Incidence of Emesis and Postanesthetic Recovery after Strabismus Surgery in Children: A Comparison of Droperidol and Lidocaine

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The authors sought to compare the antiemetic and sedative postanesthetic effects of droperidol versus lidocaine given intravenously. One hundred and fifty children, ASA physical status I or II, ages 2–15 y, were studied. Each child was randomly assigned to receive either droperidol, 0.075 mg/kg; lidocaine, 1.5 mg/kg, or a combination of lidocaine, 1.5 mg/kg, and a reduced dose of droperidol, 0.025 mg/kg, immediately after induction of anesthesia, which was with thiopental, atropine, and succinylcholine. Anesthesia was maintained with halothane and nitrous oxide. The incidence of postanesthetic vomiting was 22% in the droperidol-alone group, which was significantly less than the lidocaine-alone group (50%). The incidence of vomiting in the combination group (30%) was not significantly different from either the droperidol- or lidocaine-alone groups. The time in the recovery room was significantly shorter for patients given lidocaine alone than those given droperidol alone or the combination. However, the mean time intervals from completion of surgery to recovery of full alertness and to discharge from the hospital did not differ significantly among the three groups. In summary, the authors found that intravenous droperidol is significantly more effective than lidocaine in reducing the incidence of vomiting in unpremedicated children after strabismus surgery. Furthermore, droperidol did not delay either the time to recovery of full alertness or the time to discharge from hospital compared to lidocaine. (Key words: Anesthesia: lidocaine; local. Surgery: pediatric ophthalmologic. Vomiting: antiemetics; droperidol.)

Recent studies have demonstrated that droperidol decreases the incidence of vomiting after strabismus surgery.1,2 At The Hospital for Sick Children in Toronto, we found that intravenous droperidol (0.075 mg/kg) significantly decreases this incidence from 60% to 16% when it is given before manipulation of the eye.2 Although droperidol is effective as an antiemetic, it may cause prolonged sedation3 and, in some instances, delay discharge from the outpatient department.4

Warner et al. investigated the effectiveness of intravenous lidocaine in decreasing the incidence of vomiting after strabismus surgery, and found that intravenous lidocaine (2 mg/kg) decreased the incidence of vomiting from 52% (controls) to 16%.5 Although Warner et al. did not report the sedative effect of intravenous lidocaine, our experience would indicate that this effect is only transient and minor when compared to that of droperidol. Therefore, we compared both the antiemetic and sedative postanesthetic effects of droperidol 0.075 mg/kg, the standard of practice in our institution, to lidocaine 1.5 mg/kg alone and a combination of these two drugs in children undergoing strabismus surgery.

Materials and Methods

With approval from the Committee on Human Research, informed written consent was obtained from the parents of 150 children, ASA physical status I or II, between 2–15 y of age. The children were all unpremedicated and fasting.

In this double-blind, prospective study, each child was randomly assigned to receive one of the following intravenous regimens at induction of anesthesia: droperidol (0.075 mg/kg) (n = 50), lidocaine (1.5 mg/kg) (n = 50), or a combination of lidocaine (1.5 mg/kg) and a reduced dose of droperidol (0.025 mg/kg) (n = 50). Lidocaine was infused iv over 30–45 s.

After iv injection of atropine (0.02 mg/kg), anesthesia was induced with thiopental (4–7 mg/kg) and followed by succinylcholine (2 mg/kg). After the administration of succinylcholine, ventilation was controlled with 100% oxygen via a mask. The trachea was then intubated, and ventilation was controlled. Anesthesia was maintained with halothane, nitrous oxide, and oxygen. When a nondepolarizing muscle relaxant was used, neostigmine and atropine were administered iv at the completion of the surgery. The trachea was extubated when spontaneous ventilation was adequate and the gag reflex was present. Narcotics were not administered at any time; oral or rectal acetaminophen (10 mg/kg) was given for postoperative pain. Intramuscular dimenhydrinate (1–1.5 mg/kg) was administered to any child who vomited three times or more within 1 h.

Postanesthetic observations in the recovery room and on the ward were completed by the nurse in charge of the patient's care. The nursing staff were unaware of the treatment regimen given to each patient. The three criteria for discharge from the hospital were: 1) oral intake
of a minimum of 60 ml of clear fluid, 2) normal arousal to stimulation, and 3) a minimum stay of 4 h on the ward.

We recorded the patient’s age and weight, the duration of time spent in the recovery room and on the ward, the level of alertness, and the timing of each episode of vomiting. An alertness score was assessed hourly from the time of arrival in the recovery room (table 1).

