·Clinical Research·

Effects of medication methods after simple and effective probing of lacrimal passage

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Abstract

• AIM: To evaluate the effect of reducing the use of antibiotics in the treatment of infant bacterial dacryocystitis after probing of the lacrimal duct.

• METHODS: A total of 542 cases of children under one year old and accepting nasolacrimal duct probing treatment were divided into two groups, which were treated with topical and oral antibiotics, respectively. Conjunctival sac secretions were used as a control index of bacterial infection, whereas the disappearance of epiphora symptoms and lacrimal passage patency were used as cure indexes. The χ^2 test was used to compare enumeration and measurement data, and a statistical significance was set at $P<0.05$. The therapeutic effect on the two groups of postoperative patients was investigated.

• RESULTS: In the two study groups, no significant differences in gender, age and postoperative control of lacrimal sac infection were observed. The cure rates after three probing operations also showed no significant difference.

• CONCLUSION: After probing of the lacrimal passage, results of this study confirmed that postoperative medication without oral antibiotics but an ophthalmic dosage of antibiotics was a simple and effective treatment method.

• KEYWORDS: dacryocystitis; lacrimal passage obstruction; lavage; infant

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INTRODUCTION

Lacrimal passage probing is a reliable method for treating chronic bacterial dacryocystitis in children with congenital nasolacrimal duct obstruction[1]. Various infections occur in congenital dacryocystitis, which requires systemic antibiotic treatment [2]. After probing of the Hasner flap to control the invasion of primary inflammation in the lacrimal duct and nasal retrograde bacterial infection in wounds, and alleviate the nasolacrimal duct tissue adhesion of inflammation, researchers reported on the intraoperative and postoperative injection of antibiotics and hormone drugs in the lacrimal duct to control the postoperative infection and reduce the recurrence rate, which resulted in certain effects[3,4]. However, the success rates reported in the medical literature greatly vary.

Various reported treatments mostly focused on the use of nasolacrimal duct probing methods, and relatively few studies have been conducted on the effects of postoperative medication safety and success rate of treatment evaluation[5-7]. Given that infants and young children comprise a special group with poor drug resistance, reducing the use of medications, especially antibiotics, after surgery can avoid excessive drug absorption without affecting the curative effects. This approach can relieve the potential effects of drugs on the growth and development of children, and the local use of antibiotics can reduce the increased risk of drug-resistant strains [8]. By assessing the necessity and effectiveness of postoperative medication, we determined a simple and effective treatment method to provide an alternative for clinicians. Compared with conventional treatment, probing of the nasolacrimal duct using a simple saline lavage of the lacrimal passage and postoperative topical ophthalmic drug in this study produced a similar curative effect.

SUBJECTS AND METHODS

General Data This study comprised children with chronic bacterial dacryocystitis associated with congenital nasolacrimal duct obstruction, who were diagnosed in the outpatient department of ophthalmology of a local hospital from May 2012 to February 2013. The exclusion criteria were the congenital abnormal shape and position of lacrimal

punctum, congenital nasolacrimal duct bony malformation and inability to establish contact after the operation. A total of 542 cases were included in this study. Among these cases, 312 were males and 230 were females. The age of respondents ranged from 3 to 12mo and 13d, with a mean age of 158.38±64.62d. These respondents were subjected to probing. The diagnostic standard of lacrimal passage obstruction is based on the symptoms and signs of persistent epiphora and yellow white secretion of conjunctival sac after birth[9]. The anatomical characteristics of the lacrimal passage were observed during probing. Within one week after birth, children had epiphora, variable amounts of white secretions at the openings of lacrimal ducts and other symptoms. Firstly, according to the eye tears spill signs, we made initial diagnosis of nasolacrimal duct obstruction. Then we flushed the lacrimal duct. During lacrimal passage probing, purulent secretion in lacrimal sac reflux liquid was visible to the naked eye. If the physiological saline for rinsing refluxed, we probed the lacrimal duct with mechanical agent. The operator reported feeling obvious hand resistance and had obvious agent through successfully "Rio empty feeling" as the probe passed through the nasolacrimal duct. Then, the lacrimal duct was flushed again. Such is the procedure we used to determine the existence of nasolacrimal duct obstruction. This result confirmed that the children had chronic bacterial infection of the lacrimal sac and mechanical obstruction of the nasolacrimal duct. Children were randomly registered and visited. In the probing process, cases with confirmed obstruction were recruited to our study, while others were excluded.Before implementing the study, three doctors agreed that these patients would be treated by two different postoperative medication methods, namely, the traditional and modified methods. Respondents were further divided in two groups, namely, the conventional group (group A) with 284 cases and the improved group (group B) with 258 cases. Patients randomly received probing of two lacrimal passages using the same operating procedures. The general conditions of the two groups were not significantly different (P>0.05), and the conditions were comparable (Table 1). This study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Zhejiang University School of Medicine. Written informed consent was obtained from each participant.

