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The Safety and Efficacy of Endoscopic Lacrimal Duct Probing in Neonates with Acute Dacryocystitis

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Abstract

Objective: To observe the safety and efficacy of endoscopic-assisted lacrimal duct probing in neonates with acute dacryocystitis.

Methods: The prospective treatment of 148 eyes of 103 cases of neonatal acute dacryocystitis was studied. In the observation group, 58 cases (76 eyes) underwent endoscopic exploration of lacrimal passage under topical anesthesia. Make the child lie on the bed, after the surface anesthesia of hydroxybucaine hydrochloride, dot dilator is not easy to expose the dilatable lower point. With the assistance of nasal endoscope, the probe of the No. 6 lateral foramina lacrimal duct entered the lacrimal duct and dacryocyst successively. After entering the dacryocyst, the pus was sucked out with a syringe and rinsed repeatedly with normal saline until no obvious suppurative secretions were discharged. Postoperative topical anti-inflammatory eye drops and oral antibiotics were used. In the control group, 45 patients (72 eyes) were treated with hospitalized systemic antibiotics and conservative treatment with local antibiotic eye drops.

Results: In the observation group, 58 cases (76 eyes) underwent superficial anesthesia and nasal endoscopy assisted lacrimal duct exploration and achieved satisfactory results. Stenosis of the lower nasal passage was found in one eye. In all cases, there were no serious complications during and after surgery, and no recurrence was observed for 3 months to 1 year after surgery. In the control group, 45 cases (72 eyes) of neonates with acute dacryocystitis, 10 cases with conjunctival sac secretion disappeared after conservative treatment. Redness and swelling in the dacryocystitis were improved in 31 cases, of which 2 cases had facial scars due to drainage of pus from the conjunctiva sac through a percutaneous laceration incision. Four patients were discharged automatically due to the aggravation of symptoms. After 6 months of follow-up, about 50% of the children received exploratory treatment of lacrimal passage and completely healed.

Conclusion: Nasal endoscope-assisted dacryocystitis is a method for the treatment of neonatal acute dacryocystitis, which is worthy of clinical promotion.

Keywords: Neonatal; Acute dacryocystitis; Nasal endoscopy; Lacrimal duct probing.

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Introduction

Neonatal acute dacryocystitis refers to acute suppurative inflammation of the dacryocystitis occurring in the neonatal period (within 28 days after birth), which is rarely seen clinically and is secondary to congenital obstruction of the lacrimal duct or congenital dacryocystic [1]. Acute dacryocystitis presents with swelling and erythema over the dacryocystis. In addition, patients with acute dacryocystitis may develop progressive cellulitis and may form abscess within the dacryocystitis due to accumulation of purulent material. Acute neonatal dacryocystitis is often accompanied by palpable masses from the dacryocystis. As the disease progresses, symptoms include dacryocystic, dacryocystic, mucocele, and amniocele [2]. The cause of the disease is mainly due to Hasna valve or epithelial debris caused by nasolacrimal duct obstruction, when children's resistance to decline or be invaded by pathogenic bacteria, easy to cause acute disease, serious cases can occur eye cellulitis, even sepsis [3].

At present, the main clinical treatment methods include conservative and surgical treatment [4,5]. Early treatment and drainage are key factors affecting the cure rate [6]. In the following retrospective study, 103 neonatal children with acute dacryocystitis treated in two hospitals in Hefei, China were reported with different treatment regimens and outcomes.

Materials and methods

From December 2016 to December 2021, Hefei Brighti Eye Hospital and Anhui Provincial Children's Hospital will receive 103 cases with 148 eyes of neonatal acute dacryocystitis, including 54 males and 54 females 49 cases; 36 cases of right eye, 22 cases of left eye, and 45 cases of both eyes; All were 7±2.74d. The selected case was the first time sick, and the family members of the observation group agreed and informed, signed Informed consent, approved by the hospital ethics committee, and exclusion of systemic congenital diseases and other He had ophthalmic diseases, and some children in the control group had systemic diseases such as pneumonia and congenital heart disease.

