The Treatment of Congenital Nasolacrimal Duct Obstruction in Children: A Retrospective Review

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ABSTRACT
Purpose: To compare success and extrusion rates of the monocanalicular and bicanalicular Crawford intubation systems (JEDMED Instrument Company, St. Louis, MO).

Methods: A retrospective review of all children who were diagnosed as having congenital nasolacrimal duct obstruction and treated with lacrimal intubation from 2005 to 2014 was performed. The total number of eyes included was 168 (75 and 93 right and left eyes, respectively). Bicanalicular intubation was used in 80 eyes (bicanalicular group) and monocanalicular intubation was used in 88 eyes (monocanalicular group).

Results: Success occurred in 63 (78.75%) and 82 (93.18%) eyes in the bicanalicular and monocanalicular groups, respectively ($P = .00653$). Extrusion occurred in 24 (30%) and 11 (12.5%) eyes, respectively ($P = .00528$).

Conclusions: Monocanalicular intubation for congenital nasolacrimal duct obstruction is superior to bicanalicular intubation. Extrusion and reoperation rates are significantly lower.


INTRODUCTION
Congenital nasolacrimal duct obstruction is a common issue encountered in pediatric ophthalmology, occurring in up to 6% of newborns. Although obstruction can occur at any place along the nasolacrimal drainage system, congenital nasolacrimal duct obstruction most frequently involves a failure of patency in the nasal mucosa.

Conservative treatment consisting of observation, massage of the lacrimal sac, and topical antibiotics is recommended because spontaneous resolution occurs in many patients. If symptoms persist, the primary intervention is probing of the nasolacrimal system. Successful resolution with probing varies from 70% to 90%. In cases of a probing failure, options include repeat probing, silicone tube intubation of the lacrimal system, and balloon dilation of the nasolacrimal duct.

Silicone lacrimal tubes are available in many different designs. The Crawford Lacrimal Intubation System (JEDMED Instrument Company, St. Louis, MO) is popular and allows relatively easy intranasal retrieval. The original Crawford tube consists of silicone tubing attached on each end to a knobbed stainless steel wire. A 56.0 silk suture is threaded in the lumen. Each end is passed through the upper and lower punctum and then retrieved in the nose with a notched Crawford hook. The result is a loop of silicone tubing running from the upper to the lower punctum. In 2006, a monocanalicular Crawford tube was introduced that permits single silicone canalicular intubation. A flange at the top end is snapped into position at the lacrimal punctum.

The current study was designed to compare success and extrusion rates of the monocanalicular and bicanalicular Crawford intubation systems.
PATIENTS AND METHODS

After approval of the institutional review board, a retrospective review of all children who were diagnosed as having congenital nasolacrimal duct obstruction and treated with lacrimal intubation at Ochsner Clinic Foundation, New Orleans, from 2005 to 2014 was performed. All patients presented with a history of epiphora, discharge, and recurrent eye infections. The diagnosis of congenital nasolacrimal duct obstruction was confirmed by the presence of a full tear lake and positive dye disappearance test. A positive test was noted if fluorescein dye was present in the tear lake 10 minutes after instillation. Exclusion criteria were the presence of craniofacial abnormalities, a history of trauma, canalicular infection, or lack of postoperative follow-up.

A similar treatment rationale was used for all patients. Observation without intervention was used until 6 months of age. If symptoms were severe, an in-office probing using topical anesthesia was offered between 6 and 11 months of age. If the initial probing failed, a second in-office probing was offered. When probing failed for patients who either presented after 11 months of age or declined an in-office probing, placement of Crawford tubes under anesthesia was considered. For patients who failed with Crawford tubes, a LacriCATH balloon (Quest Medical, Inc., Allen, TX) dilation and repeat intubation were performed. LacriCATH balloon dilation was used primarily with intubation in the original surgery for patients with Down syndrome or who had a narrowed nasolacrimal duct. An endoscope was not used in any patients.

All procedures were performed using laryngeal mask anesthesia. Prior to intubation, the nares were packed with oxymetazoline-soaked gauze to reduce intranasal hemorrhage. The punctum was dilated and probing was performed using a 23-gauge McIntyre lacrimal cannula (ASICO, LLC, Westmont, IL). Intubation of the lacrimal system was performed using either a monocanalicular or bicanalicular lacrimal stent. Prior to 2010, all intubations were bicanalicular. After 2010, all intubations were monocanalicular. Surgeon preference was to intubate through the lower canalicular system unless resistance and difficulty with intubation were encountered; in this situation, the upper system was intubated. The stent was passed through the canalicular system and nasolacrimal duct and extracted from the nasal antrum using a Crawford hook. If a bicanalicular tube was used, the tubes were secured to the lateral nasal ala using a 6-0 polyglactin 910 suture. When a monocanalicular tube was used, the tube was simply trimmed in the nasal antrum and not secured.