Postoperative Medication Methods Group A used 0.02% fluorometholone longan syrup (Japan Santen, Osaka, Japan) eye drops four times a day for 3d, combined with levofloxacin eye drops (Japan Santen, Osaka, Japan) four times a day for 7d, and oral administration of cefadroxil dispersible tablets (Huaneng Pharmaceutical Co. Ltd., Guangdong, China) of 15 mg per kilogram of body weight (15 mg/kg) three times a day for 3d. Cured patients discontinued the drugs after a week. Patients who required further probing repeated the same regimen until healed.

Table 1 Comparison of general situation of children in two groups

Groups	n	Gender		Age (a)
		M	F	
A	284	161	123	154.99±61.17
B	258	151	107	162.10±68.15

Constituent ratio of male and female gender in two groups, χ^2=0.187, P=0.666; comparison of ages in two groups, t=1.280, P=0.201.

Group B only used 0.02% fluorometholone longan eye drops four times a day for 3d, combined with levofloxacin eye drops four times a day for 7d. Cured patients discontinued the drugs after a week. Patients who required further probing repeated the same regimen until healed.

Observation Index The disappearance of epiphora was used as the clinical recovery index, whereas secretion at the opening of the lacrimal duct was used as the degree of infection control. The patients returned for a follow-up a week after probing. If the patients reached complete remission, they could discontinue medication followed by continued observation. If the patients had epiphora at the second week of follow-up, they underwent a second round of probing and repeated medication methods. If the patients had no remission at the third week of follow-up, they underwent a third round of probing and repeated medication methods. If the patients had no remission at the fourth week of follow-up, they no longer needed probing, medication was discontinued and regular clinical observations were advised. If the patients exhibited symptoms of infection, they were given drug therapy according to their circumstances. During follow-up three months after the operation or telephone follow-up, the absence of epiphora and secretions at the lacrimal duct openings was considered the clinical cure.

Statistical Analysis SPSS 13 statistical software was applied. The enumeration data were obtained using the χ^2 test, whereas the measurement data were collected using t-test. Statistical significance was set at P<0.05.

RESULTS

The constituent ratio of males and females, as well as the age of the two groups, did not exhibit a statistically significant difference. The control of lacrimal sac infection after the operation was similar in the two groups, and the difference was not statistically significant. The cure rates of the first operation were 62.7% and 62.8% in groups A and B, respectively. The cure rates of the second operation were 92.6% and 95.0% in groups A and B, respectively. The cure rates of the third operation were 98.9% and 99.6% in groups A and B, respectively. No significant difference was observed in the clinical cure rates (Tables 2, 3). In the two groups of patients, 541 cases showed clinical recovery three months after the treatment. For one case in group B, the lacrimal passages were unobstructed during follow-up, but regurgitation was observed at the offside orifice of the lacrimal duct. Moreover, epiphora was still observed even

Table 2 The postoperative remission cases of secretions at the openings of the lacrimal duct in two groups *n* (%)

Groups	*n*	After the 1st probing	After the 2nd porbing	After the 3rd probing
A	284	246 (86.6)	274 (96.5)	283 (99.6)
B	258	226 (87.6)	248 (96.1)	258 (100)

Constituent ratio of the postoperative remission cases of secretions at the openings of the lacrimal duct in two groups. After the 1st probing: χ^2=0.115, *P*=0.735. After the 2nd probing: χ^2=0.048, *P*=0.827. After the 3rd probing: χ^2=0.48 (the minimum theoretical frequency directly calculation probability), *P*=1.000 (fisher exact test).

Table 3 Postoperative clinical cured cases in the two groups *n* (%)

Groups	*n*	After the 1st probing	After the 2nd porbing	After the 3rd probing
A	284	178 (62.7)	263 (92.6)	281 (98.9)
B	258	162 (62.8)	245 (95.0)	257 (99.6)

Constituent ratio of postoperative clinical cured cases in the two groups. After the 1st probing: χ^2=0.001, *P*=0.0.978. After the 2nd probing: χ^2=1.276, *P*=0.259. After the 3rd probing: χ^2=0.165 (the minimum theoretical frequency 1.90, continuous correction calculation χ^2 and *P*), *P*=0.685.

after three operations, but no prominent conjunctival sac secretion was found. After 2mo of follow-up, the symptoms of epiphora spontaneously relieved, and the patient finally recovered after being transferred to another hospital for balloon dilation of the lacrimal duct.

