

The Investigation of Modified Lacrimal Canalicula Anastomosis Without Endoscope

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Abstract: Objective Explore the the clinical outcomes of RS lacrimal tube versus epidural anesthesia tube for lacrimal canalicular laceration. Methods it was divided into two groups That 65 participants with lacrimal canalicular laceration. The treatment Group Were inserted with RS tubes which were placed in superior and inferior canaliculi. The control Group Were inserted with epidural anesthesia intubation. Results It was significant difference that the effective rate between the treatment group and the control group, which was 89.5% and 70.1% ($P < 0.05$). and the comparison that the complication rate of these groups resulted with statistically significant difference ($P < 0.05$). Consequence By using this modified lacrimal intubation technique, RS can be utilized efficiently, easily, and nontraumatically in basic hospitals for the treatment of the lacrimal canalicular laceration.

Keywords: Lacrimal canalicular laceration; RS lacrimal tube; Epidural anesthesia; Intubation; Lacrimal intubation

1. Introduction

About 1/3 accounts for ocular trauma of the ophthalmic inpatients in primary hospitals in China. Lacrimal canalicular laceration which involved in 70% of lacrimal duct injuries [1], is one of the common emergencies of ocular trauma and. Naik et al [2] reported that lacrimal canalicular lacerations were occurred in 36% of eyelid lacerations. Patients might suffer from epiphora, pain, ptosis, lower eyelid ectropion, medial canthal deformity, or other conditions after the failure of lacrimal canalicular lacerations. It is widely acknowledged that the implantation and fixation of lacrimal canalicular supports were the critical success factor in lacrimal canalicular lacerations. While the supports can be divided into nylon wire, epidural anesthesia catheter, ureter catheter and silicone tube [3]. For decades, RS tube was favored for clinicians by which have the advantages of stable chemical properties, soft, smooth, and good biocompatibility [4]. In this retrospective study, we compared the efficacy of RS lacrimal tube with epidural anesthesia tube in the management of lacrimal canalicular laceration.

2. Material and Methods

2.1. Patients

This was a retrospective interventional case series performed at Department of Ocular Trauma, Handan

Ophthalmology Hospital, from August 2016 and July 2018. A total of 65 patients (65 eyes) were recruited for the study. A written informed consent was obtained from parents/guardians of all patients, and the patients were randomized into two groups. The treatment group received RS tubes therapy, and the control group received epidural anesthesia tubes therapy. Inclusion criteria were as follows: canalicular lacerations, no previous lacrimal history, trauma < 48 hours, and no previous treatment. The exclusion criteria were as follows: additional lacerations involving the punctum, lacrimal sac, and/or nasolacrimal duct or congenital and/or acquired lacrimal stenosis and/or obstruction [5].

2.2. Lacrimal system evaluation

Evaluation of the lacrimal system was done before surgery. Further examination of the lacrimal system was done by lacrimal irrigation using a 2.0-mL syringe of 0.9% saline solution. If the liquid flowed from the wound, a lacrimal probe (size 5) was used to confirm the position of the distal lacerated end of the lacrimal canaliculi.

2.3. Surgical procedure and medication treatment

The operations were performed by the Department of Ocular Trauma, Handan Ophthalmology Hospital. Adults were under local anesthesia and pediatric patients were under general anesthesia. The patients of

lacerated canaliculi were divided into 2 groups according to surgery way.

First, the lacrimal system was probed and irrigated. The punctum was gently dilated using a regular punctal dilator. The nasal side ends were identified with the surgical microscope (ZEISS, Germany, 6-magnification). The treatment group were inserted with RS tubes which were placed in superior and inferior canaliculi. (Chen sheng, Shandong, China). The control group were inserted with epidural lanesthesia intubation (Ai Ming, Beijing, China). The cannulas were inserted first vertically and then horizontally following the anatomy of the canaliculus. The proximal and distal lacerated ends were subsequently anastomosed with 3 pairs of 6-0 absorbable sutures around the canalicular tube.

Second, any additional eyelid injuries were repaired after the lacrimal intubation was completed. The eyelids were left in the correct anatomical position to prevent lid malposition and epiphora. If the cannula could be advanced into the nasolacrimal stent, irrigation was then performed. A post-surgery intravenous antibiotic was used to prevent infection.

Post-surgery follow-up visits were recorded at 1.0, 2.0 Week and 1.0, 2.0, 3.0 and 6.0 months. Postsurgery canalicular obstruction was defined as the incidence of reflux during lacrimal irrigation, and the presence of symptomatic lacrimal laceration, lacrimal eversion and lower eyelid ectropion were recorded.

2.4. Statistical analysis

Descriptive statistics, including the mean, standard deviation and range were calculated for different variables. Fisher's exact test was used to analyze clinical outcomes. The SPSS software was used (version 20.0, IBM, Chicago, IL, USA) for statistical analysis. Differences were considered statistically significant at $P < 0.05$.

3. Consequence

The 65 participants included 38 treated with RS tubes and 27 treated with epidural lanesthesia intubation. In the treatment group, there were 22 males and 16 females, with a mean age of 45.2 years (standard deviation (SD) 6.1) (range 6 to 64). The control group consisted of 18 males and 9 females the mean age was 41.3 years (SD 5.7) (range 10 to 70).

