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Original Article

Anatomical and functional outcomes of canalicular laceration repair with self retaining mini-MONOKA stent

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Abstract

Aim: To evaluate the anatomical and functional outcomes of canalicular laceration repair with self retaining monocanalicular intubation system (Mini-MONOKA).
Materials and methods: The data of 29 patients undergoing canalicular laceration repair from 2010 to 2014 were retrospectively analyzed. Operative details and complications were noted. The stent was removed earliest at 3 months. Anatomical and functional success was defined by a patent syringing and the absence of epiphora respectively.
Results: Out of 29 patients, 23 (79.3%) were males. Mean age at presentation was 19.3 ± 13.8 years. Lower canaliculus was involved in 19 (65.5%), upper in 8 (27.5%) and both canaliculi in 2 (6.8%). Ten patients presented later than 11 days after trauma (range 12–168 days), and repair was attempted successfully in all.
Fourteen (48.2%) cases reported for stent removal, at a mean follow-up period of 4.64 ± 2.12 months. Anatomical success was noted in 12 (85.71%) and functional success in 13 (92.85%) cases. Four patients had stent related complications.
Conclusion: Canalicular injuries are more common in young males. Mini-MONOKA stents are easy to insert and retrieve, and yield excellent anatomical and functional outcome. Canalicular laceration repair can be attempted successfully irrespective of the delay in presentation.

Keywords: Canalicular laceration, Mini-MONOKA

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Introduction

Canalicular lacerations are seen in 16% of eyelid lacerations and 20% of globe injuries.[1,2] It can be caused by both penetrating and blunt trauma.[3] The principles of repairing a canalicular injury involve identification of the torn medial end of the canaliculus, suturing of the cut ends under high magnification and intubating the canaliculus to prevent fibrosis and subsequent stenosis and thereby maintain its patency.[4,5] A variety of materials have been used to stent the torn canaliculus in the past. Medical grade Silicone, because of its inert nature, flexibility, and easy availability, has emerged as the material of choice for lacrimal stenting.[6–11] The Mini MONOKA© monocanalicular stent (FCI Ophthalmics, USA) is a silicon rod with diameter 0.64 mm, with a bulb and collar at the proximal end, which makes it self-retaining. The purpose of the present study was to analyze the clinical profile of canalicular lacerations and to evaluate the success rate of commercially available self retaining, monocanalicular intubation system, Mini-MONOKA.

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Material and methods

A retrospective analysis of all patients who underwent canalicular laceration repair with Mini-MONOKA stent (FCI Ophthalmics, USA) over a period of 5 years (January 2010–December 2014) was done. The study was approved by the Institutional Review Board and it adhered to the tenets of Declaration of Helsinki. The data collected from the medical records included patients' demographic details, associated ocular injuries, time interval between injury and presentation, intra-operative findings, postoperative complications, and their management. All patients underwent canalicular laceration repair and stenting with Mini-MONOKA under local anesthesia in adults and general anesthesia in children. The demographic data of the patients are depicted in Table 1.

The most difficult part of the repair was identifying and locating the distal cut end of the canaliculus especially if the laceration was deep, near the junction of the lacrimal sac. The cut canaliculus is identified as pinkish white tubular mucosal structure. Careful inspection and gentle traction with Q tips under magnification usually are sufficient. Various methods, such as injection of air or dye through the opposite punctum while maintaining pressure over the lacrimal sac and observing the medial cut area submerged in saline have been described to aid in its identification.[12,13] In patients who presented late with excessive fibrosis at the cut end, a pigtail probe was used to aid in its identification and subsequent suturing and intubation of the canaliculus.

The monocanalicular stent is a short silicone tube with a phalange at the proximal end (Fig. 1). Once the cut end of the canaliculus was identified, a number-0 Bowman lacrimal probe was passed into both the cut end of the canaliculus reaching up to lacrimal sac and appreciating a hard stop. The mini-Monoka (FCI Ophthalmics, Marshfield Hills, MA), was cut with one end beveled to an overall length of 13–15 mm. The punctum was dilated with the small-gauge punctum dilator to prevent excessive punctal dilation. Then the distal end of the stent was passed through the punctum and brought out through the proximal end of the severed canaliculus. The phalange was then fixed securely in the punctum by gently pulling the distal end of the stent, which

Table 1. Demographic profile of patients undergoing Canalicular laceration repair.

