Effect of Dexamethasone on Postoperative Pain after Adult Tonsillectomy

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Abstract

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วัตถุประสงค์ : เพื่อศึกษาว่า dexamethasone ที่ให้ทางหลอดเลือดกลมผ่าตัดต่อมท่อนอนจะมีผลลดการปวดและภาวะแทรกซ้อนในผู้ป่วยเมื่อเปรียบเทียบกับยาหลอก วิธีการวิจัย : การศึกษาแบบ double-blind randomized controlled trial โดยประเมินความสัมพันธ์ในการระบายและภาวะแทรกซ้อนที่เกิดหลังการผ่าตัดต่อมท่อนอนซึ่งมีวิธีปฏิบัติเป็นไปอย่างเท่ากัน ผู้ป่วย 50 คน (กลุ่มละ 25 คน) ที่ได้รับยา dexamethasone 20 มก. กลุ่ม 1 และกลุ่ม 2 ได้รับยา dexamethasone 20 มก. แต่กลุ่ม 1 ได้รับยา Placebo

ค่าสำคัญ : Adult, Dexamethasone, Postoperative pain, Tonsillectomy

Tonsillectomy is one of the most common operations performed in the world. Despite advances in surgical and anesthetic techniques, postoperative pain remains a significant problem after tonsillectomy. The pain inhibits chewing and swallowing, which leads to dehydration and contributes to lassitude and delayed recovery of strength and well-being. Many studies have attempted to use various interventions to reduce postoperative pain. Dexamethasone is one of the drugs used to reduce postoperative pain in various operations.\textsuperscript{1-4}

Dexamethasone has anti-inflammatory actions. These are mediated by inhibition of production of inflammatory cell factors, such as cytokines in macrophages, monocytes, and lymphocytes which results in decreased extravasation of leukocytes, lysosomal enzyme release, and vascular permeability in areas of injury. This reduces edema and decreases fibrosis during healing.\textsuperscript{5} Several studies have therefore examined the use of dexamethasone in tonsillectomy. Trials in both children and adults have produced conflicting results with respect to the effects on postoperative pain and morbidity. Dexamethasone tends to lower postoperative pain in pediatric tonsillectomy patients.\textsuperscript{6-9} However, few studies have examined the effect of dexamethasone on postoperative pain in adult patients undergoing tonsillectomy. These studies included limited numbers of patients and their anesthetic and postoperative analgesic protocols were not standardized.

The aim of this study was to assess the effects of a single intraoperative dose of intravenous dexamethasone on postoperative pain and complications in adults undergoing tonsillectomy using a standardized anesthetic technique.

**Materials and Methods**

The study was approved by the Ethics Committee of Prince of Songkhla University. Fifty patients undergoing elective tonsillectomy were included after giving their informed consent. The inclusion criteria were age 15-60 years and American Society of Anesthesia (ASA) physical status I-II. Patients were excluded if they had a history of steroid allergy, history of the bleeding tendency, obstructive sleep apnea, active infection or history of severe postoperative nausea and vomiting.

The study design was randomized, double-blind, and placebo-controlled. All the patients were instructed in the use of verbal numerical pain scores (VNS) for pain, from VNS scale of 0-10 (0 = no pain ; 10 = most extreme pain), before surgery. The patients were prospectively randomized to receive either 20 mg of dexamethasone sodium phosphate or placebo (an equal volume of isotonic sodium chloride solution) intravenously during the operation by a computer-generated table. Study drugs were marked only with coded number labels.

Patients were not allowed to take solid food for 8 hours before surgery. Fluid, dextrose 5% with sodium chloride 0.45%, was started 2 mL.kg\textsuperscript{-1} at 7.00 a.m. Premedication with oral diazepam 5 mg was given before sleep and 1 hour preoperatively. Lactated Ringer’s solution of 5 mL.kg\textsuperscript{-1} was administered for preloading fluid. General anesthesia was induced with propofol 2-2.5 mg.kg\textsuperscript{-1} and fentanyl 1 μg.kg\textsuperscript{-1} Succinyl choline 1-1.5 mL.kg\textsuperscript{-1} was used to facilitate intubation. The study drug was given immediately after intubation. Anesthesia was maintained with vecuronium, isoflurane 0.2%-1.0% and nitrous oxide 50%-66% in oxygen. Fentanyl 0.5 μg.kg\textsuperscript{-1} and isoflurane were adjusted to maintain the mean arterial pressure and heart rate within 20% of preoperative values. NIBP, ECG and SpO\textsubscript{2} were monitored in all patients. Tonsillectomy was started by injecting 0.25% bupivacaine with 1 : 100,000 epinephrine into each tonsillar bed, then electrodissection was used to remove the tonsils.

