The effects of dexamethasone, bupivacaine and topical lidocaine spray on pain after tonsillectomy

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KEYWORDS
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Pain;
Bupivacaine;
Dexamethasone;
Lidocaine

Summary
Objective: To compare the administration of bupivacaine hydrochloride, dexamethasone and lidocaine hydrochloride in decreasing post-tonsillectomy pain.

Methods: Eighty patients were enrolled in the study in ENT Clinic, Firat University, and in ENT Clinic Elazığ SSK Hospital, Elazığ (Turkey). Children between 6 and 14 years of age referred to our department for bilateral tonsillectomy for either recurrent tonsillitis or tonsillar hypertrophy. Data from 80 patients were analyzed. The first group had bupivacaine hydrochloride. The second group had dexamethasone infiltrated around each tonsil. The third group was given equal doses of 10% lidocain hydrochloride sprayed on the tonsillectomy fossa four times a day, and a placebo group received 9% NaCl applied to the tonsillar fossa four times a day. Pain scores, determined by visual analog scale, were obtained in the first, third and seventh postoperative days.

Results: Pain scores in the postoperative period were identical in the first, third and seventh postoperative days. According to VAS results the groups were compared on the basis of postoperative pain. In the first postoperative day, the difference between bupivacaine/placebo, dexamethasone/placebo and lidocaine/placebo groups was found to be statistically significant (P < 0.05). Nevertheless the difference between bupivacaine–dexamethasone, bupivacaine–lidocaine and dexamethasone–lidocaine were not significant (P > 0.05). In the third postoperative day, the difference between bupivacaine and lidocaine group found to be statistically significant (P < 0.05). In the seventh postoperative day the results of bupivacaine, dexamethasone, lidocaine and placebo groups were similar (P > 0.05).

Conclusion: Bupivacaine, Dexamethasone and Lidocaine nasal aerosol decreased the pain significantly in the first postoperative day when it was compared with the placebo group. These three medicines can be used to reduce pain for children during the postoperative period applied tonsillectomy during the post-operative period. But lidocaine was more preferable, reducing pain in the third postop day better than bupivacaine.

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1. Introduction

Tonsillectomy is one of the most commonly performed surgical procedures. Tonsillectomy is
often associated with significant intraoperative bleeding and postoperative pain [1]. There have been many advances in surgical and anesthetic techniques, which have resulted in faster operations and fewer post-tonsillectomy complications [2]. In addition, patients commonly have problems with postoperative nausea, emesis, abdominal discomfort, and constipation. The cause of postoperative gastrointestinal problems is most likely to be multifactorial, resulting from swallowed blood, recovery from general anesthesia, and administration of postoperative pain medications [3]. Other than the obvious negative impact on patients’ well being, pain may also impair swallowing, leading to an increased risk of secondary infection, bleeding, and dehydration [2]. This results in prolonged hospitalization or occasional re-hospitalization in same-day surgery practices.

Management of post-tonsillectomy problems has included parenteral or oral analgesic usage as well as intravenous hydration and antibiotics if necessary. Antibiotics may have a role in decreasing postoperative morbidity [4]. Pain after tonsillectomy is thought to be due to a combination of nerve irritation, inflammation, and pharyngeal muscle spasm [5]. In the last few years, electrophysiologic studies have demonstrated that a noxious stimulus may activate afferent C fibers and induce long-lasting changes in the excitability of dorsal horn neurons [6]. These nociceptive impulses could contribute to postoperative pain [7]. For this pain, the application of fibrin glue [8,9], steroids [10–12], cryoanalgesia [2], acetaminophen with codeine [3] and local anesthetics [1,13–15] has been reported. Jeebels et al. [16] showed a notable reduction of pain after tonsillectomy in children aged 6–18 years when the tonsillar fossa were preoperatively infiltrated with bupivacaine.

The aim of present study was to compare the administration of bupivacaine, dexamethasone and, lidocaine in reducing post-tonsillectomy pain.

2. Materials and methods

The present study was performed on a total of 80 children, at the ENT Clinic, at Firat University and at the ENT Clinic, at Elazığ SSK Hospital. The design of this study has been approved by the Ethical Committee of the Firat University. Eighty children were recruited into the study from March 1998 through July 2001. Indications for tonsillectomy included hypertrophy with obstructive symptoms and recurrent tonsillitis. Criteria for exclusion were signs of acute pharyngeal infection, suspected malignant neoplasm, known hypersensitivity to bupivacaine or lidocaine, and regular consumption of analgesics, hypnotics, or sedatives.

