

Analysis of the Effects of Local Injection of Epinephrine and Lidocaine on Postoperative Pain and Bleeding in Children Undergoing Tonsillectomy

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Abstract: *Objective:* To explore the effects of local injection of epinephrine and lidocaine on postoperative pain and bleeding in children undergoing tonsillectomy. *Methods:* Sixty-eight children who underwent a tonsillectomy in our hospital from March 2019 to October 2020 were selected. The children were randomly divided into two groups of 34 cases each. The observation group received local anesthetic injections of lidocaine and the control group received local anesthetic injections of epinephrine. The postoperative pain, operation time, blood pressure changes, and intraoperative blood loss of the two groups of children were observed and analyzed. *Results:* The postoperative pain, operation time, and intraoperative blood loss scores of the children in the observation group were 4.36 ± 0.69 , 0.36 ± 0.09 , and 39.36 ± 1.78 respectively, which were significantly better than those of the children in the control group ($P < 0.05$) at 5.36 ± 0.77 , 0.79 ± 0.05 , and 45.36 ± 1.56 , respectively. The systolic blood pressure and diastolic blood pressure of the observation group 3 minutes before surgery and 180 minutes after surgery were no different from those of the control group ($P > 0.05$). *Conclusion:* Local injection of epinephrine and lidocaine effectively relieved postoperative pain and reduced bleeding in children undergoing tonsillectomy as compared to epinephrine alone.

Keywords: Epinephrine; Lidocaine; Tonsillectomy; Postoperative pain; Intraoperative bleeding

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1. Introduction

Tonsillectomy is an effective treatment for enlarged tonsils but is associated with complications after surgery, such as pain and bleeding. Not only does postoperative pain affect the quality of life of children, but it may also cause a series of psychological and behavioral problems, such as anxiety and depression. Postoperative bleeding may lead to greater consequences and may require reoperation in some cases. Therefore, reducing postoperative pain and bleeding is crucial for the child's recovery. Epinephrine and lidocaine are two commonly used local anesthetics that have analgesic and hemostatic properties. Recently, the local injection of epinephrine and

lidocaine in tonsillectomy has received increasing attention. Studies by Li *et al.* have shown that local injection of epinephrine and lidocaine effectively reduced postoperative pain and reduced bleeding, but the results were inconsistent with other studies ^[1,2]. Therefore, more in-depth studies are warranted to investigate the effects of local injections of epinephrine and lidocaine on postoperative pain and bleeding in children undergoing tonsillectomy. This study analyzed the effects of local injection of epinephrine and lidocaine on postoperative pain and bleeding in children undergoing tonsillectomy.

2. Materials and methods

2.1. General information

Sixty-eight children who underwent tonsillectomy in our hospital from March 2019 to October 2020 were selected. The children were randomly divided into two groups of 34 cases each. The children in the observation group received local anesthetic injections of lidocaine and the children in the control group received local anesthetic injections of epinephrine.

Inclusion criteria: (1) Children aged 3-12 years old, regardless of gender; (2) diagnosed with tonsillar hypertrophy and require tonsillectomy; (3) children whose family consented; (4) absence of serious heart or liver disease during preoperative evaluation, lung, kidney, and other organ dysfunction; (5) no obvious bleeding tendencies or coagulation disorders.

Exclusion criteria: (1) Children who are allergic to epinephrine, lidocaine, or other related drugs; (2) children who have received other drug treatments that may affect postoperative pain and bleeding; (3) severe systemic diseases or infections; (4) children who have recently received other drugs; (5) children who have undergone other surgeries or trauma within 3 months; (6) children whose families are unwilling to participate.

