

# Application Value of Topical Anesthesia in Children Strabismus Surgery

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## Abstract

**Purpose:** Comparison of topical vs general anesthesia for strabismus surgery.

**Methods:** Preoperative patients (aged 6~12 years) were divided into two study groups: the topical anesthesia group ( $n=22$ ), and the general anesthesia group ( $n=21$ ). The study groups were compared on the following measures: analgesic effect, surgical correction effect, eye-heart reflex, preoperative preparation time, and operation time, using  $t$ -tests or  $X^2$  tests where appropriate.

**Results:** Compared with the general anesthesia group, the topical anesthesia group gained better surgical correction results ( $P<0.05$ ), had a lower rate of eye-heart reflex ( $P<0.05$ ), and had a shorter preoperative preparation time ( $P<0.001$ ). No significant difference was observed between the groups in terms of the analgesic effect or operation time ( $P>0.05$ ).

**Conclusion:** Topical anesthesia represents a safe and effective alternative to general anesthesia for strabismus surgery in children. (*Eye Science* 2012; 27:134-137)

**Keywords:** topical anesthesia; children; strabismus surgery; eye-heart reflex

Children strabismus is one of the common ocular diseases, and most strabismus patients should be corrected surgically. Both domestic and foreign scholars performed strabismus surgery under general anesthesia, which poses certain risks of surgical complications. Hence, this clinical trial is designed to investigate the clinical significance of modifying anesthesia types in strabismus correction surgery. To evaluate the clinical effects of topical anesthesia, both topical anesthesia and general anesthesia were applied in children strabismus correction operation since January 2009.

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## Materials and methods

### General materials

Forty three children with strabismus, ineffective by wearing correction glasses, 23 male, 20 female, including 18 cases of concomitant esotropia and 25 concomitant exotropia, were enrolled in this study. The degree of strabismus ranged between  $15^\circ \sim 45^\circ$ ,  $35.8^\circ$  on average. Twenty two underwent surgery under topical anesthesia, aged between 6.2 and 11.3 years, 8.1 years averagely and twenty one under general anesthesia, aged from 6.0 and 10.8 years, 8.3 years on average.

### Anesthesia method

In the topical anesthesia group, the operated eyes were given 0.5% alcanin eye drops at 5 min preoperatively and when entering the operating room, followed by 0.3 ml of 2% lignocaine via subconjunctival injection. The children in the general anesthesia group were administered with atropine and diazepam via intramuscular injection at 30 min prior to surgery. Intraoperatively, the patients were given ketamine via intravenous injection (0.8~1.0 mg/kg). The injection rate was maintained between 0.8 and 1.5 mg/min when the children became unconscious.

### Evaluation of analgesic effect

Grade I: no sense of pain or discomforts

Grade II: slight sense of pain, retraction and swelling

Grade III: severe or unbearable pain

### Statistical analysis

Measurement data were analyzed using  $t$ -test. Enumeration data were studied by  $\chi^2$  test.

## Results

### Analgesic effect

In the general anesthesia group, 21 children were classified as grade I (100%). In the topical anest-

hesia group, 19 patients were grade I (86.3%) and 3 were grade II (13.6%), as shown in Table 1.

### Surgical correction effect

The objective degree of strabismus (absolute value) of each children in both groups was measured with synoptophore at day 7 postoperatively, arc as unit. The means between two groups were statistically compared in Table 2.

### Eye-heart reflex

In the topical anesthesia group, 9 children were positive for eye-heart reflex, accounting for 40.9% ; in the general anesthesia group, 21 were positive for eye-heart reflex (71.4%), as shown in Table 3.

### Preoperative preparation time

In the topical anesthesia group, preoperative

preparation procedures included delivering surface anesthetics, sterilization, eyelid opening and subconjunctival injection of 2% lignocaine. In the general anesthesia group, preparation works included preoperative intramuscular injection, vein opening, intravenous injection of ketamine, monitoring cardiopulmonary function and sterilization (minute as unit). The mean preoperative preparation time between the two groups were statistically compared in Table 4.