76 eyes of 58 cases in observation group were treated with nasal endoscopy-assisted lacrimal duct probing under outpatient topical anesthesia. The specific methods are as follows: (1) The child should be restrained by a bed sheet or surgical gown while lying down. The assistant holds his head with his hands. (2) After oxybucaine hydrochloride is under topical anesthesia, the puncta expands. The tensioner dilates the upper puncta (expandable lower puncta that is not easily exposed). (3) No. 6 tear with side holes The lacrimal probe enters from the punctum, entered the lacrimal canaliculus and the common lacrimal duct in turn, and encountered resistance at the common lacrimal canal. After probing, it entered the lacrimal sac, the pus was aspirated with a syringe, and the normal saline was repeatedly flushed until no more Obvious purulent secretions, nasal endoscopy-assisted descending lacrimal duct probing, and partial retraction in case of a sense of loss Needle, rinse the lacrimal duct, see that there is irrigation fluid in the lower nasal passage, the probing is successful; if there is a large resistance, Do not force the probe, but observe with the aid of a nasal endoscope, and change the direction of the probe appropriately [4]. Postoperative Local use of antibiotic eye drops and oral antibiotics; 72 eyes of 45 cases in the control group were treated with hospitalized systemic Infusion of antibiotics, conservative treatment with topical antibiotic eye drops, children with larger lacrimal sac abscess supplemented by Skin incision lacrimal sac drainage treatment. The evaluation criteria of treatment effect are shown in Table 1.

All data involved in the study were tallied using SPSS 22. Age and treatment days were tested using independent samples t-test, and response rate and cure rate were tested using paired samples t-test.

Table 1: Criteria for cure.

Diagnosis	Clinical features
Cure	no redness and swelling in the lacrimal sac area, smooth lacrimal duct flushing, and disappearance of epiphora and conjunctival sac secretion
Improvement	The redness and swelling of the lacrimal sac area of the child subsided, the lacrimal duct was blocked, and the epiphora and conjunctival sac secretion decreased.
Ineffective	The redness and swelling of the lacrimal sac area of the child did not improve, the lacrimal duct was blocked, and the epiphora and conjunctival sac were separated. Discharge did not improve.

Results and Discussion

58 cases of 76 infants with neonatal acute dacryocystitis in the observation group were treated with the assistance of outpatient anaesthesia and nasal endoscopy. All lacrimal duct probing achieved satisfactory results, no inflammation spread in one eye, and 57 cases (75 eyes) underwent postoperative. On the first day, the redness and swelling of the lacrimal sac area subsided significantly, and the eye secretion of the child disappeared after 1-7 days of topical application. In 1 case (1 eye), it was found that the space of the lower nasal passage was narrow, and the bone resistance was encountered during probing. After the pus was drawn out, gatifloxacin ophthalmic gel was injected, and the lacrimal sac area was red and swollen on the first day after the operation. The ocular secretions of the child improved, and the lacrimal sac area bulged again after 1 month. After probing, the mass in the lacrimal sac disappeared, and the nasolacrimal duct probing was successful after constricting the nasal cavity. There were no serious complications after operation, and there was no recurrence during the follow-up period of 3 months to 1 year. 45 cases in the control group 72 eyes of neonatal acute dacryocystitis, 10 cases of 16 eyes with dacryocystitis after conservative treatment Symptoms subsided, conjunctival sac secretion disappeared, 31 cases of 49 children with lacrimal sac area improved and swollen, conjunctiva Decreased sac secretion, of which 2 out of 31 children had 2 eyes with percutaneous incision of the lacrimal sac drain Pus, leaving facial scars, 4 children with 7 eyes had aggravated symptoms, and were automatically discharged to a higher-level hospital ,After further treatment, about 50% of the children underwent lacrimal duct probing treatment after 6 months of follow-up. The clinical outcomes and complication statistics between the two groups are shown in Table 2.