To determine the incidence and severity of vomiting after discharge from hospital, the guardians or parents were telephoned between 48 and 72 h after discharge.

The number of patients required in each group was determined before the study by power analysis. This was based on four assumptions: that the incidence of vomiting with droperidol (0.075 mg/kg) will be 15%, that the incidence of vomiting with lidocaine will be 45%, that the (two tailed) = 0.05, and that \( \alpha \) = 0.20. The minimum number of patients required in each group was 54.

Statistical significance \( (P < 0.05) \) was determined using the Fisher exact test, Chi-square analysis (with the Yates correction for continuity for 2 \( \times \) 2 tables only), and the Bonferroni t test.

**Results**

The age and weight did not differ significantly among the three treatment groups. There were no episodes of delayed tracheal extubation.

The incidence of postanesthetic vomiting (in hospital and after discharge) in the droperidol (0.075 mg/kg) group was 22%. This was significantly less than that in the lidocaine (1.5 mg/kg) group, 50% \( (P < 0.05) \). The incidence of vomiting in the combination group, 30%, did not differ significantly from the incidence in either the droperidol or lidocaine alone groups. None of the children were hospitalized overnight for vomiting or drowsiness.

The time in the recovery room was significantly shorter for patients given lidocaine alone than for those given droperidol alone and the combination (table 2). However, the mean time intervals from completion of surgery to recovery of full alertness and to discharge from the hospital did not differ significantly among the three groups (table 2). The time to recovery of full alertness in those patients who received lidocaine and imidazole (52%) was 175 min. This was significantly longer than the 76 min required to recover full alertness in those who received lidocaine without dimenhydrinate \( (P < 0.05) \). None of the patients given either droperidol (0.075 mg/kg) or lidocaine with droperidol required dimenhydrinate.

Nine children received nondepolarizing muscle relaxants during surgery: six in the droperidol group, one in the lidocaine-alone group, and two in the combination group. Neuromuscular blockade was reversed at the completion of surgery with neostigmine and atropine. None of these children vomited after surgery.

**Discussion**

Recent evidence suggests that intravenous lidocaine may be as effective as droperidol in reducing the incidence of vomiting after strabismus surgery in children. However, the results of our study do not support that evidence. We found that lidocaine (1.5 mg/kg) is significantly less effective than droperidol (0.075 mg/kg) in reducing the incidence of vomiting after strabismus surgery \( (P < 0.05) \). While we did determine the incidence of postanesthetic vomiting with lidocaine **per se**, there was no obvious decrease in the incidence of vomiting when compared to the results of previous studies. Based on these results, droperidol 0.075 mg/kg remains the most effective antiemetic for children undergoing strabismus surgery.

The incidence of vomiting in the patients who were given lidocaine 1.5 mg/kg in this study was threefold

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<tr>
<th>TABLE 1. Alertness Scale</th>
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<td><strong>Score</strong></td>
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<td>Asleep, not rousable</td>
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<tr>
<td>Drowsy</td>
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<td>Awake, not oriented</td>
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<th>TABLE 2. Demographic and Recovery Data</th>
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<td><strong>Droperidol</strong> 1.5 mg/kg <strong>Lidocaine</strong> 1.5 mg/kg <strong>Lidocaine</strong> (1.5 mg/kg) and Droperidol (0.075 mg/kg)</td>
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<tr>
<td>Number of patients</td>
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<td>Age (yr)</td>
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<td>Weight (kg)</td>
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<td>Incidence of vomiting</td>
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<td>Time in recovery room (h)</td>
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<td>Time to discharge (h)</td>
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<td>Time to full alertness (h)</td>
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Data are mean ± SD. * \( P < 0.05 \) compared to droperidol (0.075 mg/kg). † 52% required dimenhydrinate for vomiting.
greater than that reported by Warner et al. Several possible explanations may account for this discrepancy: 1) the reduced dose of lidocaine, 2) the reduced volume of intravenous fluids given in the perioperative period, 3) the earlier administration of oral fluids postoperatively, and 4) absence of premedication in this study compared to that of Warner et al. It is unclear which of these explanations account in part or in whole, for the ineffectiveness of lidocaine in our study.