After surgery, all patients were transferred to the recovery room. The VNS was assessed every 15 minutes. Fentanyl was given every 10 minutes if VNS was > 5. Total fentanyl dosage, vomiting times and duration of recovery room stay were recorded.
Postoperative pain was evaluated at 4, 8, 24, 36 and 48 hours after surgery using the VNS. The following analgesics were administered as needed: a syrup of acetaminophen (10 mg/kg.dose\(^{-1}\)), given orally every 6 hours for VNS < 5 and morphine 3 mg, given intravenously every 1 hour for VNS > 5. Total analgesic doses given within the first 48-hour postoperative period were recorded. Complications such as postoperative nausea and vomiting (PONV), active bleeding and ear pain were also recorded. Ondansetron 4 mg was given intravenously every 8 hours for PONV upon patient request. Amoxicillin syrup 40 mg/kg.day\(^{-1}\) or cefuroxime syrup 500 mg. day\(^{-1}\) (if penicillin allergy) was given in all patients. Times to eligibility for liquid diet, soft diet and discharge were recorded. All patients were followed up by an otolaryngologist 1 week after surgery for evaluation of infection.

Sample Size
A sample size calculation was performed using a change in VAS mean values of 1.2 with a SD of 1.5. Calculations were performed to determine the number of patients required in this study to have 80% power to detect as statistically significant (P < 0.05). By accepting a type I error of 0.05 and a type II error of 0.20, the study size needed was 25 patients per group. All data are presented as mean ± SD.

Statistical Analysis
Statistical analysis of the data was performed by “SPSS 13.0.” Parametric data were analysed using Student’s t-tests and non-parametric data were analysed using Chi-squared test. Statistical significance was achieved when P was < 0.05.

Results
Fifty patients were included in the study. Twenty-five patients were randomized to the dexamethasone group and 25 were randomized to placebo group. There were no significant differences between groups in demographic data (Table 1). No patients required blood transfusion.

Verbal numerical pain scores (VNS) are shown in Figures 1 and 2. The mean VNS were lower in the dexamethasone group than in the placebo group at 45 min and up to 36 hours postoperatively, but it was significant at 4 hours postoperatively (P = 0.03).

The time to the first administration of postoperative analgesia was longer in the dexamethasone group than in the placebo group. In the recovery room, more total doses of fentanyl consumption were given in the dexamethasone group than in the placebo group. However, the total doses of morphine given and acetaminophen consumption were less in the dexamethasone group than in the placebo group (Table 2).

The incidence of complications during the 48-hour observation period was comparable (Table 3). Rate of complications of post-tonsillectomy PONV, otalgia and active bleeding were lower in the dexamethasone group. PONV was higher in the placebo group (28%) than in the dexamethasone group (16%), but was not significant. Ondansetron was given more frequently in the dexamethasone group (3 ± 2) than in the placebo group (2.5 ± 2.98), but the difference was not significant. Three patients (12%) in the dexamethasone group had secondary bleeding and were admitted for observation. Two had bleeding on the 5\(^{th}\) day postoperatively; one of them was returned to the operating room to stop bleeding. Another patient had bleeding on the 7\(^{th}\) day postoperatively. No patients in the placebo group had secondary bleeding.

Discussion
Post-tonsillectomy morbidities include pain, vomiting, poor oral intake, dehydration, fever and bleeding. An electrodissection technique was used because it virtually eliminates immediate postoperative hemorrhage.\(^{11,12}\) However, it may cause more pain, dis-
### Table 1  Demographic and intraoperative data.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Dexamethasone (n = 25)</th>
<th>Placebo (n = 25)</th>
<th>P value</th>
</tr>
</thead>
</table>
| Sex (Male/Female)
|                         | 7/18                  | 6/19             |         |
| Age (yr)                 | 34.6 ± 11.1            | 32.3 ± 9.2       | 0.42    |
| BMI (kg.m\(^2\))         | 22.2 ± 2.8             | 24.5 ± 5.9       | 0.32    |
| Diagnosis\(^a\)          |                        |                  |         |
| - Chronic tonsillitis    | 16                     | 19               |         |
| - Recurrent tonsillitis  | 4                      | 1                |         |
| - Tonsillar hypertrophy  | 3                      | 3                |         |
| - Other                  | 2                      | 2                |         |
| ASA Classification\(^a\)|                        |                  | 0.38    |
| - Class I/II             | 12/13                  | 8/17             |         |
| Intubation attempts\(^a\)|                       |                  | 0.34    |
| - 1/2/3                  | 21/3/1                 | 24/1/0           |         |
| Duration of surgery (min)| 63.2 ± 35.3            | 63.6 ± 30.5      | 0.96    |
| Duration of anesthesia (min)| 90.6 ± 38.9          | 83.8 ± 29.6      | 0.49    |
| Total fluid replacement (mL)| 876.0 ± 362.6      | 864.6 ± 243.5    | 0.89    |
| Fentanyl consumption (μg)| 92.9 ± 30.5            | 85.8 ± 28.4      | 0.44    |