A standard anesthetic protocol was used for all the patients. All the patients received 0.006 mg/kg atropine, 4 mg/kg pentobarbital sodium, and 0.5 mg/kg atracurium besylate for muscular relaxation. After oral intubation, anesthesia was maintained with nitrous oxide, oxygen, and inspired isoflurane. The usual physiologic parameters (respiratory rate, pulse, blood pressure, and temperature) were monitored during surgery.

Standard surgical techniques were used. The dissection and snare technique for tonsillectomy was performed by otolaryngology residents under the supervision of the attending surgeon. Hemostasis was obtained by compression and catgut sutures, if required. No narcotic was used for premedication or after surgery. All patients received oral amoxicillin (50 mg/kg) for 5 days. The analgesics were not administered to the patients separately in postoperative days. All administered medications were carefully recorded.

The patients were randomly assigned to each group. In this group these patients were divided to in four groups of 20 individuals.

Group I (bupivacaine group): Before tonsillectomy, the tissue surrounding the tonsils were infiltrated with 0.25% bupivacaine hydrochloride with epinephrine (1:200,000), 3–5 ml per tonsil.

Group II (dexamethasone group): The tissue surrounding the tonsils, before tonsillectomy, were infiltrated with 1 mg/kg dexamethasone sodium phosphate per tonsil.

Group III (lidocaine group): 4 mg/kg of 10% lidocaine HCl aerosol in four equal doses was sprayed onto the tonsillectomy fossa four times a day.

Group IV (placebo group): 2 ml of 9% NaCl was sprayed onto the tonsillectomy fossa four times a day.

All the patients were discharged on postoperative day 1. The children were seen in the first, third and seventh postoperative days. Evaluation on day 1 was performed postoperatively with 4 h intervals. The values were accumulated and the average values was calculated and these were used as the value on day 1. The pains were evaluated by visual analogue scale (VAS). The controls and the groups were compared with each other.

The day before surgery the patients were instructed on how to use a VAS that consisted of a 100 mm horizontal line marked “no pain” at its left (1 point) and “worst pain” at its right end (5 point). Type of pain was assessed: pain caused by drinking 100 ml of water. Each children rated his or her
pain, in the first, third and seventh postoperative days.

Analysis was done using a Microsoft Excel 98 spreadsheet and Statistical Package for Social Sciences 9.5 (SPSS Inc., USA). The chi square test ($\chi^2$-test) was used when sex, tonsillar hypertrophy, recurrent tonsillitis, nausea, emesis, abdominal pain and constipation of the groups were compared with one another statistically. Kruskal–Wallis Variance Analysis (ANOVA) and Mann–Whitney U-test were used when VAS, age and the first oral intake term of the groups were compared one another statistically. Friedman Variance Analysis (ANOVA) was used to compare daily inner-group VAS values among one another. The values found as $P < 0.05$ was examined using Wilcoxon Rank test between each other.

3. Results

Thirty-three females and 47 males for a total of 80 children (age 6–14 years) entered the study. Data from 80 patients were analyzed.

There was no statistically significant differences between the groups for sex, age, indication for surgery or postoperative nausea, emesis, abdominal pain and constipation ($P > 0.05$) (Table 1). Comparisons of the groups among one another by their average VAS values were given in Table 2, while comparisons of each group itself daily were shown in Table 3.

According to VAS results, the groups were compared on the basis of postoperative pain. In the first postoperative day the difference among bupivacaine, dexamethasone and lidocaine with placebo group was found to be statistically significant ($P < 0.05$), but the difference between bupivacaine, dexamethasone and lidocaine was not significant ($P > 0.05$). By the third post-operative day, the difference between the lidocaine–bupivacaine and lidocaine–placebo was significant ($P < 0.05$), but among the other groups. On the seventh day, the results of bupivacaine, dexamethasone, lidocaine and placebo groups were similar ($P > 0.05$). As the groups were compared with one another by their VAS, bupivacaine and dexamethasone groups did not show difference in the first and third day. However, the difference for placebo and lidocaine groups in the first and third day was significant. For all the groups, the difference between VAS1–VAS7 and VAS3–VAS7 was significant. Pain decreased for all the groups by the seventh day.

