Ondansetron and dexamethasone have been observed to decrease the incidence of vomiting in children after general anesthesia, and low dose ondansetron plus dexamethasone is a more effective prophylactic antiemetic combination than high dose ondansetron (150 µg kg⁻¹) in children, and it is known that each episode of in hospital vomiting prolongs discharge by 13 ± 2 min (1,2). Vomiting is a common unpleasant sequela to surgery and anesthesia may result in

**SUMMARY**

Background and objective: The minimum effective dose of dexamethasone in conjunction with 50 µg kg⁻¹ ondansetron was evaluated in the treatment of vomiting after elective tonsillectomy or adenos tonsillectomy.

Methods: 102 healthy children aged between 2-12 were participated in this prospective, randomized, double-blind study. A single intravenous (IV) dose of dexamethasone (50, 100, 150 µg kg⁻¹, maximum dose 8 mg) with ondansetron (50 µg kg⁻¹) was administered just before the end of surgery. Equal amounts of normal saline was given to the control group. General anesthesia was induced and maintained by inhalation of N₂O/O₂ and sevoflurane. All other preoperative and postoperative medications (including a supplementary dose of antiemetics if necessary), anesthelia and surgical techniques were standardised.

Results: No significant differences were observed between groups in postoperative vomiting on the day of surgery and the next day, or in the need for postoperative pain medication and supplementary doses of antiemetics (p>0.05).

Conclusions: These results indicate that surgical technique and anesthetic management used in this study could be the cause of lower incidence of nausea and vomiting. Assessment of nausea and vomiting in a prospective study with larger groups of patients may reflect different results.

**Key Words:** Adenotonsillectomy, Dexamethasone, Ondansetron, Postoperative Vomiting

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dehydration, important electrolyte disturbances, delayed discharge from hospital and unanticipated admission to hospital (2,3). As much as 40-73% of children vomit after tonsillectomy, and anesthesiologists are searching for cost-effective techniques to minimize this problem (4).

**Patients and Methods**

With the Hospital Ethics Committee’s approval and parental consent, 102 healthy children aged between 2-12 undergoing elective tonsillectomy or adenotonsillectomy were enrolled in this prospective, randomized and double-blind study. Patients were excluded from the study if they had an allergy to any of the drugs to be used or if they had a symptomatic medical illness or motion sickness, or required reversal before extubation.

As premedication, 0.5 mg kg\(^{-1}\) midazolam (maximum dose 15 mg) was given orally 20-30 min before surgery. When the patients arrived in the operating room, baseline hemodynamic data were recorded after routine monitorization. Anesthesia was induced with sevoflurane and \(\text{N}_2\text{O} / \text{O}_2\). After induction, mivacurium (0.25 mg kg\(^{-1}\)) was administered and 20 µg kg\(^{-1}\) atropin was given to all patients. Endotracheal tube was inserted while patients were under anesthesia of appropriate depth. Anesthesia was maintained with 70% \(\text{N}_2\text{O}\) and 2% sevoflurane. The intraoperative intravenous fluids used was Ringer’s lactate at standard rates, which were defined as one half of the deficit during the first hour plus maintenance fluids.

A combination of ondansetron and dexamethasone was administered intravenously in a double-blind manner just before the end of surgery. There were four groups.

**Group I**: 50 µg kg\(^{-1}\) (max 8 mg) ondansetron + 150 mg kg\(^{-1}\) (max 8 mg) dexamethasone

**Group II**: 50 µg kg\(^{-1}\) (max 8 mg) ondansetron + 100 µg kg\(^{-1}\) (max 8 mg) dexamethasone

**Group III**: 50 µg kg\(^{-1}\) (max 8 mg) ondansetron + 50 µg kg\(^{-1}\) (max 8 mg) dexamethasone

**Group IV**: Normal saline was given to this group.

Patients were allocated randomly to receive one of the 4 treatments. A randomization list was prepared by a random number function in a computer spread sheet and identical syringes containing each drug and saline for control group were prepared by personnel not involved in the study.