Table 2: Clinical efficacy and complications in the treatment and control groups.

Group	Number of cases	Cure	Upturn	Invalid	Efficient	Recovery rate
Observation group	58 (76eyes)	57 (75eyes)	1 (1eye)	0 (0eye)	100%	98.68%
Control group	45 (72eyes)	10 (16eyes)	31 (49eyes)	4 (7eyes)	90.28%	22.22%
X^2	0					0
P value	0					0.06

Discussion

Acute dacryocystitis in infants is one of the more difficult diseases in ophthalmology, caused by young age, poor resistance and delicate skin. Its mechanism has not been fully researched and there are characteristics of rapid disease progression and high family requirements that make it a struggle for ophthalmologists. Also the disease requires high puncture technique and is risky, plus most ophthalmologists are unfamiliar with systemic neonatal medications and lack of knowledge about the disease and sufficient confidence in treatment, so most children are referred to the neonatology department. However, neonatologists lack the expertise of ophthalmologists, and treatment of the disease is mostly symptomatic, such as systemic antibiotics, for acute dacryocystitis in infants. The underlying cause, however, is obstruction of the nasolacrimal duct disease. Some scholars believe that acute lacrimal sac inflammation in infants may be due to maternal weakness, poor resistance, contraction fatigue, prolonged labor, amniotic fluid contamination, and cephalopelvic disproportion causing squeezing of the head by the pediatrician, which results in myelomeningeal exudation of neonatal ocular tissue after edema in the lacrimal sac [7]. Some studies suggest that the disease may be due to cross-infection from incomplete flushing and disinfection of the birth canal during delivery and from contact between the child and medical personnel after delivery [8]. Most of the neonates with acute lacrimal sacculitis treated in this study were caused by secondary infection in children with congenital lacrimal sacculitis, which is consistent with the 15 cases (16 eyes) reported by other investigators [9], and all neonates with acute lacrimal sacculitis had lacrimal sacculous mucus sacs immediately after birth, and acute lacrimal sacculitis was caused by secondary infection at about 1 week of onset. Congenital lacrimal sac protrusion, also known as bulging congenital lacrimal sac disease or neonatal lacrimal sac mucoceles, is rare clinically and can occur at birth or a few days later. Due to the obstruction of the lacrimal duct, the lacrimal sac is enlarged by the accumulation of mucus secreted by the mucus glands in the inner wall of the lacrimal sac. It is characterized by nasal side down to the bottom of the internal canal ligament, is slightly blue, cystic, and non-tender. A slightly blue, cystic, non-tender hard mass may be found under the medial canalicular ligament in the nasal cavity of newborns [10]. Acute infection may be secondary to weakened resistance or incorrect massag [11]. Some investigators have suggested that congenital protruding lacrimal sacs are subject to secondary infection and form acute dacryocystitis in infants, which is recommended to be treated as soon as possible [12]. In the present study, based on clinical experience, it was observed that most children with congenital lacrimal sac protrusion had cysts visible under nasal endoscopy (Figure 1), it was difficult to have congenital nasolacrimal duct obstruction, and lacrimal tract exploration generally failed in most cases.

Common causative agents of acute lacrimal sacculitis in neonates include Streptococcus, S. pneumoniae, and S. aureus [13]. The pathogenesis is not caused by a single factor, and few factors affecting neonatal lacrimal sacculitis have been reported abroad [14]. Some scholars pointed out that in addition to Hasner flap obstruction of the inferior nasolacrimal duct, there are bony and epithelial obstructions [15]. It was found that the main risk factors for x neonatal dacryocystitis were gestational age <37 weeks, family history of rhinitis, cesarean delivery, family economic status, time of birth and birth weight >4 kg [16, 17].