DISCUSSION

The incidence rate of infant dacryocystitis combined with nasolacrimal duct obstruction is approximately 5%[1]. Some scholars believe that treatment methods for infants under one year old are mainly conservative techniques, but Asian children with chronic infections are prone to suffer from blepharitis and outer canthal eczema [10,11]. Nasolacrimal duct probing treatment is a widely used traditional therapy for infants under one year old, and is a putative therapeutic method [12]. Domestic scholars recommend the intraoperative and postoperative routine use of tobramycin eye drops, saline and fluorometholone or dexamethasone eye drops for continuous lavage of the lacrimal passage and oral antibiotic therapy to improve efficacy. Given the characteristics of growth and development of children, we investigated whether the reduction of the dosage and design of a simple and safe treatment method could obtain similar therapeutic effects. Our results show that the clinical symptoms and infection evidently improved among children with chronic bacterial dacryocystitis combined with nasolacrimal duct obstruction after probing. The improvement and control of clinical symptoms and infection are vital factors for the success of treatment. The curative effects of the two treatment groups were not statistically different. Results indicate that the selection of a sensitive and safe eye dosage to control postoperative infection and postoperative reaction, and not the use of oral antibiotics, failed to affect the control of postoperative infection and cure rate.

Bacterial cultures of chronic dacryocystitis mainly comprise *Staphylococcus epidermidis*, *Streptococcus* and some Gram-negative bacteria, such as *Pseudomonas aeruginosa*[13]. The "clinical guidelines of ophthalmology" of the United States of America Department of Ophthalmology, 2006, recommend topical ofloxacin eye drop as the first choice in controlling lacrimal sac infection. Patients in the experimental group received probing at an earlier age, which differed from recent reports that implemented probing of nasolacrimal duct among children older than one year [14,15]. However, Al-Faky *et al* [16] reported that the treatment effect has no differences in age. A study showed that resistance to cefadroxil and cefazolin drugs exists [13]. The safety of medication for children was considered in the present study, and supporting evidence to eliminate antibiotic dependence in some countries and regions was provided. Results show that therapeutic success was independent of the use of oral antibiotics, and probing of lacrimal passage had a vital function. Studies showed that the administration of oral antibiotics to children after the rehabilitation of nasolacrimal duct patency is an additional treatment method. This study showed that patients who received the first and second nasolacrimal duct probing had no significant difference in postoperative infection control and clinical cure rates. Data on children requiring a third operation were statistically calculated as the remission cases with the secretion at the opening of the lacrimal duct. Given that the minimum theoretical frequency was 0.48, the difference was not statistically significant. No statistical difference was also found on the third clinical cure rate in operation using continuous correction calculation χ^2 and *P* because the minimum theoretical frequency was 1.90. After the traditional treatment was simplified, no difference was found between the results of the proposed and conventional treatment methods. Thus, the expected objective was achieved.

In this study, lacrimal passage probing only used physiological saline as the lavage liquid, which produced a treatment effect similar to that in the literature [17-20]. In lacrimal passage probing, the flow rate of the lacrimal lavage fluid is relatively quick. The mucosal lining of the lacrimal sac has a mucus-secreting function, so drugs in the lacrimal sac cannot be easily retained. Secondly, skilled operators can almost finish the treatment process within 3min because of the short operation time of lacrimal passage probing. Most

parents are reluctant to accept treatment performed under general anaesthesia. Some scholars tend to operate under local anaesthesia for young children[21]. However, children are uncomfortable when awake, which can affect lacrimal gland secretion. Tears flow along the lacrimal passage when probed, which can dilute the retained drug. Thus, the drug is unable to reach the effective anti-inflammatory antimicrobial concentration. If the drug is absorbed through the vascular plexus of the nasal mucosa, children could swallow the fluid, which will then enter the gastrointestinal tract. The extra lavage liquid will be absorbed into the body, and the local drug at the nasal mucosa will create opportunities to increase the resistant strains. In addition, the mechanism of aminoglycoside risk of childhood hearing loss is not dose-dependent. Based on the aforementioned reasons, the traditional use of antibiotics and hormone drugs in lavage liquid has minimal antibacterial effects. By contrast, the tears through lacrimal passage contain lipotropin, lactoferrin and lysozyme, which have specific sterilisation functions and make the addition of medicine in lavage liquid unnecessary. Low concentrations of fluorometholone eye drops cause less adverse reactions of the eye tissue to hormone response, such as steroid glaucoma, and increase the spread of infection opportunities. However, low concentrations can also reduce the postoperative traumatic oedema of lacrimal duct mucosa and expand the inner diameter of lacrimal passage after probing, which enables inflammatory secretion and the easy discharge of a small amount of blood. Moreover, low concentrations can benefit the "self-cleaning" functions of the lacrimal duct. Low concentrations of fluorometholone can inhibit the formation of scar tissue during the corneal wound healing process, aid in the repair process of the lacrimal duct mucosa, help complete mucosal repair and prevent recurrent adhesion opportunities. Thus, the recurrence rate drops accordingly.

In the treatment of nasolacrimal duct obstruction combined with chronic dacryocystitis lacrimal duct in children, the results of this study show that the recovery of lacrimal duct patency was the key to treatment. The use of postoperative ophthalmic formulations of antibiotics could replace the systemic administration of antibiotics. The reduction of the types and dosages of clinical medication for children, especially for children with multiple system diseases, could decrease the burden of drug metabolism, adverse drug reactions and excessive drug potential effects on the growth and development of children. Thus, this approach was a secure, simple and effective method for children.

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