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 X2 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.

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°~ 45°, 35.8° 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 χ² 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 child 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 anestheisa group, 9 children were positive for eye-heart reflex, accounting for 40.9%; in the general anestheisa group, 21 were positive for eye-heart reflex (71.4%), as shown in Table 3.

**Preoperative preparation time**

In the topical anestheisa group, preoperative preparation procedures included delivering surface anesthetics, sterilization, eyelid opening and subconjunctival injection of 2% lignocaine. In the general anestheisa 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 anestheisa group started from subconjunctival injection to conjunctival flap suture, while that in the general anestheisa 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.

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<tr>
<th>Table 1</th>
<th>Comparison of analgesic effect between the two groups (%)</th>
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**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\(^1,^2\), 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 anesthesia 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 myotasis-induced proprioceptive sensation\(^3\). 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\(^4\).

In this study, the three children presenting with a sense of myotasis 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 strabismus 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\(^5\). 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 strictly evaluate the correction effect by Krimsy test plus Hirschberg corneal reflex test, adjust the amount of operations whenever necessary and enhance the success rate of a single operation\(^6\). 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 brady-cardia, 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\(^2,^3\). 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 topi
cal retardance is stronger than that of systemic administra
tion of atropine.

This study also revealed that the preoperative preparation
time under topical anaesthesia was signi
ficantly shorter than that under general anaesthesia
(\(P<0.001\), Table 4) because the topical anaesthesia
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 anaesthesia group
took more preoperative preparation time conduct in
tramuscular injection of drugs at 30 min before surgery, vein opening and injection of ketamine in
the operation room and could not perform steriliza
tion and eyelid opening until the patient became uncon
scious, lost sense of pain and restored normal cardiopulmonary function. Besides, it took more
time for the patient receiving general anaesthesia to become conscious in the operation room. If there
were no significant difference in surgical time be

tween two groups (\(P>0.05\), Table 5), the surgery
under topical anaesthesia 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
anaesthesia in children strabismus correction surgery:
1. The surgeon should inform the patient of the sur
gical procedure to ease the fear and meantime ac
quire 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
spose and the degree of cooperation of the patient.
3. Once the patient experienced intolerable pain un
der topical anaesthesia, general anaesthesia should
be immediately given instead to complete the surgery.
4. The surgeon needs to perform eye muscle retrac
tion quickly and adroitly to alleviate the pain and re
duce the incidence of eye-heart reflex. 5. Intraopera
tively, cardiac electric activity should be closely mon
itored to identify and handle eye-heart reflex early.

To sum up, applying topical anaesthesia 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 anaesthesia. However, the preparation work for general anesthe
sia should also be necessarily done to handle emer

gency.

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