For the purpose of this study, vomiting was defined as “the forceful expulsion of liquid or solid gastric contents”. Retching and nausea were not considered vomiting. Postoperative vomiting was treated with 1 mg kg\(^{-1}\) dimenhydrinate given intravenously, if the patient had vomited twice or more. The incidence of vomiting in the hospital was recorded by the nursing staff. Postoperative pain was treated with 15 mg kg\(^{-1}\) metamizol.

Patients were discharged according to standardized criteria which included a minimum 4-hour stay in the day care surgical unit (DCSU). Standardized criteria included lack of respiratory distress, stable vital findings for 30-60 minutes, tolerance of clear oral fluids, capability of mobilisation and oral intake for pain management. Patients were observed for 24 hours after the surgery. 24-hour observation was divided into 4 different periods as follows; 0-30 minutes in postanesthesia care unit (PACU), 30 minutes-4 hours in day care surgical unit (DCSU), in postoperative 4-12 hours (surgery day) and in postoperative 12-24 hours (first day). Parents were interviewed on the day after surgery by the research assistant. The parents reported all episodes of vomiting and any other surgical or anesthesia related problems.

Data were compared by one-way analysis of variance, chi-square analysis, Fisher’s exact tests or kappa test whichever was appropriate. Data are presented as mean ± SD.
Results

We enrolled 102 patients in the study. Group I (n = 26), group II (n = 27), group III (n = 24) and group IV (n = 25) were similar with respect to age, weight, and duration of anesthesia. Duration of surgery was significantly low in group I (p<0.05) (Table 1). Vomiting was assessed at four different times, in PACU, in the DCSU, on surgery day and on postoperative first day as previously described. With respect to four different times and four different groups, the incidence of vomiting was similar (p>0.05) (Table 2). In group I, the incidence of vomiting in PACU was similar with in DCSU (p>0.05), and on surgery day (p>0.05), also in DCSU and on surgery day (p>0.05). In group II, the incidence of vomiting in PACU was similar with in DCSU (p>0.05), and also between that in PACU and on surgery day (p>0.05) and in DCSU and on surgery day (p>0.05). In group III, the incidence of vomiting in PACU was similar with in DCSU (p>0.05), and also between that in PACU and on surgery day (p>0.05), also in DCSU and on surgery day (p>0.05). In group IV, the incidence of vomiting in PACU was similar with in DCSU (p>0.05), and also between that in PACU and on surgery day (p>0.05) and in DCSU and on surgery day (p>0.05) (Table 2).

In hospital vomiting, there was no requirement for treatment with dimenhydrinate. Non of the patients required reversal at the end of the surgery. Discharge rates from the hospital were similar in all groups.

Discussion

Morbidities like pain, inadequate oral intake, dehydration, fever, bleeding and vomiting can follow tonsillectomies in children. Postoperative nausea and vomiting is a common problem after general anesthesia (5). It has an incidence of 40 - 73 % following tonsillectomies (4). It may lead to some wound site complications and aspiration pneumonia syndromes (5-7). On the other hand it elongates stays in postanesthesia care units, it may cause delayed discharges from hospital and even unanticipated hospitalisations.

Table 1. Demographic data,*p<0.05

<table>
<thead>
<tr>
<th></th>
<th>Group I (n = 26)</th>
<th>Group II (n = 27)</th>
<th>Group III (n = 24)</th>
<th>Group IV (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>5.32 ± 2.16</td>
<td>6.12 ± 2.23</td>
<td>5.89 ± 1.78</td>
<td>5.76 ± 1.96</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>21.07 ± 5.35</td>
<td>18.00 ± 5.28</td>
<td>20.75 ± 6.68</td>
<td>19.63 ± 6.04</td>
</tr>
<tr>
<td>Sex M/F</td>
<td>18/8</td>
<td>15/12</td>
<td>17/7</td>
<td>18/7</td>
</tr>
<tr>
<td>Operation time (min)</td>
<td>44.80 ± 13.30*</td>
<td>50.37 ± 8.65</td>
<td>52.50 ± 12.93</td>
<td>50.19 ± 9.24</td>
</tr>
<tr>
<td>Anesthesia time (min)</td>
<td>61.61 ± 16.47</td>
<td>63.81 ± 13.59</td>
<td>66.25 ± 16.50</td>
<td>62.94 ± 15.72</td>
</tr>
</tbody>
</table>

Table 2. Incidence of vomiting in groups.

