

Results of Traumatic Canalicular Laceration Repair Performed by Trainees in a Tertiary Eye Care Center

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Background: Lacrimal canalicular laceration is a common condition in emergency medicine. Many eyelid lacerations involve the lacrimal canalicular system. In the authors' institution, nearly all cases of lacrimal canalicular laceration are treated by ophthalmology trainees, and are followed-up periodically in the post-operative period.

Objective: To analyze the success rate of the cases of lacrimal canalicular laceration treated by trainees in a tertiary eye care center in Thailand.

Materials and Methods: Thirty patients with canalicular laceration were treated between January 2005 and December 2017. Data gathered from ICD10, operation records, and in-patient and out-patient medical records were retrospectively analyzed.

Results: There were 20 males (66%) and 10 females (34%) with a mean age of 30.86 years (range 1 to 78 years). Seventy percent of patients presented outside of normal office hours. Most injuries were caused by non-vehicular accidents. Twenty-five of 30 cases (83.33%) were repaired by trainees, and 63% of cases were repaired after office hours. The mean waiting time from presentation to repair was 9 hours 56 minutes (range: 3 hours 35 minutes to 22 hours 10 minutes). The follow-up rate at six months postoperative was 53.33%. The success rate of repairs performed by trainees was 93.75%.

Conclusion: The success rate of lacrimal canalicular laceration repair performed by trainees was very satisfactory. The average waiting time for surgery was acceptable. Only half of the patients were followed-up for six months post-operative. Improvement is required in the recording of pertinent details in the medical records, which is an important issue to train the trainees.

Keywords: Tear canaliculus, Lacrimal canalicular laceration, Repair, Residents, Trainees, Oculoplastic surgeon

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Eyelid injury is a common problem, and the severity of such injury depends on the mechanism and etiology. Eyelid injury frequently involves the lacrimal drainage system, including the canaliculus, the lacrimal sac, or the nasolacrimal duct, which results in epiphora. Previous studies have reported incidences of lacrimal drainage system damage in all cases of eyelid trauma of 16%⁽¹⁾ and 36%⁽²⁾. Many techniques

have been used to explore the medial cut end of the torn canaliculus, including air injection, viscoelastic agent injection, and fluorescein dye injection. Other novel techniques have been developed, such as the insertion of filtered air through a side-port probe with a closed round tip⁽³⁾, and the use of a 23 Ga fiber optic light pipe before the insertion of a silicone tube via a monocanalicular stent, bicanalicular stent, or annular loop⁽⁴⁾. In tertiary referral centers, the initial care at the time of presentation is performed by the on-duty ophthalmology residents (or trainees). The results of their treatments and sequential visits influence the patients' eye health and daily life activities. The present study aimed to evaluate the outcomes of lacrimal laceration repair performed by ophthalmology trainees.

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Table 1. Demographic and baseline variables (total n=30)

	n (%)
Sex, male:female	20:10 (66:34)
Age (year); mean±SD	31±20
Cases presented after office hours	21 (70)
Type of trauma	
Accident	12 (40)
Dog bites	8 (27)
Vehicle accident	4 (13)
Body assault	4 (13)
Others	2 (7)
Place of injuries	
Bangkok	24 (80)
Other provinces	6 (20)
Day of operation	
Sunday	4 (13.3)
Monday	2 (6.6)
Tuesday	5 (16.6)
Wednesday	5 (16.6)
Thursday	3 (10.0)
Friday	9 (30.0)
Saturday	2 (6.6)

SD=standard deviation

Materials and Methods

The medical records of patients with ocular injuries between January 2005 and December 2017 at the Department of Ophthalmology, Faculty of Medicine, Chulalongkorn University were retrospectively reviewed. The data were searched using ICD10, and the patients diagnosed with laceration of the canaliculus or lacrimal drainage system were identified from the operative records. Demographic data including sex, age at presentation, etiology, geographical location at which the injury occurred, time of presentation, waiting time for repair, day of surgery, operation time, complications, follow-up duration, medication usage, and outcomes were gathered. Patients were scheduled for post-operative follow-up examinations by the trainees. Success was defined as the absence of epiphora three months post-operatively.

Medical records reviewal was allowed by the Hospital committee. The study was approved by the institutional Review Board and complied with the tenets of the Declaration of Helsinki. The study was registered in the Thai Clinical Trial Registry (identification number TCTR20171018001). There

were two reviewers who were highly experienced ophthalmologist.

Surgical procedure

All cases were repaired under surgical microscopy, and most cases were performed under general anesthesia. A round-tipped eyed pigtail probe with a loop of #6/0 monofilament suture inside the hole was inserted through the normal punctum and canaliculus, and passed through the common canaliculus to the distal (medial) cut end, the proximal (lateral) cut end of the wound, and out of the opposite punctum. A prepared silicone tube (diameter 0.6 mm, length 23 to 25 mm) containing a longer piece of #6/0 monofilament was put in the monofilament loop of the pigtail probe. The pigtail probe was pulled back through the normal punctum so that one end of the silicone tube could be seen outside the punctum. The cut ends were approximated by suturing the pericanalicular tissue with #6/0 polyglycolic acid in an interrupted pattern. Then, both ends of the silicone tube (with #6/0 monofilament inside) outside the puncta were trimmed to appropriate lengths, and the inside monofilament was tied to form a circular loop of the silicone tube. The anastomosed end of the silicone tube was rotated so that it was hidden inside the canaliculus.