Previously, hot compresses, local or systemic antibiotics were used in the treatment of acute dacryocystitis in infants, or skin puncture to draw pus or abscess incision and drainage after controlling the inflammatory response [18]. However, these methods are highly injurious, tend to destroy the normal structure of the lacrimal sac, have many complications, cause lacrimal sac fistula, are prone to repeated breakage, and even leave skin scarring, which affects the aesthetics of the child, and have a long treatment period, causing pain to the child. In this study, although the overall efficiency rate was not statistically significant, it only controlled the acute inflammation and did not solve the underlying problem of nasolacrimal duct obstruction, so half of the children in the control group still needed lacrimal tract exploration after 6 months.

In infants with acute dacryocystitis, the underlying cause is nasolacrimal duct obstruction, and traditional puncture or excision does not address the root cause of the obstruction. In recent years, the leidaoleidaot lacrimal tract exploration for the treatment of neonatal j-agent dacryocystitis in the course of d remains controversial. Some scholars have proposed that lacrimal ducts are not contraindicated [19], while others believe that lacrimal duct probing is appropriate after 3 months [9]. However, lacrimal inflammation in children with acute dacryocystitis is persistent, and repeated lacrimal mucosal injury and repair predispose to obstructive fibrotic thickening of the lacrimal membrane, which affects the effect of evacuation. In advanced and long-term dilation of the tear sac, the tear sac wall loses elasticity, and the tear duct function is imperfect even if late lacrimal exploration is successful. And because of the long-term presence of excessive tearing, especially in children with cysts on both sides of the nose, there is a risk of respiratory distress, which is recommended to be treated as soon as possible [20]. Some investigators believe that the use of "lacrimal aspiration + probing" in the early stages of acute dacryocystitis in neonates can shorten the treatment time and prevent the deterioration of the disease. Drawing on that experience, in this study, pus was aspirated from the lacrimal sac through the lacrimal punctum before lacrimal exploration (Figure 3A), and the lacrimal sac irrigation test device was used if necessary, and the lacrimal exploration technique was performed after the irrigation

fluid was clear. However, because the child is in the acute phase, the eyelid is edematous and tear exposure is difficult, while there are difficulties with functional or mechanical locking of the tears mainly, and the passage of the agent tends to form a false channel, causing congenital damage and possibly even the spread of inflammation.

With the development of endoscopic transnasal approach in recent years, especially in the eye and nasal related fields, the contraindication of doing nasal lacrimal sac anastomosis for traditional acute dacryocystitis has been surpassed and the results are satisfactory. Therefore, some scholars have used nasal lacrimal sac anastomosis [21], and although the surgical results were immediate, a number of problems have arisen, such as anesthesia and the possibility of anesthetic accidents. Some researchers concluded that anesthetic surgery in infancy and early childhood had no significant effect on the development of forward intelligence and sensory integration in children, but children in the anesthesia group had higher values of differences in working memory-verbal comprehension indicators in the intellectual structure and an increased incidence of vestibular imbalance after two anesthetic procedures in infancy and early childhood [22]. The role of the central nervous system in anesthesia is very important. The human central nervous system is not fully developed at birth, and the last 3 months of intrauterine development and the years after birth, especially the first 3 months of life, are the most important, known as the burst period of brain development or the synaptic period, which is the basis for the development of the central nervous system and cognitive functions [23]. Evidence from most retrospective studies supports that babies aged 2 to 3 years are more likely to develop cognitive and behavioral impairments, and the number of anesthesia sessions, duration of exposure, and exposure dose are directly related to the risk of cognitive dysfunction. Moreover, it is difficult for most families to accept general anesthesia for children. In addition, anesthesia requires the insertion of a laryngeal mask or endotracheal tube, which may cause damage to the child's throat. In addition, the sinus structure is not fully developed in newborns, and if the nasal bone is removed prematurely, it may also have an impact on the long-term development of the child. Neonates are relatively close to the structure and operating area of the skull base, with small nasal cavities and limited operating space. Neonates have low hemoglobin and there are complications such as high trauma and bleeding with damage, therefore, this procedure is limited to children with bony nasolacrimal duct obstruction. In the treatment of congenital lacrimal sac cysts with apparently prominent sinus cysts just now [24], the results were more satisfactory and the procedure was minimally invasive compared to lacrimal sac nasal anastomosis, which is not recommended relative to the situation of the children in this study to start using this procedure. The main reason is the young age of the neonate and the need for general anesthesia for the procedure, the risk of anesthesia is then greater, especially for primary or specialized discipline hospitals, where resuscitation conditions are limited and the neonate's condition changes rapidly, and safety cannot be guaranteed. Second, the procedure is more expensive. To improve the success rate, some scholars suggest that surgical treatment such as lacrimal drainage tube implantation into the lacrimal duct can be used for those who fail to explore [25,26]. However, lacrimal drainage tubes can cause ocular discomfort in children, with the potential for corneal damage and tearing of the tear dots. In addition, a second stage of extubation is required, and tube placement should be considered for children who have failed repeated visits.