Data represent mean ± standard deviation, \(^a\)represents number of patients.

### Table 2  Postoperative analgesic consumption, time to first liquid and soft diet.

<table>
<thead>
<tr>
<th></th>
<th>Dexamethasone (n = 25)</th>
<th>Placebo (n = 25)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to first fentanyl request (min)</td>
<td>22.9 ± 11.9</td>
<td>23.5 ± 19.6</td>
<td>0.55</td>
</tr>
<tr>
<td>Total fentanyl consumption in recovery room (μg)</td>
<td>41.2 ± 18.6</td>
<td>35.3 ± 19.5</td>
<td>0.32</td>
</tr>
<tr>
<td>Total morphine consumption (mg)</td>
<td>7.0 ± 7.1</td>
<td>9.5 ± 7.9</td>
<td>0.25</td>
</tr>
<tr>
<td>Total acetaminophen syrup consumption (mg)</td>
<td>1644.0 ± 947.7</td>
<td>1682.4 ± 1302.6</td>
<td>0.90</td>
</tr>
<tr>
<td>Time to first liquid diet (hours)</td>
<td>5.2 ± 4.7</td>
<td>4.8 ± 3.3</td>
<td>0.76</td>
</tr>
<tr>
<td>Time to first soft diet (hours)</td>
<td>16.1 ± 7.9</td>
<td>16.9 ± 8.2</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Data represent mean ± standard deviation.
**Table 3** Complications of Postoperative Tonsillectomy

<table>
<thead>
<tr>
<th>Complications</th>
<th>Dexamethasone (n = 25)</th>
<th>Placebo (n = 25)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea/Vomiting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- recovery room</td>
<td>1 (4)</td>
<td>0 (0)</td>
<td>0.81</td>
</tr>
<tr>
<td>- ward</td>
<td>3 (12)</td>
<td>7 (28)</td>
<td>0.46</td>
</tr>
<tr>
<td>Otalgia</td>
<td>2 (8)</td>
<td>5 (20)</td>
<td>0.41</td>
</tr>
<tr>
<td>Infection</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Active bleeding</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Secondary bleeding</td>
<td>3 (12)</td>
<td>0 (0)</td>
<td>0.23</td>
</tr>
<tr>
<td>Length of hospital stay (days)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.9 ± 0.9</td>
<td>2.9 ± 0.8</td>
<td>1</td>
</tr>
</tbody>
</table>

Data represent number of patients (%), <sup>a</sup> represents mean ± standard deviation.

**Figure 1** Pain scores, determined by verbal numerical pain scores (VNS), at 0, 15, 30, 45, 60 minutes postoperatively in recovery room (RR) in dexamethasone group and placebo group. Bars represent SD. There were no significant differences between groups (P > 0.05)

**Figure 2** Pain scores, determined by verbal numerical pain scores (VNS), at 4, 8, 24, 36, 48 hours postoperatively in dexamethasone group and placebo group. Bars represent SD. * P < 0.05
comfort and poor oral intake due to more local inflammation, edema, nerve irritation and laryngeal muscle spasm.\textsuperscript{12,13} Dexamethasone is one of the most potent glucocorticoids available, being 25 times more potent than endogenous cortisol. It suppresses a basic inflammatory response to tissue injury, however, it must be delivered in high concentrations for maximal effectiveness. A single dose of corticosteroids, even a large one, is virtually without harmful effect.\textsuperscript{5} We studied a 20 mg dexamethasone intravenous dosage for postoperative pain at 48 hours because dexamethasone has a 36-72 hour biological half-life and previous study has found pain was unchanged from the first day to the tenth day after surgery.\textsuperscript{14}