4. Discussion

Tonsillectomy is a commonly performed procedure in children. Postoperative morbidity, including pain, inadequate oral intake, dehydration, and bleeding can create problems in the pediatric patient. Since postoperative pain often results in poor oral intake, many attempts have been to decrease the pain associated with tonsillectomy [12].

Pain is a subjective and complex expression [17]. Its terms of measurement and standardization

<table>
<thead>
<tr>
<th>Study parameters</th>
<th>Groups</th>
<th>Comment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Bupivacaine ($n = 20$)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dexamethasone ($n = 20$)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lidocaine ($n = 20$)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Placebo ($n = 20$)</td>
<td></td>
</tr>
<tr>
<td>Age (years) (± S.D.)</td>
<td>9.0 ± 2.7</td>
<td>9.6 ± 2.8</td>
</tr>
<tr>
<td>Gender (number)</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Indication for surgery</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Tonsillar hypertrophy</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Recurrent tonsillitis</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Time to first oral intake (h) (± S.D.)</td>
<td>2.2 ± 0.4</td>
<td>2.2 ± 0.4</td>
</tr>
<tr>
<td>Postoperative</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Nausea</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Emesis</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

NS, not significant ($P > 0.05$).
It has been suggested that the pain after tonsillectomy is caused by inflammation, nerve irritation, and spasm of exposed pharyngeal muscles. The pain does not completely subside until the muscle spasm of exposed pharyngeal muscles. The pain becomes covered with mucosa 14 days after surgery [19]. Many strategies have been proposed to eliminate or minimize the factors that result in postoperative pain. The surgical technique can be altered. Leach et al. [20] have compared the sharp-dissection-snare technique with electrocautery. The electrocautery may cause more pain than sharp dissection alone [12]. The dissection and snare technique was used exclusively in this study.

Studies have shown that anti-inflammatory agents such as aspirin and indomethacin can decrease postoperative pain in patients undergoing tonsillectomy. The analgesic effect seems to be related to the anti-inflammatory effect [12]. However, these agents are also strong inhibitors of prostaglandins and platelets and can be related to an increased incidence of postoperative bleeding [21].

The concept that local infiltration of the operative area with a local anesthetic during inhalational anesthesia, could alleviate postoperative pain has been known since the beginning of the century [7,22]. Local anesthetics have been injected into the tonsillar fossa to provide long-acting analgesia, with no benefit consistently demonstrated [12].

Jebeles et al. [16] found that bupivacaine hydrochloride infiltration decreased post-tonsillectomy pain in a small group of patients. Johansen et al. [13], found a significant effect in the VAS score for the period as a whole after preincisional infiltration with bupivacaine. Broadman et al. [1] and Schoem et al. [18] found no important difference in postoperative pain with the use of peritonsillar infiltration of bupivacaine. In our study, after bupivacaine or dexamethasone had been infiltrated around tonsil in the first post-operative day, the pain decreased significantly when it was compared with the placebo group (P < 0.05). But in the third and seventh days the pain did not decrease significantly when it was compared with the other groups (P > 0.05).

In his study of children, Bissonette [23] noted that when he had sprayed 4 mg/kg of 10% lidocaine aerosol directly onto tonsillar fossa, the post-tonsillectomy pain decreased significantly. At the same time, Elhakim and Abdel Hay [15] in their study sprayed 4 mg/kg 10% lidocaine aerosol onto tonsils 1–3 min before surgical incision and reported that they did not find significant difference in postoperative pain between the lidocaine group and those in which it was not applied. In our study, the pain decreased significantly when 4 mg/kg of 10% lidocaine aerosol was used postoperatively. Particularly, the lidocaine—bupivacain and lidocaine—placebo groups differences were statistically significant for the pain till the third day (P < 0.05).

### Table 2  Comparison of postoperative visual analog scale between groups

<table>
<thead>
<tr>
<th></th>
<th>Bupivacaine (n = 20)</th>
<th>Dexamethasone (n = 20)</th>
<th>Lidocaine (n = 20)</th>
<th>Placebo (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS 1</td>
<td>2.6 ± 1.6*</td>
<td>2.5 ± 1.5*</td>
<td>2.3 ± 1.5*</td>
<td>4.3 ± 1.0</td>
</tr>
<tr>
<td>VAS 3</td>
<td>2.6 ± 1.4*</td>
<td>2.5 ± 1.3</td>
<td>1.8 ± 1.1V</td>
<td>3.0 ± 1.4</td>
</tr>
<tr>
<td>VAS 7</td>
<td>1.5 ± 0.8</td>
<td>1.5 ± 0.6</td>
<td>1.3 ± 0.8</td>
<td>1.7 ± 0.9</td>
</tr>
</tbody>
</table>

P < 0.0001 (Kruskall–Wallis Variance Analysis); *, P < 0.05 (Mann–Whitney U-test) compared bupivacaine, dexamethasone and lidocaine with placebo; τ, P < 0.05 (Mann–Whitney U-test) compared bupivacaine with lidocaine; V, P < 0.05 (Mann–Whitney U-test) compared lidocaine with placebo.