Total patients	29
Males	23 (79.3%)
Females	6 (20.6%)
Eye involved	
Right	17 (58.6%)
Left	12 (41.3%)
Canaliculus involved	
Upper	9 (31.3%)
Lower	18 (82%)
Both	2 (6.9%)
Mode of injury	
Blunt injury	13 (44.8%)
Penetrating injury	16 (55.1%)
Mean time between injury and repair	25.45 ± 43.52 days (Range: 6 h - 5.6 months)
Mean time of stent removal	4.64 ± 2.12 months (Range: 3–9 months)
Mean follow-up period	6.67 ± 7.49 months (Range: 3–27 months)

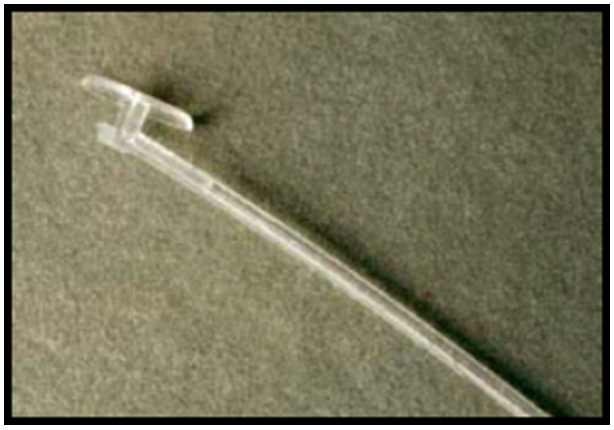

Figure 1. Mini-MONOKA- with a 2 mm collarette at the punctal end.

was then threaded into the distal cut end of the canaliculus and fed into the lacrimal sac with help of a plain forceps (Fig. 2).[14–16]

Pericanalicular sutures with 6-0 polyglactin suture were taken to repair the canalicular laceration. Associated lid and facial tears involving the skin were repaired with 6-0 nylon interrupted sutures. Post-operatively the patients were advised topical antibiotic ointment for two weeks and topical lubricants till the stent was removed.

The patients were reviewed on day 1 after surgery, at three months for stent removal and at six months. Patients who had follow-up of less than three months were excluded from further analysis.

The stent was removed earliest at three months from the date of surgery. In all patients, stent was removed under topical anesthesia in office settings. Lacrimal sac syringing was done for all adult patients and children who were cooperative, after stent removal and on subsequent visits. Anatomical success was defined as patent nasolacrimal drainage system on lacrimal sac irrigation, and functional success was defined as the absence of epiphora, after removal of the stent.

Results

A total of 29 patients underwent canalicular tear repair with Mini-Monoka of which majority were males (23,79.3%).

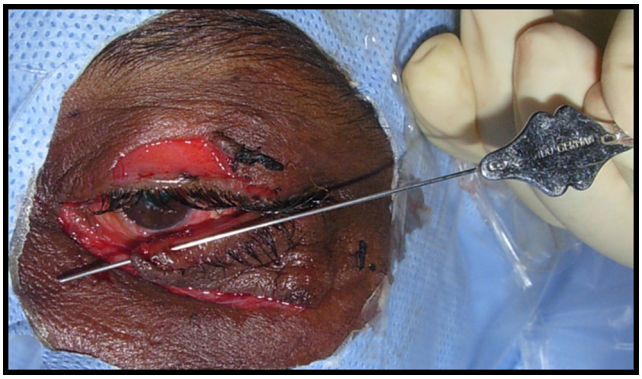

Figure 2. Intraoperative photograph demonstrating method of locating the distal end of the canaliculus with the help of Bowman's probe.

More than half of the patients were less than 16 years of age (17, 58.6%). Penetrating injury was noted more commonly (16, 55.1%). In children less than three years of age (n = 8), injury with mother's blouse hook while breast feeding (Fig. 3) was noted in 3 (37.5%) children (Table 1). Time of presentation after injury varied from 6 h to 5.6 months (Mean: 25.45 ± 43.52 days). Sixteen (55.1%) had isolated lid tears. Details of other associated injuries are described in Table 2. The upper canaliculus was involved in 9 (31%); lower in 19 (65.5%) and both canaliculi in 2 (6.8%) patients. In 9 (31%) patients who presented within 2 days of the injury the medial end of the canaliculus was easily visualized. In patients who presented late, visualization of the medial end was difficult and accompanied with fibrosis at the cut ends. In these cases a pigtail probe was used to aid the identification of the cut medial end of the canaliculus (see Table 3).