Postoperative care

Patients were prescribed systemic antibiotics for five to seven days, a combination antibiotic-steroid eyedrop four times daily for one to two months, and eye ointment was applied to surgical wound three times a day for one to two weeks. Follow-up examinations were done one week, one month, three months, six months, and 12 months post-operatively.

Statistical analysis

All data were analyzed using Stata Statistical Software, version 15.1 (StataCorp LLC, College Station, TX, USA). Continuous data were analyzed using the Unpaired t-test or the Mann-Whitney U test, while categorical data were analyzed using the chi-square test or the Fisher's exact test. A p-value of less than 0.5 was considered statistically significant.

Results

Thirty patients underwent canaliculus repair between 2005 and 2017. The demographic data and baseline variables of the enrolled patients are shown in Table 1. There were more males than females, 20 males (66%) versus 10 females (34%), and the mean

Table 2. Operative variables

	Trainees (n=25)	Oculoplastic surgeons (n=5)	p-value
Mean operation time (hour); mean±SD	2.1±0.78	1.9±0.36	0.9
Intraoperative complications; n (%)	2 (8.3)	1 (20.0)	0.44
Combination of antibiotic-steroid eye drop post operation	42%	50%	1.0
Silicone stent in place at 1 week	88%	80%	0.53
Silicone stent in place at 3 months	70%	50%	0.57
Tearing symptoms at 3-month period	0%	20%	0.16

SD=standard deviation

patient age was 30.86 years (range 1 to 78 years). Twenty-one of 30 patients (70%) presented after office hours, of which 73% arrived at the emergency room from 16.01 to 00.00 p.m., 10% arrived from 00.01 to 08.00 a.m., and 16% presented in office hours (08.01 a.m. to 16.00 p.m.). The most common cause of injury was non-vehicular accident (40%), followed by dog bite (27%), vehicular accident (13%), assault (13%), and others (7%). The eyeball was ruptured in 10% of the cases. Twenty-five of 30 cases of canalicular laceration (83.33%) were repaired by trainees, while five cases were repaired by oculoplastic surgeons. Sixty-three percent of cases were repaired after office hours, while only 37% received surgery during working hours (from 8.01 a.m. to 16.00 p.m.). Most repairs (27/30 cases; 90%) were performed under general anesthesia. The mean waiting time from presentation to surgery was 9 hours 56 minutes (range 3 hours 35 minutes to 22 hours 10 minutes) (Table 2). The mean operation time for repairs done by trainees was similar to the time taken by oculoplastic surgeons ($p=0.9$). All cases were repaired by the standard surgical procedure and retained silicone annular loop as described. There was no significant difference in the rate of intraoperative complications for repairs done by oculoplastic surgeons versus trainees ($p=0.44$). The canaliculus could not be identified in one case treated by an oculoplastic surgeon, and two cases treated by trainees; one case required enucleation due to very severe ocular injuries. The most commonly prescribed oral antibiotic was Cloxacillin (47.5%), followed by Augmentin® (31.5%), and others (21%). The silicone stent was removed after two to three months in 70% of patients treated by trainees and 50% of patients treated by oculoplastic surgeons ($p=0.57$). Twenty-three of 30 cases (76.67%) were followed-up for three months, while 16 cases (53.33%) were followed-up for six months. At three months post-operative, three of the 23 cases had no definite record of whether the passages were patent. Of the remaining 20 cases with

patent passages, 16 had been repaired by trainees, while four had been repaired by oculoplastic surgeons. Thus, the success rate was 15/16 cases (93.75%) for repairs performed by trainees, and 3/4 cases (75%) for repairs performed by oculoplastic surgeons ($p=0.16$). The rates of lacrimal sac irrigation at one week, three months, and six months post-operatively were 6.6%, 46.6%, and 66.6%, respectively. The overall success rate of lacrimal canalicular laceration repair was 18/20 cases (90%).

