Clinical effects of three types of silicone intubations in repairing lacerations of canaliculus

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Objective: To evaluate the clinical effects of one-passage, double-passage and circular canalicular intubations in repairing lacerations of canaliculus.

Methods: A total of 109 eyes in 109 cases of canalicular laceration were repaired with three types of silicone intubations, among which 23 with one-passage canalicular intubation, 51 with double-passage canalicular intubation, and 35 with circular canalicular intubation. The average follow-up period was 12-15 months.

Results: The wound/junction of the lacrimal canaliculi was ruptured in 5 cases (9.80%) of the double-passage group, 3 cases (8.57%) of the circular group, and 8 cases (34.78%) of the one-passage group. The rupture incidence of the one-passage group was significantly higher than that of the other two groups ($\chi^2=9.416, P<0.01$). During the intubation, canaliculitis was observed in 12 cases (23.53%) of the double-passage group, while only 3 cases (8.57%) in the circular group and 8 cases (34.78%) in the one-passage group. The circular group had significantly lower incidence of canaliculitis than the other two groups ($\chi^2=6.955, P<0.05$).

After extubation 6 months after laceration repair, the lacrimal passage remained patent with canalicular irrigation in 46 cases (90.20%) in the double-passage group, 30 cases (85.71%) in the circular group and 15 cases (65.22%) in the one-passage group. Six months after surgery, the canalicular patency in the one-passage group was significantly lower than that of the other two groups ($\chi^2=7.390, P<0.05$).

Conclusions: Circular canalicular intubation is more stable and has less surgical complications than the double-passage and one-passage canalicular intubations. It is also more effective clinically 12-15 months after laceration surgery.

Key words: Lacrimal apparatus; Intubation; Wounds and injuries

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Traumatic inferior canalicular rupture is one of the common ocular emergencies. The standard care is canalicular repair with silicone intubation. If it is not repaired properly, long-term epiphora would occur. The main factors affecting the effectiveness of laceration repair include the extent of canalicular laceration, intubation materials, intubation methods and duration of intubation. According to our knowledge, no reports on how intubation methods affect the effectiveness of laceration repair are found in literature. The objective of the present study was to evaluate the clinical effects of three types of intubation methods, i.e. circular, double-passage and one-passage canalicular intubations in repairing laceration of canaliculus.

METHODS

Patients

A cohort of 109 patients (86 males and 23 females, aged 10-63 years, 36.5 years on average) received canalicular laceration repair at the Department of Ophthalmology, Affiliated Hospital of Qingdao University, China, between March 2002 and February 2007. Among the 109 patients (including 109 eyes) with laceration of canaliculus, 58 right eyes and 51 left eyes were involved. The causes of canalicular laceration included automobile accidents, fist fighting, hits by high-velocity objects or sharp objects, etc. The patients sought medical advice from ophthalmologists 0.5-72 hours after injury. Circular canalicular laceration repair was performed for 35 cases, double-passage ones for 51 cases and one-passage ones for 23 cases.

Operative procedures

Sterilization and anesthesia Routine sterilization was made and drape surgical cloth was placed. Infratrochlear and infraorbital nerve block anesthesia
were performed with 2 ml 2% lidocaine and 2 ml 0.75% bupivacaine added with little epinephrine hydrochloride (1: 100 000).

Searching ruptured nasal canaliculus  Ruptured nasal canaliculus was searched under an ophthalmic surgical microscope.

Silicone intubations  (1) Circular canalicular intubation  A pigtail probe (13 mm in diameter) was inserted through the superior punctum and canaliculus to the common canaliculus, then to the lacrimal sac, finally pulled out from the ruptured nasal end of the inferior punctum. Then 5# polyester suture was tied to one end of the 0.8-mm-diameter medical silicone tube, which was imported from the interior lacrimal punctum through the lacrimal sac and was pulled out from the superior lacrimal punctum. The silicone tube was sutured between the superior and inferior puncta.  

(2) Double-passage canalicular intubation  A lacrimal hollow cannula with internal copper wire was inserted into the ruptured nasal canaliculus, the lacrimal sac and the nasolacrimal duct, then the copper wire was pulled out from the inferior nasal passage with hemostatic forceps, the cannula was removed, the copper wire was tied with 5# polyester suture and the polyester suture was pulled out from the nasal end of the ruptured canaliculus, and then the other end of the polyester suture was tied with the medical silicone tube for 0.8 mm in diameter. Retro-intubation was performed from the ruptured nasal end, and the silicone tube was inserted through the temporal side of the canaliculus and pulled out from the inferior punctum. Similar procedure was performed to insert the silicone tube into the superior punctum and pull it out from the inferior nasal passage. The two corresponding ends of the silicone tube were tied securely with proper length retained so that it neither extended to the outside of the nostrils nor retracted back into the nasolacrimal duct and the extra silicone tube was sheared off at the end.