2.2. Method

Physical examinations and routine blood tests were performed by an otolaryngologist before surgery. Compound chlorzoxazone injection (Zhejiang Kelun Pharmaceutical Co., Ltd., National Drug Approval No. H20040443) was used for intravenous infusion before surgery, 2 mg/kg each time, once a day, for 7 days. The operating room was cleaned and sterilized, and the required surgical instruments were prepared, including syringes, epinephrine, lidocaine, and sterilization supplies. The child was given general anesthesia to ensure that they were unconscious. At the end of the surgery, a special syringe was used to absorb an appropriate amount of epinephrine and lidocaine, and alcohol or iodophor was used to disinfect the tonsillectomy site. Several points around the tonsillectomy site were then selected for injection. These points were spread as far as possible to cover the entire surgical area. A needle was used to pierce the chosen site and epinephrine and lidocaine were slowly injected. The medicine was evenly distributed in the surgical area. During the injection process, the child's reaction was closely monitored to ensure there were no allergic or other adverse reactions. After the injection, the surgical area was examined to ensure no bleeding or other abnormalities. If everything is normal, the operation ends, and the child will be sent back to the ward for postoperative care. During the recovery period, the child's condition was closely observed by the medical staff, especially for any bleeding or abnormal reactions at the surgical site. Children in the observation group received a local anesthetic injection of lidocaine and epinephrine 30 minutes before the start of surgery. Meanwhile, children in the control group were injected with a local anesthetic injection of epinephrine 30 minutes before the start of surgery.

2.3. Observation indicators

The visual analog scale (VAS) score of the child was recorded within 24 hours after surgery and the pain level

was graded from 0–10. The higher the pain score, the more severe the pain. The postoperative bleeding volume was evaluated using the VAS scale with a score of 0–5. A score of 0 to 2 indicated no bleeding, 3 indicated light bleeding, 4 indicated moderate bleeding, and 5 indicated severe bleeding. Blood pressure changes (average systolic blood pressure (MAP) and diastolic blood pressure (DBP)) before surgery, 3 minutes, and 180 minutes after surgery were recorded. MAP was measured and DBP was calculated within 1 hour after surgery. If the MAP is lower than the normal value, it is considered abnormal; if it is higher than the normal value, it is considered normal. Lastly, the operation time was recorded.

2.4. Statistical methods

Data were analyzed using the SPSS 24.0 statistical software. Measurement data were expressed as mean \pm standard deviation and two independent sample *t*-tests were used for comparison between groups. Count data were expressed as % and analyzed using the chi-squared (χ^2) test. The Kolmogorov-Smirnov test was used to compare the pain scores between the two groups and the Mann-Whitney U test was used to compare the postoperative bleeding volume between the two groups. Results were considered statistically significant at $P < 0.05$.

3. Results

3.1. Analysis of postoperative pain, operation time, and intraoperative blood loss between the two groups of children

As shown in **Table 1**, the postoperative pain, operation time, and intraoperative blood loss scores of the children in the observation group were significantly better than those in the control group ($P < 0.05$).

Table 1. Analysis of postoperative pain, operation time, and intraoperative blood loss between the two groups of children

Group	Postoperative pain	Operation time (h)	Intraoperative blood loss (mL)
Observation group ($n = 34$)	4.36 \pm 0.69	0.36 \pm 0.09	39.36 \pm 1.78
Control group ($n = 34$)	5.36 \pm 0.77	0.79 \pm 0.05	45.36 \pm 1.56
<i>t</i>	5.640	24.353	14.782
<i>P</i>	< 0.05	< 0.05	< 0.05

3.2. Analysis of blood pressure changes between the two groups of children

As shown in **Table 2**, there was no difference in the MAP and DAP between the two groups 3 minutes before surgery and 180 minutes after surgery ($P > 0.05$).

Table 2. Analysis of changes in blood pressure between the two groups of children

Group	3 minutes before surgery		180 minutes after surgery	
	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Observation group ($n = 34$)	123.77 \pm 4.37	67.50 \pm 4.38	124.51 \pm 4.74	66.88 \pm 4.14
Control group ($n = 34$)	123.50 \pm 4.38	66.98 \pm 4.28	123.99 \pm 4.69	67.21 \pm 4.24
<i>t</i>	0.255	0.496	0.455	0.325
<i>P</i>	> 0.05	> 0.05	> 0.05	> 0.05