### Table 3  Comparisons of each group itself daily

<table>
<thead>
<tr>
<th></th>
<th>Visual Analog Scale (days)</th>
<th>1 Mean</th>
<th>3 Mean</th>
<th>P</th>
<th>1 Mean</th>
<th>7 Mean</th>
<th>P</th>
<th>3 Mean</th>
<th>7 Mean</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bupivacaine</td>
<td></td>
<td>2.6 ± 1.6</td>
<td>2.6 ± 1.4</td>
<td>0.6</td>
<td>2.6 ± 1.6</td>
<td>1.5 ± 0.8</td>
<td>0.002</td>
<td>2.6 ± 1.4</td>
<td>1.5 ± 0.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td></td>
<td>2.5 ± 1.5</td>
<td>2.5 ± 1.3</td>
<td>0.6</td>
<td>2.5 ± 1.5</td>
<td>1.5 ± 0.6</td>
<td>0.003</td>
<td>2.5 ± 1.3</td>
<td>1.5 ± 0.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Lidocaine</td>
<td></td>
<td>2.3 ± 1.5</td>
<td>1.8 ± 1.1</td>
<td>0.005</td>
<td>2.3 ± 1.5</td>
<td>1.3 ± 0.8</td>
<td>0.002</td>
<td>1.8 ± 1.1</td>
<td>1.3 ± 0.8</td>
<td>0.003</td>
</tr>
<tr>
<td>Placebo</td>
<td></td>
<td>4.3 ± 1.0</td>
<td>3.0 ± 1.4</td>
<td>0.000</td>
<td>4.3 ± 1.0</td>
<td>1.7 ± 0.9</td>
<td>0.000</td>
<td>3.0 ± 1.4</td>
<td>1.7 ± 0.9</td>
<td>0.000</td>
</tr>
</tbody>
</table>

P < 0.05 Friedman Variance Analysis and Wilcoxon Rank test.
After tonsillectomy, there is often significant edema and inflammation. If effective, the mechanism of action of corticosteroids would decrease local inflammation by blocking the chemical mediators of inflammation. The biological half-life of dexamethasone is 36–54 h. The effect of corticosteroids should be most apparent in the first 24–48 h after tonsillectomy [12]. Smith [24] and Smith et al. [25] used a tonsillar fossa injection of a corticosteroid–penicillin–lidocaine mixture (methylprednisolone acetate–chloroprocaine penicillin O–lidocaine hydrochloride); they reported decreased pain and inflammation in the injection group. Papangelou [26] treated 323 patients with oral corticosteroids (betamethasone methylfluoroprednisolone) and antibiotics for the first 4 postoperative days; these patients had less pain and uvular edema than did patients treated with antibiotics alone. Most recently, Volk et al. [4] published a double-blind, randomized study in which 49 children received IV dexamethasone or placebo before tonsillectomy. The single dose of corticosteroid did not produce a notable reduction in trismus, fever, oral intake, or pain. Ohlms et al. [12] used a single intraoperative does of IV dexamethasone; they reported a single intraoperative dose of IV dexamethasone did not change the postoperative course in children undergoing tonsillectomy. Their results are in agreement with those of Volke et al. [4].

5. Conclusion

Postoperative pain is significant problem in children who undergo tonsillectomy. Pain may lead to decreased oral intake and dehydration, lengthening hospital stay and increasing patient and parent anxiety. According to results found in our study bupivacaine and dexamethasone infiltrated around tonsil pre-operatively and significantly decreased the pain especially in first 48 h. But there was no effect noted at day 7. Lidocaine nasal aerosol decreased the pain significantly in the first and third postoperative day as compared with the placebo group. Lidocaine was more effective than bupivacaine in the third post-operative day. In the seventh post-operative day no medicine had an advantage over placebo and seemed similar. These suggest these medicines might be used to reduce pain in the early period after tonsillectomy.

References