Surgery was carried out under magnification with the aid of an operating microscope. The stent was left in situ for a minimum of 12 weeks (Fig. 4). Out of 29, 14 patients reported for stent removal. Mean time for stent removal was 4.64 ± 2.12 months (Range: 12–36 weeks). Syringing was found to be patent in 12 (85.71%) patients and 13 patients (92.85%) did not complain of epiphora till the last follow-up (Mean 6.67 ± 7.49 months, Range, 3–27 months). Out of two patients in whom lacrimal sac syringing was not patent, one had presented 48 days after injury while the other patient had involvement of both canaliculi with a deep medially located laceration. Both of these patients developed canalicular fibrosis as suggested by soft stop on probing after removal of mini Monoka.

The main postoperative complications were stent extrusion and granuloma formation. Spontaneous extrusion of the stent was noted in 3 patients at 4, 10 and 16 weeks respectively. Out of these three, two were adults and post extrusion syringing was patent in them. The third patient was a 2-year-old in whom syringing was not attempted as he did not have any epiphora and Fluorescein dye disappearance test (FDDT) was negative. Punctual granuloma was noted in one patient. Conservative management with topical steroids was tried initially without any success and had to be excised surgically. Syringing was patent in this patient. None of the patients had any corneal complications due to the stent.

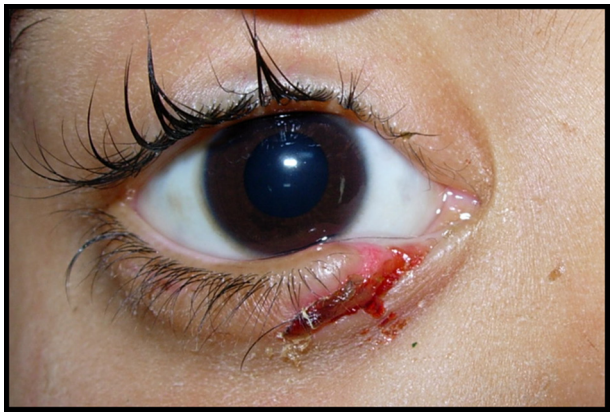

Figure 3. Clinical photograph of a child with lower canalicular laceration.

Table 2. Associated injuries noted in patients with canalicular laceration.

Associated injuries	Number (n = 29)
Ocular surface injuries	7
Intraocular injuries	2
Orbital fracture	1
Other facial lacerations	3
Isolated lid tear	16

Table 3. Time of repair in days and lacrimal patency in patients reporting for stent removal.

Time of repair in days	Syringing at last follow-up
0.5	Patent
2	Patent
2	Not patent
3	Patent
4	Patent
5	Patent
5	Patent
6	Patent
6	Patent
12	Patent
18	Patent
48	Not Patent
48	Patent
120	Patent

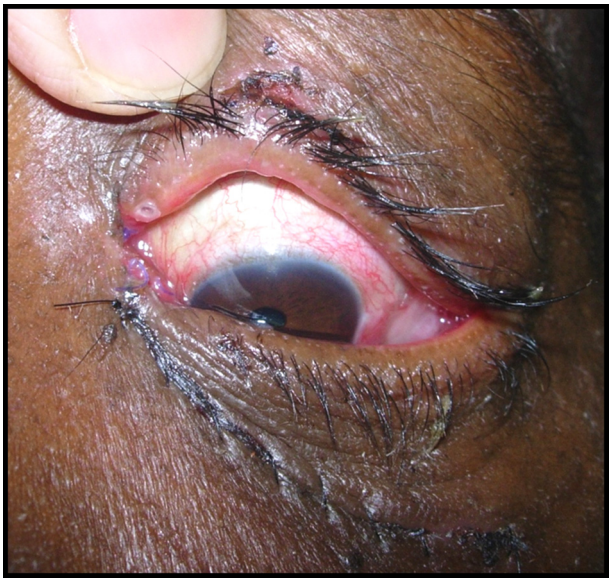

Figure 4. Postoperative patient with injury of both canaliculi. Note the presence of Mini-MONOKA in the upper canaliculus.

Discussion

Canalicular lacerations, if not managed properly, can lead to lifelong epiphora. In our series 54.8% patients were below 16 years of age and majority were males (79%). This is in accordance with the findings of earlier studies.[6,7,10] Lower canaliculus was more commonly injured (82%) than the upper as reported by other investigators.[6,8,17,18]

We found injury by mother's blouse-hooks in breast feeding infants (3 out of 8, 37.5%) a unique cause of canalicular lacerations particular to the Indian subcontinent as previously described by Naik et al.[7] There were no dog bites in our

cohort of canalicular lacerations, which has been implicated as a major cause in pediatric age group.[3] Most of our patients had history of trauma while playing outdoors (16, 55%).