In this study, for acute dacryocystitis in neonates, the observation group was treated with nasal endoscopy-assisted descending lacrimal duct exploration, which was performed under outpatient surface anesthesia only, without the risk of hospitalization and general anesthesia, and without the need for systemic infusion of fluids. After treatment, the erythema in the lacrimal sac area of the child disappeared significantly (Figure 4), supplemented with local antibiotic eye solution, lacrimal sac massage, and oral antibiotics if necessary for severe inflammation, with no erythema in the lacrimal sac area and disappearance of conjunctival sac secretions on the first postoperative day (Figure 2 and Figure 3B). There was no recurrence at 3 to 6 months of follow-up. This approach is relatively the most minimally invasive and has a high cure rate, and the child recovers quickly. Moreover, with the aid of nasal endoscopy, it is visualized that the child has more factors affecting the passage of the agent through the nasal cavity, such as cysts in the nasal cavity and adhesions in the lateral nasal wall of the inferior turbinate. The success rate of tear duct passage is high and relatively safer. However, at the same time, it is more demanding for the surgeon, requiring extensive experience in infant lacrimal duct exploration through, as well as a strong psychological profile, which should not be affected by the sound of crying newborns, but rather the requirement of a fixed head for the assistant. Another assistant is also needed to cooperate with the nasal endoscopic observation, especially during the probing process through the probe into the tear sac, which cannot be forcibly removed through the tear duct, because the child's tear duct does not go in. The procedure should also take care to prevent bleeding, which can walk into the false tract and subsequently lead to the spread of inflammation and injury to the child's infection.

The effect of ophthalmic gel can be carried out after successful lacrimal duct injection with broad-spectrum antibiotics through the preparation, which can be anti-inflammatory and support the lower nasolacrimal duct. One study reported a gel with antibiotics injected after lacrimal tract exploration for congenital dacryocystitis, which used 0.3% ofloxacin ophthalmic gel, but the general safety remains to be observed [27]. It was found that after 7 consecutive days of drops of gatifloxacin ophthalmic gel, the concentration of tifloxacin drug in all plasma samples was below the lower limit of quantification [28], indicating that the drug is safe for topical use and can adhere to the surface of the eye after drops due to its viscosity and fluidity. Gatifloxacin with the patented technology of extra-strength-technology can maintain the duration of action in intraocular tissues and rapid release of the drug quickly, effectively and durably, and increase bioavailability, which is supplemented by lacrimal tract probing for local administration of postoperative anti-inflammatory drugs in neonates, with obvious advantages over antibiotic eye drops.