At following-up visits, patients were performed irrigation. It was significant difference that the effective rate between the treatment group and the control group, which was 89.5% and 70.1% ($P < 0.05$). The findings were assessed by the department of Ocular Trauma,

Handan Ophthalmology Hospital according to efficacy criteria [6-7]

All patients of the treatment group had good correction of inner canthus, without complications such as lacrimal laceration, lacrimal eversion and lower eyelid ectropion. But two of the patients occurred tube shedding during the follow-up. One of these cases was removed from the lacrimal puncture within 2wk, the other case was removed from the lacrimal puncture within 1~2mon after the operation, and the lacrimal canal flushing was improved. Complications occurred in 8 eyes (incision dehiscence in 3 eyes, lacrimal punctum eversion in 2 eyes, lower eyelid ectropion in 1 eye and extubated catheter in 2 eyes) in the control group. Comparison of these groups resulted with statistically significant difference ($P < 0.05$).

4. Discussion

The wall of lacrimal canaliculi is composed of orbicularis oculi muscle. The orbicularis oculi muscle is retracted to separate the broken end of the canaliculi from the subcutaneous tissue and skin of the eyelid margin when the lacrimal canaliculi ruptured. The wall of the broken end of the nose protrudes from the surrounding tissue and is like a pale white trumpet. Early intervention (within 48 hours) is strongly encouraged to restore the anatomy and function, as well as to reduce the incidence of postsurgery complications and recurrence [1]. In this study, all operations were performed within 48 hours after injury, and were successful by open vision, water injection or steam injection. Previous studies have shown that the major factors influencing the efficacy of anastomosis for lacrimal canaliculi fracture were the degree of lacrimal canaliculi fracture, the choice of support and indwelling method, and the length of time of catheterization [8]. With the application of surgical microscope, the detection of the broken end of the nasolacrimal canaliculi is no longer a difficult problem. The principle of lacrimal canaliculi catheterization is to make use of the physical support of the canaliculi to repair the broken end of the canaliculi along the wall of the canaliculi, reduce the stenosis of the canaliculi, and maintain the function of lacrimal canaliculi.

The wall of lacrimal canaliculi is relatively thin, with a diameter of 0.3~0.5mm. However, it has excellent elasticity and can be extended for 3 times. The lacrimal duct with a diameter of 1mm can be implanted. In this study, the diameter of RS tube and epidural anesthesia tube were 0.5mm and 0.8mm respectively, but the latter was hard in texture and poor in flexibility. Even if the lacrimal canaliculi anastomosis was successful, later complications such as the disappearance of lacrimal

siphon function, lacrimal tear, lacrimal canaliculi tear and lacrimal duct shedding would also be brought [9]. While RS tube was a better catheterization material by which has stable chemical properties, soft and smooth texture, good biocompatibility, non-toxic and irritating effects after long-term placement in the lacrimal duct, and does not affect the daily life of patients during catheterization [3].

In this study, the common advantages of the two lacrimal duct are simple operation method, avoiding nasal operation, and no need for nasal endoscope. However, the clinical efficacy and postsurgery complications of epidural anesthesia tube were significantly lower than that of RS tube. Statistical significance was found in the two groups. RS tube is relatively flexible, with a horizontal "C" shape between the upper and lower lacrimal points, and can slightly slide in the lacrimal duct during the process of opening and closing the eyelids. The siphonage of the lacrimal duct can facilitate the flow of tears into the lacrimal canaliculi, which can well guarantee the clinical efficacy. All patients in the treatment group had good correction of inner canthus, without complications such as lacrimal laceration, lacrimal eversion and lower eyelid ectropion. But two of the patients occurred tube shedding during the follow-up. Zhan et al reported if the patient has no symptoms when the accidental loss occurs after 2wk, there is no need to rush the operation again. The anastomotic site has been preliminarily healed and remains unobstructed [10]. This was also confirmed in our study. In the treatment group, one eye was caused by accidental touch after discharge, and one eye was caused by secondary trauma. The RS tube is mainly stuck in the crossing position between the dacryocyst and the lacrimal canaliculi by the expanded part in the middle, and its end is left in the nasolacrimal duct without fixation. This may be the important causes of lacrimal duct detachment. In addition, the average age of patients in our hospital is 43.1 years old, and there are a large number of people engaged in physical labor. They would not pay attention to eye care after discharge. Therefore, in the future work, we need to vigorously strengthen postoperative publicity and education of patients, and make sure that patients realize the importance of nursing and reduce improper eye operations.

As a new type of lacrimal duct support, RS tube has achieved good clinical effects in the treatment of children's lacrimal discharge, nasolacrimal duct obstruction, nasolacrimal sac anastomosis and lacrimal duct laceration [11]. They also have the following advantages: (1) the wall hole of the tube wall can flush the solution to eliminate the potential risk of lacrimal

tract infection; (2) it is a safe, effective and less invasive surgical method to remove the catheter without requiring the patient to be anesthetized again, so as to relieve the patient's physical and mental pain and reduce the patient's medical costs. In summary, the study results suggest that RS tubes can not only make lacrimal canaliculi anatomically reposition, but also maintain its physiological function. They can improve the success rate of surgery, reduce iatrogenic injury, reduce the probability of postoperative complications, provide good appearance effect and reduce the cost of surgery. They appear to be widely carried out in primary hospitals.

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