Clinicians believe that adults tolerate post-tonsillectomy pain more poorly than the young children do.\textsuperscript{15} Whether this is because they have more scarring from repeated infections, resulting in more muscle damage during tonsillectomy or are better able to express their discomfort or other reasons, is a matter of debate.\textsuperscript{10} For these reasons, the studies of post-tonsillectomy pain in children may not be transferable to an adult patient. Several studies, examining the use in pediatric tonsillectomy patients of a single bolus of intravenous dexamethasone given after induction of anesthesia, have found that dexamethasone reduced post-tonsillectomy pain.\textsuperscript{6-7} However, there have been few studies about the effect of dexamethasone on post-tonsillectomy pain in adults. The studies of Papangelou\textsuperscript{16} and Stewart\textsuperscript{17} found that a course of oral steroid reduced postoperative pain after adult tonsillectomy.

Our study found that the dexamethasone group had lowered mean pain scores at 45 minutes and up to 36 hours postoperatively. However, it was only significant at 4 hours postoperatively ($P = 0.03$) because the plasma half-life of dexamethasone is 3-4 hours and the addition of intraoperative bupivacaine infiltration might well be a factor preventing us to see any major difference in pain scores. In our study, surgical and anesthetic techniques were controlled. The analgesic doses of morphine and acetaminophen required were lower in the dexamethasone group. Our results are in agreement with the findings of Mckean\textsuperscript{18} that 10 mg intravenous dexamethasone at induction reduced mean pain scores after tonsillectomy, but their surgical technique was cold dissection, which is less painful than hot dissection.\textsuperscript{11-13} Carr\textsuperscript{10} found a single intraoperative dose of intravenous dexamethasone slightly reduces pain over 10 days after surgery, but the study had small sample sizes and did not include details of anesthetic technique that may have affected post-tonsillectomy pain. Malde\textsuperscript{19} studied the effectiveness of a single intravenous dose of dexamethasone (0.15 mg.kg\textsuperscript{-1}) in patients aged $> 3$ years undergoing sharp dissection snare tonsillectomy, finding that dexamethasone provided significant analgesia, reduced edema and improved quality of oral intake.

Complications of post-tonsillectomy such as PONV and otalgia were less frequent in the dexamethasone group than in the placebo group, but differences were not significant. Overall incidence of PONV in our study (44%) was similar to previous studies (40%-73%). Bleeding is the most serious complication of tonsillectomy and occurs in up to 3% of patients.\textsuperscript{20} No patients had active bleeding. No patients were found to have infection after postoperative evaluation. Secondary bleeding was only found in the dexamethasone group (12%). Multiple factors that might predispose to postoperative hemorrhage have also been studied.\textsuperscript{21-23} Secondary infection, surgeon’s experience, patient’s conditions (men, aged 16-25 years, history of recurrent tonsillitis and infectious mononucleosis), and surgical technique (hot dissection) are predisposing factor for secondary hemorrhage.

**Conclusions**

This study demonstrates that a single 20 mg dose of dexamethasone, given intravenously after induction
of anesthesia in adult patients undergoing electrocautery tonsillectomy, significantly decreased pain scores at 4 hours postoperatively. It shows a slightly reduced mean pain score at 36 hours postoperatively, and reduced the dose of analgesic drugs without significant side effects.

Acknowledgements

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References

**Effect of Dexamethasone on Postoperative Pain after Adult Tonsillectomy**

**Abstract**

*Objective*: To evaluate the effects of a single dose of intravenous dexamethasone on postoperative pain and complications after adult tonsillectomy.  
*Methods*: Fifty patients scheduled for elective tonsillectomy were recruited to this randomized, double-blind, placebo-controlled study. Dexamethasone 20 mg intravenously was given after intubation in one group whereas the placebo group, saline solution was given. Pain score was assessed using verbal numerical pain scores (VNS). Side effects such as postoperative nausea and vomiting (PONV), active bleeding, otalgia, infection and secondary bleeding were also recorded.  
*Results*: The patients receiving dexamethasone had lower mean pain scores at 45 min and up to 36 hours postoperatively, however the only significant period was found at 4 hours postoperatively ($P = 0.03$). The dexamethasone group required less analgesics postoperatively. The incidence of side effects was lower in the dexamethasone group.  
*Conclusion*: Dexamethasone 20 mg given intravenously before tonsillectomy may reduce postoperative pain in adults without any significant side effects.

*Keywords*: Adult, Dexamethasone, Postoperative pain, Tonsillectomy