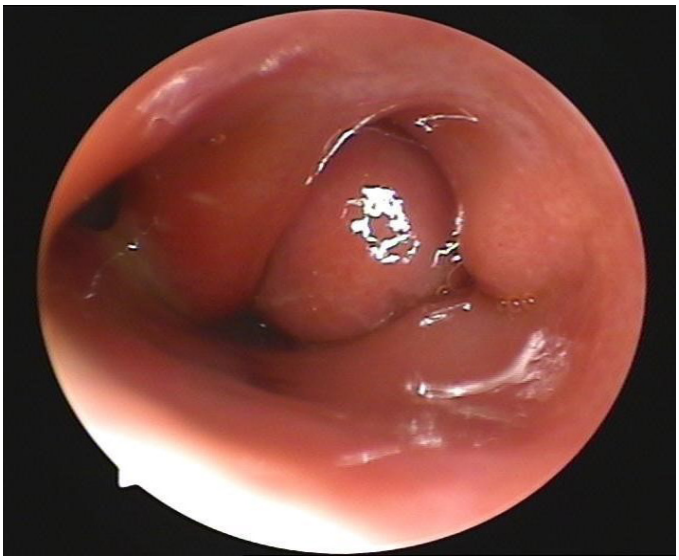

Figure 1: Left nasal endoscopic view of congenital lacrimal sac protrusion.

Figure 2: A 4-day-old binocular infant with acute dacryocystitis before surgery.

Figure 3: A and B were the pus extracted through the lacrimal sac during the operation and the first day after the operation of endoscopic lacrimal duct probing.

Figure 4: A and B respectively showed acute dacryocystitis of newborns born 9 days before and immediately after operation.

Conclusions

In conclusion, transnasal endoscopy-assisted descending lacrimal duct exploration for the treatment of acute dacryocystitis in neonates is safe, relatively simple to operate, with short treatment time, rapid recovery of the child, and definite efficacy, providing a new protocol for the diagnosis and treatment of this disease.

References

1. P ZF Treatment of acute dacryocystitis in neonates. J Pediatr Ophthalmol Strabismus, J Pediatr Ophthalmol Strabismus. 1991; 28: 341-343.
2. L GT. The association of neonatal dacryocystoceles and infantile dacryocystitis with nasolacrimal duct cysts (an American Ophthalmological Society thesis), Trans Am Ophthalmol Soc. 2012; 110: 74-93.
3. MJ Ali. Pediatric Acute Dacryocystitis, Ophthalmic Plast Reconstr Surg. 2015; 31: 341-347.
4. Y Takahashi, H Kakizaki, WO Chan, D Selva. Management of congenital nasolacrimal duct obstruction. Acta Ophthalmol. 2010; 88: 506-513.
5. J Heichel, T Bredehorn-Mayr, HG Struck. Congenital nasolacrimal duct obstruction from an ophthalmologist's point of view: Causes, diagnosis and staged therapeutic concept. HNO. 2016; 64: 367-375.
6. J Heichel, F Bachner, A Schmidt-Pokrzywniak, HG Struck, U Stuhltrager, T. et al. Treatment of congenital lacrimal duct obstruction: A prospective clinical cohort study. Ophthalmologe. 2015; 112: 840-847.
7. Y LA. Dysthyroid ophthalmopathy in children. J Pediatr Ophthalmol Strabismus. 1979; 16: 105-107.
8. ZY Liu Shuhong, Tan Jianwei. Clinical analysis of acute dacryocystitis in neonates. Chinese journal of strabismus and pediatric ophthalmology. 2007; 15: 37.
9. S.L. Wang Hong, Treatment of acute dacryocystitis in neonates, Chinese journal of strabismus and pediatric ophthalmology. 2011; 19: 38-40.
10. O.D.o.G.W.a.C.M.C. The Childhood Eye Disease Screening Group of the Childhood Eye Care Professional Committee of the China Maternal and Child Health Association, Expert consensus on the diagnosis and treatment of tear-related diseases in infants and

children Chinese Journal of Strabismus and Pediatric Ophthalmology. 2021; 29: 1-4.