Postoperatively, patients had the tubes removed in the clinic at the 6-week postoperative visit.

Medical records were reviewed for extrusion, which is defined as the loss of the tube prior to the 6-week postoperative visit. Success was defined as the alleviation of symptoms and no need for reoperation within 12 months of the first surgery. Tube-related complications were recorded.

RESULTS

One hundred forty-two patients were identified who met the inclusion criteria. Congenital nasolacrimal duct obstruction was unilateral in 116 patients and bilateral in 26 patients. The total number of eyes included was 168 (75 and 93 right and left eyes, respectively). The patients’ ages ranged from 7 months to 14 years. Bicanalicular intubation was used in 80 eyes (bicanalicular group) and monocanalicular intubation was used in 88 eyes (monocanalicular group). LacriCATH was used in 30 eyes (13 and 17 eyes in the bicanalicular and monocanalicular groups, respectively). Success occurred in 63 (78.75%) and 82 (93.18%) eyes in the bicanalicular and monocanalicular groups, respectively ($P = .00653$) (Table 1).

Extrusion occurred in 24 (30%) and 11 (12.5%) eyes in the bicanalicular and monocanalicular groups, respectively ($P = .00528$). Of the 35 eyes in which early extrusion occurred, reoperation was required in 9 eyes. Reoperation when the tube remained in place for the designated 6 weeks was observed in 14 of 145 eyes.

DISCUSSION

Spontaneous resolution of congenital nasolacrimal duct obstruction occurs in 70% to 90% of patients over time; however, in many infants, the problem persists and requires treatment. Membranous blockage is a causative mechanism in most cases of congenital nasolacrimal duct obstruction; therefore, probing of the lacrimal system is the mainstay of treatment. Reformation of the membrane and recurrence of obstructive symptoms occur in 10% to 30% of cases, so most surgeons advocate the use of lacrimal intubation to increase the success rate in recurrent cases.
Many lacrimal intubation systems are available. As noted earlier, the original Crawford tube design was a bicanalicular silicone tube requiring intubation of both upper and lower canaliculi. The resulting loop running between the puncti permitted easy extrusion with simple eye rubbing. The monocanalicular design that became available in 2006 consisted of a proximal hub that snapped into the punctum and rested flush to the lower eyelid margin. The benefits of the monocanalicular system were the ease of insertion (1 vs 2 tubes to insert) and, theoretically, less extrusion because of the lack of an exposed loop.

The current study supports the benefits and superiority of the monocanalicular system. Success and reoperation rates were significantly better with the monocanalicular tube. Similarly, extrusion with the monocanalicular system was less than with the bicanalicular system (12.5% vs 30%). Further, extrusion observed in the monocanalicular system was less problematic compared to the bicanalicular system. When the monocanalicular tube was extruded, it simply fell out. Alternatively when the bicanalicular tube was extruded, a loop of silicone tubing remained that ran from the upper to lower punctum and required removal. An emergent clinic visit usually ensued to deal with the externalized tube.

Analysis suggests early extrusion results in a higher failure rate. In 9 of the 35 eyes with extrusion (25.71%), a reoperation was required. Alternatively, 14 reoperations were required in the 145 eyes in which the tube remained in place for 6 weeks (9.7%).

The overall success rate observed with monocanalicular intubation in this study (93.18%) was similar to that seen in the Pediatric Eye Disease Investigator Group’s study (91%)\(^{10}\); however, the success rate with bicanalicular intubation was notably lower (78.75%). We suggest that the reason for this is the high extrusion rate seen in the bicanalicular group. Many methods to secure the bicanalicular tube have been described\(^{11,12}\) and the use of one of these methods may have possibly improved success.

Monocanalicular intubation for congenital nasolacrimal duct obstruction is superior to bicanalicular intubation. Extrusion and reoperation rates are significantly lower. If a bicanalicular intubation system must be used due to availability, an attempt to secure the tube is necessary so that early extrusion does not occur, which might reduce the success rate.

**REFERENCES**