The surgical time in the topical anesthesia group started from subconjunctival injection to conjunctival flap suture, while that in the general anesthesia group began from eyelid opening until conjunctival flap suture (minute as unit). The mean surgical time between the two groups were statistically compared in Table 5.

**Table 1** Comparison of analgesic effect between the two groups (%)

Group	Case No.	Grade of analgesic effect			$\chi^2$	P
		I	II	III		
Topical anesthesia group	22	19(86.3%)	3(13.6%)	0	3.078	>0.05
General anesthesia group	21	21(100%)	0	0		

**Table 2** Comparison of the postoperative residual degree of strabismus between the two groups

Group	Case No.	Postoperative mean degree of strabismus	t	P
Topical anesthesia group	22	2.420±0.784	2.183	<0.05
General anesthesia group	21	3.285± 1.69		

**Table 3** Comparison of the incidence of eye-heart reflex between the two groups

Group	Case No.	Eye-heart reflex	Incidence	$\chi^2$	P
Topical anesthesia group	22	9	40.9%	4.057	<0.05
General anesthesia group	21	15	71.4%		

**Table 4** Comparison of the mean preparation time between the two groups ( $\bar{x}\pm s$ )

Group	Case No.	Mean preoperative preparation time	t	P
Topical anesthesia group	22	14.16±1.68	25.54	<0.001
General anesthesia group	21	35.06±3.03		

**Table 5** Comparison of the surgical time between the two groups ( $\bar{x}\pm s$ )

Group	Case No.	Mean surgical time	t	P
Topical anesthesia group	22	38.20±8.44	1.77	>0.05
General anesthesia group	21	35.11±7.16		

## Discussion

Strabismus not only affects the appearance and

vision development, but also lacks of stereopsis. Most strabismus cases can be corrected surgically. Previously, the children underwent strabismus cor-

rection surgery under general anaesthesia both domestically and internationally<sup>1,2</sup>, which enables them to lose consciousness and sense of pain, guaranteeing the surgical success. However, general anaesthesia severely interferes normal physiological activities and causes a variety of adverse events, such as, respiratory depression, convulsion and delirium, hallucination, nausea and vomiting when conscious. Therefore, exploring a safe and effective anaesthesia method during strabismus correction surgery is a vital subject facing clinical ophthalmologists.

Postoperative outcomes in this study demonstrated that both types of anaesthesia equally attained desirable analgesic effects, as shown in Table 1 ( $P>0.05$ ). In the topical anaesthesia group, 19 children (86.3%) achieved grade I analgesic effect without sense of pain and discomfort, while three patients (13.6%) had grade II analgesic effect with a slight sense of traction and swelling intraoperatively. No case was classified as grade III. The anaesthesia method applied in strabismus correction surgery aims to make the patients have no sense of pain or discomfort during operation. It is difficult to complete operation successfully and achieve sound surgical results because of lacking of cooperation from children due to severe pain. Previous studies proved that topical anaesthesia can directly block the transmission of nerve fibers that sense pain and yield desirable analgesic effect while have little effect upon myotaxis-induced proprioceptive sensation<sup>3</sup>. Hence, some children receiving subconjunctival infiltration anaesthesia still had a sense of retraction pain and discomforts. Skilled surgeons should be employed to perform the surgery quickly and adroitly to ease the pain and make efforts to obtain patients' cooperation through comforting and explanation<sup>4</sup>.

In this study, the three children presenting with a sense of myotaxis and swelling during surgery were willing to cooperate with surgeons after sincere consolation and encouragement and successfully finished the surgical procedure.