11. J. Hoffmann, S. Lipsett. Acute Dacryocystitis, N Engl J Med. 2018; 379: 474.

12. S.L. CAI WenQian, Zhang DeYong. Clinical analysis of 46 cases of congenital lacrimal sac protrusion Chinese Journal of Strabismus and Pediatric Ophthalmology. 2018; 26: 35-37.

13. D.E. Baskin, A.K. Reddy, Y.I. Chu, D.K. Coats, The timing of antibiotic administration in the management of infant dacryocystitis, J AAPOS. 2008; 12: 456-459.

14. S. Bulgurcu, M. Idil, Y. Pekcevik, I. Cukurova, Relationship Between Lacrimal Bone Thickness and Lacrimal Sac in Chronic Dacryocystitis, J Craniofac Surg. 2020; 31: 207-209.

15. M. Juul-Dam, C. Laursen, L. Wiboe, B. Hertz, J. Bille, K. Naeser, Bilateral dacryocystitis complicated by unilateral retrobulbar abscess in a five-week-old infant Orbit. 2020; 39: 209-211.

16. K. Spaniol, T. Stupp, C. Melcher, N. Beheiri, N. Eter, V. Prokosch, Association between congenital nasolacrimal duct obstruction and delivery by cesarean section, Am J Perinatol. 2015; 32: 271-276.

17. Z.P. Zhang Lijun, Zhao Yade. Diagnosis and treatment of acute dacryocystitis in neonates, Chinese Journal of Strabismus and Pediatric Ophthalmology. 2004; 40.

18. W.X.B. Xiang Shihong, Treatment of acute dacryocystitis in neonates with lacrimal flushing in 22 cases, New Progress in Ophthalmology. 2008; 142: 273.

19. Q.J. Zhao Enxian, Clinical analysis of irrigation dacryocystitis combined with ofloxacin in the treatment of neonatal dacryocystitis. Journal of Anhui Medicine. 2014; 18: 155-157.

20. L.Y. Lu Jiang, Zheng Lifang, Treatment of neonatal acute dacryocystitis, Journal of Anhui Medicine. 2018; 22: 646-648.

21. F. Jinlu., Children of lacrimal duct design and implementation of the ladder to treat obstructive disease Journal of ophthalmology. 2017; 26: 361-365.

22. W.D. Li Chunqing, Ma Xubo. Long-term effects of anesthesia on intelligence and sensory integration in children Chinese Journal of Clinicians (electronic edition). 2012; 6: 2326-2335.

23. S.S. Lang, E. Vollmer, L. Wu, A. Bathini, B. Kanuga, A. Ma, K. Barrett, J.A. Galvez, P.B. Storm, J. Huh, A.F. Simpao, A Retrospective Study of Neurological Complications in Pediatric Patients With Moyamoya Disease Undergoing General Anesthesia, Anesth Analg. 2021; 132: 493-499.

24. W.Q. Yu Gang, Hu Man. Clinical manifestation and treatment of congenital dacryocystosis., Collection of papers of the 17th Ophthalmology Conference of Shandong Province, 2013.

25. O. Karti, E. Karahan, D. Acan, T. Kusbeci, The natural process of congenital nasolacrimal duct obstruction and effect of lacrimal sac massage. Int Ophthalmol. 2016; 36: 845-849.

26. Y.J. MacEwen CJ, Barras CW, Ram B, White PS. Value of nasal endoscopy and probing in the diagnosis and management of children with congenital epiphora, Br J Ophthalmol. 2001; 85: 314-318.

27. S.W.Y. Wang T, Clinical technique of dacryocystitis treated by dacryocystitis combined with antibiotic gel injection, Journal of Clinical Ophthalmology. 2009; 17: 78-79.

28. W.H. Wu Linan, Gu Yuan. Analysis of human plasma exposure to gatifloxacin eye gel, Chinese Journal of Pharmacy. 2015; 50: 1335-1340.