To determine the effectiveness of iv lidocaine to attenuate vomiting after strabismus surgery, we compared droperidol 0.075 mg/kg to the two drug regimens: lidocaine 1.5 mg/kg alone and lidocaine 1.5 mg/kg with droperidol 0.025 mg/kg. Lidocaine 1.5 mg/kg was chosen for the following reasons: 1) lidocaine 1.5 mg/kg has been shown to attenuate physiological reflex responses including ophthalmic reflexes and 2) this dose of lidocaine is unlikely to produce cardiovascular or neurological side effects when administered slowly. The combination of lidocaine 1.5 mg/kg and droperidol 0.025 mg/kg was included in this study to determine whether the purported antiemetic effect of lidocaine is synergistic with that of droperidol. We selected a low dose of droperidol 0.025 mg/kg, because this dose does not significantly attenuate the incidence of vomiting after strabismus surgery as reported previously. We found that the incidence of vomiting with the combination of lidocaine and droperidol (80%) was similar to lidocaine alone (50%) (table 2). Given these incidences of vomiting, α1 = 0.05 and n = 50, the power to detect a difference between these two treatments was only 0.64. Since this power value provides less than a 2:1 likelihood of proving a difference when it truly exists, we cannot reject the notion that the antiemetic effect of lidocaine is synergistic with that of droperidol. To reject the notion, a larger sample size would be required.

We compared the incidence of vomiting with lidocaine alone to data reported in a previous study from our institution. We justified a comparison with previous data on the basis of: 1) ethical considerations and 2) treatment of the historical controls. It is the current practice in our institution to administer droperidol 0.075 mg/kg to all children undergoing strabismus surgery. In view of the 300-400% decrease in the incidence of vomiting with droperidol 0.075 mg/kg compared to the control group reported previously, we could not ethically justify withholding droperidol for the purpose of creating another control group. The historical controls referred to in this study were similar to the present cohorts of patients in that the historical controls were matched for all demographic variables and were managed perioperatively in a manner identical to patients in the present study. Based on these arguments, we believe that that the limited reference to historical controls in the present study was justified.

We expected the children who were given intravenous lidocaine alone to recover full alertness after surgery more rapidly than those given droperidol alone. However, the children who were given lidocaine recovered full alertness as slowly as those given droperidol (table 2). The delayed recovery of children who received lidocaine may be attributed to the postanesthetic administration of the antiemetic dimenhydrinate. Fifty percent of those children who received lidocaine vomited and 52% of those who vomited required dimenhydrinate. Because dimenhydrinate is a sedative as well as an antiemetic, the time to full recovery of alertness in children given both lidocaine and dimenhydrinate was more than twice that in children given lidocaine without dimenhydrinate. This data indicates that children who receive only lidocaine recover full alertness rapidly after strabismus surgery, although, in instances where dimenhydrinate is given, full recovery may be delayed.

It has been suggested that succinylcholine should be avoided in children undergoing strabismus surgery. This is based, in part, on a recent retrospective study by Carroll in which she found a 2.8% incidence of masseter muscle rigidity (MMR) in 229 children who received succinylcholine at induction of anesthesia for strabismus surgery. In contrast to the findings of Carroll, our experience suggests that, when thiopental precedes succinylcholine, MMR is an exceedingly rare event even in children with strabismus. With prospective documentation of the perioperative course of 390 children who received thiopental, atropine, and succinylcholine for strabismus surgery, we found a zero incidence of MMR. This finding indicates that the likelihood of a zero incidence of MMR in the entire population of children undergoing strabismus surgery with this induction technique is 99.23%. This likelihood exceeds the 95% threshold accepted for both statistical and clinical significance. The difference in the incidence of MMR between our experience and that of Carroll et al. may be attributed, in part, to our use of thiopental in place of halothane before succinylcholine. It remains our opinion that the iv regimen of thiopental, atropine, and succinylcholine is a safe and acceptable induction regimen for children undergoing strabismus surgery.

Nine children received neostigmine and atropine to reverse neuromuscular blockade at the completion of surgery. Although none of these children vomited, their numbers were insufficient to infer any effect by this combination of drugs on the incidence of vomiting. In view of the lack of published evidence implicating neostigmine and atropine in vomiting after surgery, it is unlikely these drugs contribute significantly to this problem.

§ Unpublished data (80 patients).
In summary, we found that intravenous droperidol (0.075 mg/kg) is significantly more effective than lidocaine (1.5 mg/kg) in reducing the incidence of vomiting in unpremedicated children after strabismus surgery. Furthermore, droperidol (0.075 mg/kg) does not delay either the time to recovery of full alertness or the time to discharge from hospital compared to the regimen of prophylactic iv lidocaine (1.5 mg/kg) with supplemental postanesthetic im dimenhydrinate (1–1.5 mg/kg) for vomiting.

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