<table>
<thead>
<tr>
<th></th>
<th>Group I (n = 26)</th>
<th>Group II (n = 27)</th>
<th>Group III (n = 24)</th>
<th>Group IV (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACU</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>DCSU</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Surgery Day</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Postoperative 1st Day</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>
Administration of perioperative opioids is the most common cause of postoperative nausea and vomiting. On the other hand opioids are most commonly used drugs for pain control in children undergoing surgery. An alternative of opioids may be an antiinflammatory drug named ketorolac which is nearly as potent as morphin but does not cause respiratory depression (8). But use of ketorolac is limited particularly in children undergoing tonsillectomy because of its effects on platelet aggregation and adhesion (9). Among recently used antiemetics, 5-HT₃ receptor antagonists like ondansetron and granisetron have an increasing popularity. In the previous literature comparing ondansetron and placebo in tonsillectomy cases, incidence of postoperative nausea and vomiting was reported to be 32% with ondansetron, while it was 61% with placebo (5). In other series ondansetron was reported to be superior to placebo, too. In these series incidence of more than 2 episodes of postoperative nausea and vomiting was reported to be 7% with ondansetron, while it was 57% with placebo (10). Although 5-HT₃ receptor antagonists are very effective antiemetics, their respectively high costs limits their widespread usage. Other antiemetics like anticholinergics, dopamin receptor antagonists and antihistaminics have significant side effects. These reasons force anesthesiologists to investigate effective antiemetics with fewer side effects and low costs.

Dexamethasone is a corticosteroid with effective antiinflammatory and prolonged antiemetic efficacy. Dexamethasone has an elimination half life of about 3 hours and a duration of action of 48 hours. Among patients receiving chemotherapy, dexamethasone is superior in suppressing delayed nausea while compared with either ondansetron or granisetron (11,12). Perioperative use of, dexamethasone has been shown to decrease the incidence of postoperative vomiting (2,8,13,14). It is a safe and effective antiemetic in patients receiving cancer chemotherapy (15-17). IV administration of dexamethasone before electrocautery tonsilloadenectomy reduces the incidence of postoperative nausea and vomiting while increasing the quality of oral intake (18). Though it reduces the incidence of postoperative vomiting and surgery related side effects, such as delayed wound healing and increased incidence of wound infection, cautious use of dexamethasone in surgical patients is recommended (2,8,19-21). Dexamethasone doses used for antiemesis varies between 8-10 mg and 1mg kg⁻¹ (22,23). To achieve the best antiemesis with the fewest side effects, Liu et al compared dexamethasone doses of 10 mg, 5 mg, 2,5 mg, and 1,25 mg with placebo in patients undergoing general anesthesia for major gynecological surgery, and they found 2,5 mg to be the minimum effective dose without discernible side effects (6). In another study including thyroidectomy cases, it is reported that a dose of 2,5 mg is partially effective and a minimum effective dose is 5 mg (24). Cost-effectivity is increasingly a focus in health care, and neither which combination of dexamethasone and ondansetron is most cost-effective, nor the best antiemetic dose of dexamethasone to be used in children is well established. A dexamethasone dose of about 150 mg kg⁻¹ up to 8 mg is reported to be effective (1).

Splinter et al have found that 50 mg kg⁻¹ ondansetron plus 150 mg kg⁻¹ dexamethasone more effectively decreased the incidence and severity of vomiting in children after strabismus surgery than did 150 mg kg⁻¹ ondansetron (1). Which combination of dexamethasone and ondansetron has the best cost-effectivity after adenotonsillectomy has not been established yet. We hypothesized that a lower dose of dexamethasone would be as effective as a larger dose in combination with 50 mg kg⁻¹ ondansetron.

In this study, we compared 3 different doses of dexamethasone in children plus 50 mg kg⁻¹ ondansetron and the control group. All four groups were not different in respect to postoperative nausea and vomiting.

In our study the incidence of vomiting was not as high as it had been reported in previous studies. Additionally there was no significant
difference between the control group and the antiemetic treatment groups. These results indicate that surgical technique and anesthetic management used in this study could be the cause of lower incidence of nausea and vomiting. Assessment of nausea and vomiting in a prospective study with larger groups of patients may reflect different results.
REFERENCES