Discussion

Lacrimal canalicular laceration is a common emergency condition seen in tertiary eye care centers. The most common cause of lacrimal canalicular laceration in the present study was non-vehicular accident (40%), followed by dog bite (27%). In contrast, previous studies reported that the incidence of canalicular laceration in the periocular dog bite group (35.6% to 66%) was significantly greater than that in the control group^(5,6). Thirty percent of the current cases presented on a Friday, although Monday is reportedly the most common day for non-fatal workplace injuries by the Bureau of Labor Statistics, United States Department of Labor in 2013. In contrast, fatal work-related injuries reportedly occur evenly across all days⁽⁷⁾. The injuries occurred in other provinces in 80% of the present cases, and the patients were referred by their local doctors because there were no oculoplastic surgeons in that region. Most cases presented to the on-duty ophthalmology residents after office hours (70%). Resident trainees officially managed these patients after reporting to the on-duty ophthalmology staff. Complete ocular examination was done, and the patients were scheduled for repair in the operating room (OR), where all lacerated tissues such as the eyelid, cornea, and canaliculus were fixed. Primary enucleation was performed in severe cases without light perception. Most cases were repaired by trainees

in their third year of residency. The mean time taken for patients to be transferred from the emergency room to the OR was 9 hours 56 minutes (range: 3 hours 35 minutes to 22 hours 10 minutes), depending on how busy the on-duty anesthesiologists were on that day. The repair was sometimes delayed until the next day during office hours. The mean waiting time in the current study was comparable to that reported in other studies. Previous studies have reported an average time from presentation to repair of 0.53 days (range 0 to 3 days)⁽⁵⁾, and two days (range 8 hours to 9 days)⁽⁸⁾. Another study reported that the mean waiting time from presentation to surgery was one day in the early repair group (within 48 hours), and 5.2 days in the delayed group (after 48 hours)⁽⁹⁾; however, there was no significant difference in the success rate between groups (92.4% vs. 90.9%)⁽⁹⁾. Canalicular laceration sometimes presents as a chronic lesion because the injury has previously been overlooked, and so the mean time from injury to repair in another previous study was 43.61 months (range 1 to 360 months)⁽¹⁰⁾. The mean operation time for repairs performed by trainees did not significantly differ to the operation time for repairs performed by oculoplastic surgeons, which reflects the good surgical capabilities of the trainees. There were some complications in the current study cohort, including one case of wound dehiscence one week post-operatively, and one patient with granulation tissue detected at the upper punctum at the 6-month follow-up examination before silicone removal. A previous study reported that canaliculitis while the silicone tube was in place occurred more often in cases with double-passage intubation than one-passage or circular canalicular intubation and found that circular intubation was more stable than the other two techniques⁽¹¹⁾. However, there was no canaliculitis seen in the current study. Patients with canalicular laceration are normally scheduled for follow-up examinations one week, one month, three months, six months, and 12 months post-operatively. At each follow-up visit, the patients should be questioned regarding the history of epiphora, and should be examined for meniscal tear and retained silicone tube. The dye disappearance test and lacrimal sac irrigation should also be performed at each visit. Although the follow-up records noted that the patients were asymptomatic, the performance of lacrimal sac irrigation was not regularly noted. There were noted in 46.6% of cases at three months post-operatively, and 66.6% at six months post-operatively. Furthermore, only 76.67% of the cases were followed-up for three months and this was reduced to 53.33% at six

months post-operatively. These data showed that improvements are required in the post-operative follow-up scheduling of patients and record keeping.

In the present study, the silicone tube was removed two to three months post-operatively, and 93.75% of patients were asymptomatic three months post-operatively. Similarly, a previous study reported an anatomically patent success rate of 98.5% for lacrimal canalicular laceration repair performed via a similar technique by three oculoplastic surgeons⁽¹²⁾. Other studies reported that the functional success rate varied between 58% to 100% for repair performed using the Mini-Monoka monocanicular silicone stent^(2,13-15). However, Murchison and Bilyk reported that the level of training was important, as the success rate was 87.2% for canalicular lacerations repaired by oculoplastic surgeons in the OR setting and 25% by ophthalmology residents in the minor procedure room⁽¹⁶⁾. Although the surgical technique used for lacrimal canalicular laceration repair in the current study was pericanalicular suturing without direct canalicular wall suturing, direct canalicular wall suturing reportedly results in a greater success rate than pericanalicular suturing⁽⁹⁾. The present study had some limitations. These limitations included the retrospective design, small sample size, imperfection nature of the medical records, and short duration of follow-up.

Conclusion

The success rate of lacrimal canalicular laceration repair performed by ophthalmology trainees was very satisfactory. The waiting time was comparable to other studies, and operation time for repairs performed by trainees versus oculoplastic surgeons did not differ, but the post-operative follow-up schedule and medical record keeping need improvement. In an academic setting with a full array of equipment and 24-hour on-call ophthalmologists or trainees, the waiting time for surgery might be shorter than that in a small hospital with a limited number of surgeons.

What is already known on this topic?

The average mean waiting time for canalicular repair is one day. The level of training was important, as the success rate was 87.2% for canalicular lacerations repaired by oculoplastic surgeons in the OR setting and 25% by ophthalmology residents in the minor procedure room.

What this study adds?

Most cases presented to on-duty ophthalmology

residents after office hours (70%). This reflected services pattern in tertiary care in Bangkok and emergency available for operative theater. However, in academic setting, the success rate of repairs performed by trainees was 93.7%. There is an acceptable waiting time for surgery in tertiary setting in Bangkok.

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Conflicts of interest

The authors received no funding for this study, and have no conflicts of interest related to this article.

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