tube (made of black braided silk) during the study period for CNLDO with a minimum follow-up of 1 year were identified from a computerized database. Those with a previous history of any intervention for CNLDO were also included. The procedure was performed as primary procedure for those above 1 year of age and for those with failed probing or digital massage in the past. Case records showing preoperative evidence of mucocoeles, punctal or canalicular atresias were excluded. Preoperative details included for analysis were demographics, duration of symptoms of watering and discharge, history of previous surgery and type of previous surgery if any with its date.

Surgical procedure

We used the Ethicon sutupack suture and a silicon tube of 0.30 mm inner diameter and 0.6 mm outer diameter as a substitute for the Ritleng's suture. The ends of the silicone tube were fixed to the Ethicon Sutupack suture using commercially available cyanoacrylate glue to make a C-loop [Fig. 1]. After fixing, the tensile strength of silicon tube and suture junction was checked to confirm that it would withstand the pulling through nose. This was then sterilized using ETO sterilization for use during surgery.

At the start of the procedure nasal decongestant drops were instilled in the ipsilateral nasal cavity. The child was sedated



Figure 1: Sutupak suture and silicone tube fixed with cyanoacrylate glue and Ritleng probe

using i.v propofol and general anesthesia was maintained with a laryngeal mask using a combination of Nitrous Oxide, oxygen, and halothane or sevoflurane. Nasal packing was done with 1:100,000 Adrenaline embedded cotton rolls placed at the level of valve of Hasner's below the inferior turbinate and one behind the Inferior turbinate. All the mucus was cleared. Following packing, the Ritleng's probe [Fig. 1] was passed through the upper punctum into the lacrimal sac [Fig. 2a] and inferior turbinate which was confirmed using a nasal endoscope. Then, the stellate was removed from the probe and the modified sutupack suture fixed in silicone tube was guided into the lumen of the probe [Fig. 2b]. When suture was seen to exit from meatus [Fig. 2c], its tip was directed forwards with a curved hook-shaped probe and retrieved out of the nose using crocodile forceps. Ritleng's probe was then pulled out from above. The sutupack suture was then pulled down through the nose so that the attached silicon tube appears into the inferior meatus. Again, same procedure was applied to bring out the other end of the silicone tube via the lower punctum into the inferior turbinate such that a C-loop was formed running from upper to lower punctum [Fig. 2d]. Once both ends of the silicone tube are in the meatus, the sutupack sutures were tied into multiple knots below the inferior turbinate of nose to prevent constant irritation during breathing. The silicone tube is kept *in situ* for 3 months. At the time of removal, we cut the C-loop of silicon tube between the puncti and retrieve the entire tube from nose endoscopically. Children were discharged 2 hours after coming out of anesthesia. Postoperatively they were given nasal saline and decongestant drops and antibiotic eye drops for 1 month. Follow-up of patient was done at days 5 and 15 and at months 1 and 3 followed by every 3 monthly visits till 1 year and then yearly.

Outcome measures

Absence of watering, discharge, and matted lashes after removal of silicone tube was defined as success. In those with persistent discharge, a Jone's test was done to determine patency of the nasolacrimal duct. Persistent watering with a negative Jone's test even after 1 month follow-up was considered as failure.



Figure 2: (a) Ritleng probe passed thro upper punctum. (b) Suture passed thro Ritleng probe. (c) Suture coming thro Ritleng probe under inferior turbinate. (d) Silicone tube running from upper to lower punctum

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Statistical analysis

Continuous variables were presented as mean with standard deviation or median with interquartile range (IQR) while categorical variables were presented as proportions (*n*, %). Differences in continuous variables between groups were analyzed using the Student's *t* test or the Wilcoxon's rank-sum test for nonparametric variables. Group differences between categorical variables were analyzed using the Chi-square or Fischer's exact test. Study variables were entered into Microsoft Excel and were analyzed using STATA 12.1 I/c (Statacorp, Fort Worth, Texas). All *P* values <0.05 were considered statistically significant.

Results

One hundred and fifty-two eyes of 152 children were included in the study. The mean age at presentation was 3.26 ± 2.3 years (median = 3 years, IQR = 1–4 years, range = 1–10 years) and 91 (60%) were boys. The mean duration of symptoms such as watering and discharge was 27.6 ± 23.9 months. Forty-seven (31%) patients reported previous intervention for CNLDO of which nine (20%) had prior digital massage, 23 (50%) had previous probing and 15 (30%) had both of these interventions. There was one intraoperative complication but no early postoperative complications such as nasal bleeding and suture infections were observed.

The procedure was successful in 145 eyes (95%) after removal of the silicone intubation. Relief of symptoms were observed in most patients by fifth-day follow-up (*n* = 120 eyes, 83%) whereas the remaining has success by day 15. In the seven cases that failed, one had fibrosis due to repeated acute dacryocystitis, one failure was due to inability to locate the silicone knot in the nose and hence it was pulled from above leading to fibrosis, one developed a fracture of the Ritleng's tip during intubation requiring an external DCR to retrieve it, two had mucocele, one had trauma to the affected eye with cut thro of the C-Loop between the puncti, and in one case, we could not determine the cause. The mean duration of follow-up was 3.48 ± 1.3 years.