The correction effect of eye position remains one of the primary concerns of both strabismus patients and surgeons whether general anaesthesia or topical anaesthesia was employed during surgery. The result demonstrated that the mean residual degree of stra-

bismus in the topical anaesthesia was significantly lower compared with that in the general anaesthesia group ( $P<0.05$ ), suggesting that strabismus correction surgery under topical anaesthesia gains better outcomes than under general anaesthesia. Although the operation under general anaesthesia renders more freedom to surgeons intraoperatively, the estimates of surgical correction outcomes heavily relies upon the surgeons' experience and preoperative detection results, which has certain blindness in terms of the accuracy of surgical correction<sup>5</sup>. However, the children who underwent correction surgery under topical anaesthesia were conscious to cooperate with the surgeons regarding eye position measurement. In addition, the surgeons could straightly evaluate the correction effect by Krimsky test plus Hirschberg corneal reflex test, adjust the amount of operations whenever necessary and enhance the success rate of a single operation<sup>6</sup>. So, the application of topical anaesthesia in strabismus surgery can achieve desirable correction effect in a single operation and great reduce severe pain induced by repeated surgeries.

Eye-heart reflex is one common complication during strabotomy with an incidence rate of 30%~75%. During surgery, the stimulus induced by eye muscle retraction was transmitted to medulla vagus nerve nucleus via ciliary ganglion and trigeminal nerve and then sent to cardiac muscle via vagus nerve. Eye-heart reflex is mainly characterized as sinus bradycardia, then arrhythmia and occasional cardiac arrest. Previous studies confirmed that the incidence of eye-heart reflex can be prevented by two aspects: one is to reduce stimulation and the other is to inhibit the excitation of vagus nerve<sup>2,3</sup>. As Table 3 indicated, the incidence of eye-heart reflex in the general anaesthesia group was 71.4% ( $n=15$ ), significantly higher than 40.9% ( $n=9$ ) in the topical anaesthesia group ( $P<0.05$ ). Albeit the occurrence of eye-heart reflex can be reduced by suppressing the excitation of vagus nerve via intramuscular or intravenous injection of atropine in the general anaesthesia group, infiltration anaesthesia can exert a more apparent effect upon retarding the transmission of stimulus to decrease the incidence of eye-heart reflex in the topical anaesthesia group. These results demonstrated that the incidence of eye-heart reflex is associated

with the usage of drugs. Additionally, the effect of topical retardance is stronger than that of systemic administration of atropine.

This study also revealed that the preoperative preparation time under topical anesthesia was significantly shorter than that under general anesthesia ( $P < 0.001$ , Table 4) because the topical anesthesia had been given at 5 min prior to surgery and the surgery could begin immediately after sterilization, eyelid opening and subconjunctival infiltration anaesthesia. However, the general anesthesia group took more preoperative preparation time conduct intramuscular injection of drugs at 30 min before surgery, vein opening and injection of ketamine in the operation room and could not perform sterilization and eyelid opening until the patient became unconscious, lost sense of pain and restored normal cardiopulmonary function. Besides, it took more time for the patient receiving general anesthesia to become conscious in the operation room. If there were no significant difference in surgical time between two groups ( $P > 0.05$ , Table 5), the surgery under topical anesthesia consumed less preparation time and time spent in the operation room which not only reduces the mental burden of patients' relatives, but greatly saves valuable time for surgeons.

According to clinical observations, the following aspects should be stressed when adopting topical anesthesia in children strabismus correction surgery: 1. The surgeons should inform the patient of the surgical procedure to ease the fear and meantime acquire the trust and cooperation from the patient. 2. During preoperative examination, the surgeon can perform eye muscle retraction when eye irrigation or administering surface anesthetics to observe the re-

sponse and the degree of cooperation of the patient. 3. Once the patient experienced intolerable pain under topical anesthesia, general anesthesia should be immediately given instead to complete the surgery. 4. The surgeon needs to perform eye muscle retraction quickly and adroitly to alleviate the pain and reduce the incidence of eye-heart reflex. 5. Intraoperatively, cardiac electric activity should be closely monitored to identify and handle eye-heart reflex early.

To sum up, applying topical anesthesia in the strabismus surgery for children is safe, easy to operate and has little influence upon normal physiology, which serves as an alternative to general anesthesia. However, the preparation work for general anesthesia should also be necessarily done to handle emergency.

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