(3) One-passage canalicular intubation  Looping was not made from the superior punctum, only the nasolacrimal duct was probed once. The silicone tube was tied inside the nasal passage with the other one from the inferior punctum securely against the cheek, and it was left on the cheek, which could be fixed through taping it on the face.  

Repairing ruptured canaliculus  The anterior, posterior and superior aspects of the ruptured canaliculus were sutured with 5# silk suture using horizontal mattress technique. The skin and subdermal tissues were sutured with 3# silk suture using vertical mattress technique.

Postoperative management  Antibiotics were used prophylactically and regular follow-up visits were scheduled. Skin sutures were removed 7 days after surgery. The silicone tube was shifted and checked monthly and extubation was performed 6 months after surgery followed by lacrimal passage irrigation. A follow-up of 6-9 months was scheduled.

Statistical analysis  The clinical effects of the three types of intubation methods were compared with Chi Square test. All \( P \) values were considered statistically significant when the values were less than 0.05.

RESULTS  
The wound/junction of lacrimal canaliculi was ruptured in 5 cases (9.80%) of the double-passage group, 3 cases (8.57%) of the circular group, and 8 cases (34.78%) of the one-passage group. The rupture incidence in the one-passage group was significantly higher than those of the other two groups \( (\chi^2=9.416, P<0.01) \). During the intubation, canaliculitis was observed in 12 cases (23.53%) of the double-passage group, while only 3 cases (8.57%) in the circular group and 8 cases (34.78%) in the one-passage group. The circular group had significantly lower incidence of canaliculitis than the other two groups \( (\chi^2=6.095, P<0.05) \). After extubation 6 months after laceration repair, the lacrimal passage remained patent with canalicular irrigation in 46 cases (90.20%) in the double-passage group, 30 cases (85.71%) in the circular group and 15 cases (65.22%) in the one-passage group. The canalicular patency 6 months after surgery in the one-passage group was significantly lower than that of the other two groups \( (\chi^2=7.390, P<0.05, \text{Table } 1) \).

DISCUSSION  
Traumatic canalicular rupture is one of the common ocular emergencies, which results from its unique anatomical location and inferior canalicular rupture in
particular. If it is not repaired in a timely manner, long-term epiphora would occur. The success of surgical repair of canalicular laceration depends on locating the laceration and choice of intubation materials. Because a surgical microscope has been commonly used, location of laceration is not a clinical challenge anymore although the choice of intubation materials, intubation method and duration of the intubation are still inconclusive. As for surgical repair of canalicular laceration, canalicular intubation is used to keep the canaliculus patent so that apposition of the lacerated canaliculus and smooth healing of the mucus are ensured. Silicone tubes with small diameter are considered the best intubation materials at present due to its good tissue compatibility and lack of irritation to ocular tissues, but the clinical effects of silicone intubation require further clinical investigation. If the intubation is not performed properly, the repair of canalicular laceration will be less likely due to canaliculitis, polyp formation and occasional additional laceration of canaliculus.

In the past, canalicular intubation was performed with one-passage and semi-circular fixation so the exterior silicone tube was fixed in the skin of the forehead. Its major disadvantages were poor stability, easy dislocation and/or abrasion of the cornea so that it was less likely to achieve extended and stable intubation, which truly, led to repair failure. In addition, laceration of the inferior canaliculus, ectropion of the inferior eyelid and the canaliculus may also occur so that normal tear drainage could not be established. This would significantly affect the work and life qualities of individuals.

Regardless of double-passage or circular canalicular intubation, circular stents with silicone tubes offer good stabilization. It keeps the natural curvature of the medial canthus, maintains the physiological anatomical location of the superior and inferior puncta which prevents the ectropion and laceration of lower eyelid and inferior punctum, offers excellent tear drainage and causes no irritation symptoms. Usually, patients can function normally during the intubation. However, during one-passage and double-passage canalicular intubations, it is common to see the following surgical complications: canaliculitis, local bulbar conjunctival injection, more secretion, rupture/laceration of puncta and rupture of the repaired laceration wound which leads to epiphora. Local infection may result from pulling the silicone tube from the nose to the canaliculus (from the wider to the narrower). Because the circular intubation does not get the tube into the nasolacrimal duct, it offers the following benefits: less irritation to the nasolacrimal duct, less incidence of canaliculitis and other relevant surgical complications, better comfort during the intubation, more likelihood for the canaliculus to stay open after extubation and maintaining normal tear draining/flow. The curvature of the Worst lacrimal cannula is consistent with the anatomical profile of the canaliculus. The cannula contacts with the lacrimal lacus and acts as a kind of syphon moving with the eyelid. Therefore, it has its own special function of tear draining. This also resolves the wound healing problems due to the tear coverage of the laceration at the medial canthus. Worst lacrimal cannula and silicone circular canalicular intubation in repair of laceration of canaliculus demonstrate less surgical complications and better clinical outcomes. The optimal extubation time is approximately 6 months after intubation because the scar tissues are stabilized and softened.

### REFERENCES


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