Comparing patients who did and did not have previous interventions for CNLDO [Table 1], we found that those without prior treatment had slightly longer duration of symptoms. There were no other significant differences between the groups including success rates.

Discussion

In this study, we performed silicone intubation in children with CNLDO with the Ritleng system and a modified sutupak suture fixed in silicone tube and found a very high success

rate of more than 90% in a large sample of patients with long term follow-up. There were no differences in success rate for those with previous probing and digital massage compared to treatment naïve patients.

Obstruction of the nasolacrimal duct in children is usually due to a lack of patency at the valve of Hasner, a fold of mucous membrane at the distal end of the duct, at the level of the inferior meatus of the nose. An opening can usually be created easily during probing but in some cases (especially where simple probing fails), silicone intubation is required for a few months to maintain patency following probing.^[7] Many techniques of probing with silicone intubation have been described in the past. Crawford described a technique for silicone intubation using a metal probe that was inserted through the lacrimal apparatus and removed from the inferior meatus.^[16] But it was not popular because of very rigid instrumentation and did not use the nasal endoscope, hence was a blind procedure. Results were not satisfactory and it was more traumatic as the metal probe was required to be pulled out from nose, leading to nasal bleeding and fibrosis.

Compared to this, much higher success rates have been reported using the Ritleng's probing and silicone intubation method. Yazici *et al.* presented their results using the Ritleng's procedure in 50 eyes of 42 consecutive children with CNLDO using a technique similar to ours except that they used the Ritleng's original suture made of polypropylene and did not employ a nasal endoscope.^[9] Authors report a success rate of 86% with a mean follow-up time of 18 months in their study population. Authors also reported that the polypropylene suture emerged out of the nose in only 8 patients and they had to use a hook to retrieve the suture using a blind technique. We anticipated this problem and overcame it by using a nasal endoscope. Our success rates were similarly high with a slightly longer follow-up. Yu *et al.* reported similar success rates (84%) from 187 eyes of 148 patients using the Ritleng's method.^[10] All patients had received previous probing in this series, though our results show that previous probing or other interventions for treating CNLDO do not affect success rates. Yalaz *et al.* reported results from 29 eyes with CNLDO having mean age of approximately 5 years using the Ritleng's procedure.^[8] Authors claimed relief of symptoms in all their cases with a mean follow-up of 8.3 months compared to failure in 7 cases seen in our study. Mullner *et al.* have also described use of Ritleng probe and suture for canalization of lacerated canaliculi in 24 patients with 100% success.^[11] However, our study enrolled a much larger population and had longer follow-up making it more likely to mimic the real-world clinical scenario.

The main purpose of the Ritleng's procedure is to create a patent tract that will not close with recurrent attacks of common

Table 1: Comparing demographics, clinical characteristics and outcomes in those with and without previous intervention for nasolacrimal duct obstruction

Variable	No prior intervention (n=105)	Previous intervention (n=47)	<i>P</i>
Age (years)	3.18±2.1	3.45±2.6	0.99
Gender (% Boys)	66 (63%)	25 (53%)	0.26
Duration of symptoms (months)	29.9±23.7	22.38±23.6	0.01
Follow-up (years)	3.41±1.2	3.69±1.5	0.57
Success (<i>n</i> , %)	100 (95%)	45 (96%)	0.89

cold experienced by these children. Since the nasal opening of nasolacrimal duct has two silicon tubes with an outer diameter of 0.6 mm each, making the opening effectively of 1.2 mm, it large enough not to close after removal of the tube in most cases. In addition to being minimally invasive, there is no fear of continued nasal bleeding like in conventional or Endonasal DCR.^[17] Thuro *et al.* have described fracture of Ritleng probe tip during intubation requiring subsequent removal of fractured tip.^[14] We too encountered similar complication in one case requiring subsequent external DCR to retrieve the fractured tip from the duct under general anesthesia.

We used a braided silk polyfilament suture (sutupak) as the guide wire compared to the monofilament polypropylene guide recommended in the Ritleng's procedure. Despite this modification we did not find any difficulty during the procedure and success rates were not affected. The sutupak suture has good tensile strength and when fixed with the silicone tube using cyanoacrylate, it is able to sustain the pull required to exteriorize the silicone tube from the nose. A comparative study using the polypropylene vs. sutupac suture in the future may provide more information on surgical performance and ease of pulling.

The main advantages of the study are the large sample size and good follow-up. Using the nasal endoscope, though adds slightly to the cost of surgery, improves visualization during surgery and thereby improves surgical ease. The drawback of the study is the lack of a comparison group.

In conclusion, Sutupac suture fixated silicone intubation using Ritleng lacrimal intubation system is an effective and nontraumatic method for treatment of CNLDO

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Conflicts of interest

There are no conflicts of interest.

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