4. Discussion

With the widespread practice of tonsillectomy, postoperative pain is a common complication in children undergoing tonsillectomy. Postoperative pain affects their quality of life after surgery and causes great suffering to children and their parents. Ma showed that local epinephrine and lidocaine have a significant impact on postoperative pain and bleeding in children undergoing tonsillectomy, suggesting that local epinephrine and lidocaine reduce intraoperative hemodynamic fluctuations and alleviate symptoms. It is a safe and effective analgesic drug for children with immediate postoperative pain^[3]. It has less impact on bleeding and is a safe and effective analgesic drug. Dong's research showed that lidocaine infusion had an impact on controlling the dosage of propofol during the perioperative period and reduced postoperative adverse events in children undergoing tonsillectomy^[4]. Other drugs can also effectively provide analgesia in children undergoing tonsillectomy. For example, Li showed that oxycodone hydrochloride had better postoperative analgesia in children undergoing tonsillectomy^[5]. At the same time, some drugs can also control the use of epinephrine. For example, Xiao showed that intranasal dexmedetomidine controlled the dosage of epinephrine used during tonsillectomy in children. Dexmedetomidine intranasal instillation within a reasonable range can be used in patients who require epinephrine for tonsillar surgery in children. It can maintain perioperative hemodynamic stability and shorten the recovery time of children^[6]. Wang *et al.* showed that tramadol injections at different times during tonsillectomy provided good analgesic effects^[7].

This study investigated the effects of local injections of epinephrine and lidocaine on postoperative pain and bleeding in children undergoing tonsillectomy. The postoperative pain, operation time, and intraoperative blood loss scores of children in the observation group were 4.36 ± 0.69 , 0.36 ± 0.09 , and 39.36 ± 1.78 respectively, which were significantly better than those in the control group ($P < 0.05$) at 5.36 ± 0.77 , 0.79 ± 0.05 , and 45.36 ± 1.56 , respectively. The results showed that the local injection of epinephrine and lidocaine effectively reduced postoperative pain and bleeding. This result was consistent with other studies. Liang showed that lidocaine topical anesthesia exhibited a good analgesic effect after tonsillectomy in children and reduced the stress response of children and the occurrence of adverse reactions rate^[8]. Wang studied the clinical observation of local anesthesia without epinephrine before tonsillectomy and found that adding epinephrine to local anesthesia improved the analgesic effect, reduced operation times, and intraoperative blood loss^[9]. Chen *et al.* analyzed the effects of the local injection of epinephrine and bupivacaine on pain and bleeding after tonsillectomy and found that epinephrine injection had a better and more obvious analgesic effect^[10]. This study believed that epinephrine and lidocaine play an important role in the reduction of postoperative pain. Adrenaline can constrict blood vessels and reduce postoperative bleeding. It can also expand local tissues and increase the penetration and absorption of local anesthetics, thereby further suppressing pain. Lidocaine can directly act on nerve fibers and inhibit the conduction of nerve impulses to further reduce pain. However, the mechanism of postoperative pain is very complex and is not only related to the surgical operation but also to individual differences, environment, and other factors. Although local injection of epinephrine and lidocaine can effectively reduce postoperative pain, it may be necessary to combine it with other treatments, such as medication, psychotherapy, etc., depending on the child. This study found that the local injection of epinephrine and lidocaine reduced postoperative bleeding. Epinephrine can constrict blood vessels and lidocaine can inhibit the inflammatory response and platelet aggregation. However, it is worth noting that postoperative bleeding may also be caused by improper surgical operations, incomplete hemostasis, and individual differences. Therefore, while applying local injections of epinephrine and lidocaine, it is crucial to pay attention to the improvement of surgical skills and hemostatic measures to ensure the safety and effectiveness of the operation.

In this study, there were no differences in the MAP and DAP between the two groups ($P > 0.05$). This

indicated that neither intravenous injection of local injection of epinephrine and lidocaine nor epinephrine alone exhibited an effect on the blood pressure of children.

5. Conclusion

The local injection of epinephrine and lidocaine effectively relieved postoperative pain and reduced bleeding in children undergoing tonsillectomy. However, further exploration and research is needed. Future research can be carried out from the following aspects: (1) Explore different doses and administration methods; (2) the effect of local injection of epinephrine and lidocaine on postoperative pain and bleeding; (3) the combined effect of other treatment methods and the local injection of epinephrine and lidocaine; (4) mechanisms of postoperative pain and bleeding, to provide more effective solutions for clinical treatment.

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