Canalicular lacerations, per se, are not an ophthalmic emergency. However, they should preferably be repaired within 72 h of the injury before scarring and epithelization of the cut edges set in. Once inflammatory edema of the pericanalicular tissue develops identification of the distal cut edge and repair becomes difficult. Recently, some authors have suggested that canalicular tear repair can be delayed up to 11 days.[11,19] We attempted repair of canalicular laceration in all our patients, irrespective of the time interval between injury and presentation. Ten out of 29 (34%) patients presented more than 11 days after trauma (Range: 12–168 days) and their canaliculus was successfully identified and repaired with mini-monoka stenting. However, only five of these patients reported for stent removal and syringing was patent in 4 (80%). The repairs were undertaken on days 12, 18, 48, 120 from the date of injury. We thus conclude it is worthwhile to try and repair the torn canaliculus by experienced surgeons at any time after injury.

Various methods, such as injection of air or dye through the opposite punctum while maintaining pressure over the lacrimal sac and observing the medial cut area submerged in saline have been described to aid in the identification of the distal cut end of the canaliculus.[12,13] We did not need to employ any of these methods. The medial cut end of the canaliculus was identified by its pinkish-white appearance and tubular mucosal structure under operating microscope.

Various authors have mentioned passing a pigtail probe into the normal canaliculus, but it carries the risk of damaging the normal canaliculus in inexperienced hands.[20] We employed pigtail probes in patients who presented late.

The canaliculus can be approximated by two to three absorbable 8-0 polyglactin sutures placed in the wall of the cut canaliculus in order to achieve mucosal apposition. Kersten and Kulwin used a single pericanalicular horizontal mattress sutures (7-0 polyglactin), with anatomical success in 100% of patients.[21]

The standard of care of canalicular lacerations in most parts of the world today mandates stent placement to maintain proper alignment of the anastomosis and to prevent stricture after canalicular repair. An indwelling canalicular stent serves to align the cut ends and maintain the lumen during the healing phase. The introduction of Mini Monoka© stents has allowed repair of monocanalicular lacerations under local anesthesia, avoiding needless manipulation and possible iatrogenic damage of the normal canaliculus.[23]

Bicanalicular intubation was previously popular for both mono- and bicanalicular lacerations. Bicanalicular stents require nasal packing, endoscopic guidance, and intranasal manipulation, which may necessitate intravenous sedation or general anesthesia. These tubes may cause several complications, including false passages, ''cheese wiring'' or erosion of the punctum, granuloma formation, anterior loop dislocation, corneal abrasion and infection.[24]

Mini Monoka intubation sets are self retaining due to the presence of a collarette at the punctal end. Monocanalicular stent can be placed under local anesthesia in adults. Other advantages of monocanalicular stents include ease of removal in office setting by holding the phalange at the punctum with forceps under topical anesthesia even in children. We repaired canalicular lacerations involving both eyelids with two mini-monoka stents rather than a bicanalicular stent, as described in a previous study.[25]

Mini Monoka stents are less secure, and can be dislodged, especially in children. In the presence of punctal injury, monocanalicular stent should be used with caution.

A bicanalicular stent is preferable in patients with medial canthal avulsion, to provide inferior and posterior traction to the wound.

Studies of normal healing suggest that the process of proliferative fibrosis is complete within 3 months.[11] Hence we prefer to leave the mini monoka stent in place for at least 12 weeks.

Premature extrusion of the stent was seen in 2 patients (at 4 and 8 weeks). One patient who also underwent punctal tear repair with absorbable polyglactin suture presented with a granuloma over the punctum. The patient was treated conservatively and syringing was patent with no further complications.

Conclusion

Canalicular injuries are commoner in the pediatric age group. They are best repaired under the operating microscope with gentle handling of tissues as early after injury as possible. Canalicular laceration repair with self retaining Mini MONOKA stents showed high anatomical and functional success rate (85.71% and 92.85% respectively) in our study. Excellent results were seen even in patients presenting late; hence, it is worth giving a trial of surgery in all such cases.

Drawbacks of the study

The drawbacks of this study were its retrospective design and a small sample size. Many patients were lost to follow-up and hence the final outcome in these patients could not be evaluated. We did not compare Mini MONOKA with other intubation materials.

Conflict of interest

The authors declared that there is no conflict of interest.

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