New Modalities in Postoperative Nausea and Vomiting

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Nausea and vomiting following surgery in the ambulatory care facility is a significant problem.1 With the use of newer anesthetics, the time to full recovery of consciousness is decreasing. Consequently, postoperative nausea and vomiting are more obvious and objectionable to the patient. The time to ambulation and subsequent discharge from the unit is prolonged because of nausea and vomiting. They are a significant cause of unexpected hospital admission from the postanesthesia care unit (PACU). In 977 pediatric patients, vomiting was the most common complication, with 1.7% of patients requiring hospital admission.

Contributing factors affecting the incidence of postoperative nausea and vomiting are listed in Table 1. The condition is more common in children and tends to decrease with age. The incidence is equal between sexes until puberty, when it becomes more common in females. A history of motion sickness and previous experience of nausea and vomiting increase the likelihood of developing postoperative emetic symptoms. There seems to be a relationship between the incidence of nausea and vomiting and the day of the menstrual cycle.3,4 A fourfold increase in nausea and vomiting has been noted when laparoscopic surgery was performed around the time of menses. Estrogen levels of women who experienced nausea and vomiting after ovum retrieval and other laparoscopic procedures have been shown to be significantly greater than for those patients who experienced no emetic symptoms.

Opioid analgesics are known to cause postoperative nausea and vomiting. However, nausea often accompanies pain in the postoperative period and can be relieved in 80% of cases when pain relief is achieved by the intravenous (IV) use of opioids.5 Several studies have concluded that an opioid-based anesthetic technique (fentanyl or alfentanil) results in earlier ambulation and patient discharge.6,7

Regional or monitored anesthesia care causes a low incidence of postoperative nausea and vomiting and enables earlier discharge of patients.8 After laparoscopy, nausea and vomiting was present in 38% of general

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Contributing Factors to Postoperative Nausea and Vomiting

**Predisposing factors**
- Young age
- Female gender
- Early pregnancy
- History of motion sickness
- Previous nausea and vomiting
- Day of menstrual cycle

**Increased gastric volume**
- Morbid obesity
- Excessive anxiety
- Noncompliance

**Opioid analgesics**

**Anesthetic technique**
- General vs regional anesthesia

<table>
<thead>
<tr>
<th>Anesthetic drugs</th>
<th>Nitrous oxide</th>
<th>Etomidate, ketamine</th>
<th>Neostigmine</th>
</tr>
</thead>
</table>

**Surgical procedure**
- Ovum retrieval
- Laparotomy
- Strabismus correction
- Orchiopexy
- Ear surgery

**Postoperative factors**
- Pain
- Sudden movement
- Hypotension

Nitrous oxide has also been implicated as a cause of postoperative nausea and vomiting. A significant decrease in the incidence of postoperative emesis was observed when nitrous oxide was omitted. But recent studies found no association between emesis and the use of nitrous oxide. Of the induction drugs, etomidate and ketamine have a significantly higher incidence of postoperative nausea and vomiting compared with thiopental and methohexital. Propofol has been shown to have the lowest incidence compared with other induction drugs. A significant increase in the incidence of postoperative emesis was noted in patients who received neostigmine to antagonize neuromuscular block.

The relationship between the incidence of postoperative nausea and vomiting and the type of surgical procedure has been well documented in several studies. In adult female patients, the incidence is highest in ovum retrieval (54%) and laparoscopic procedures (35%). In pediatric patients, the incidence is highest with strabismus surgery and orchiopexy.

Postoperative factors contributing to nausea and vomiting include pain, sudden movement, and hypotension.

**Prevention and Treatment**

It is important to identify the susceptible patient. General measures that help reduce nausea and vomiting include reassurance and adequate preoperative explanation of the procedure to allay anxiety. In the PACU, the patient should be kept warm using a warming blanket, administered adequate IV fluids, and moved very slowly. Nasopharyngeal suction should be minimized to avoid stimulating the gag reflex.

A number of drugs have been used to control postoperative nausea and vomiting in adults (Table 2). Promethazine, cyclizine, benzquinamide, prochlorperazine, and hydroxyzine have met with only limited success. A combination of metoclopramide, 10 to 20 mg IV, and droperidol, 0.5 to 1.0 mg IV, has been shown to be more effective than metoclopramide alone. Metoclopramide, 10 mg alone or in combination with 300 mg of cimetidine, was significantly more effective compared with control or cimetidine-alone groups. Metoclopramide does not prolong recovery, but occasional side effects, including drowsiness, lassitude, and agitation, have been observed. More serious symptoms of severe dysphoria and akathisia have been reported following metoclopramide 10 mg IV.

Droperidol is an effective antiemetic. When given

**Table 1. Contributing Factors to Postoperative Nausea and Vomiting**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Anesthetic drugs</th>
<th>Surgical procedure</th>
<th>Postoperative factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young age</td>
<td>Nitrous oxide</td>
<td>Ovum retrieval</td>
<td>Pain</td>
</tr>
<tr>
<td>Female gender</td>
<td>Etomidate, ketamine</td>
<td>Laparotomy</td>
<td>Sudden movement</td>
</tr>
<tr>
<td>Early pregnancy</td>
<td>Neostigmine</td>
<td>Strabismus correction</td>
<td>Hypotension</td>
</tr>
<tr>
<td>History of motion sickness</td>
<td></td>
<td>Orchiopexy</td>
<td></td>
</tr>
<tr>
<td>Previous nausea and vomiting</td>
<td></td>
<td>Ear surgery</td>
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<tr>
<td>Day of menstrual cycle</td>
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</tr>
</tbody>
</table>

**Table 2. Drug Therapy for Postoperative Nausea and Vomiting**

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzquinamide</td>
<td>Limited success</td>
</tr>
<tr>
<td>Cyclizine</td>
<td>Effective antiemetic</td>
</tr>
<tr>
<td>Hydroxyzine</td>
<td>Restlessness, anxiety, acute dystonia have been reported</td>
</tr>
<tr>
<td>Prochlorperazine</td>
<td>If given during final phase of recovery or in high dose can potentiate drowsiness</td>
</tr>
<tr>
<td>Promethazine</td>
<td>More effective when combined with droperidol</td>
</tr>
<tr>
<td>Droperidol</td>
<td>Drowsiness, lassitude, and agitation and, with IV administration, severe dysphoria and akathisia have been reported</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>Effective when combined with metoclopramide</td>
</tr>
<tr>
<td>Cimetidine</td>
<td>Effective when combined with metoclopramide</td>
</tr>
<tr>
<td>Ephedrine</td>
<td>Effective alone or in combination with hydroxyzine</td>
</tr>
<tr>
<td>Scopolamine</td>
<td>Effective when given transdermally the night before surgery</td>
</tr>
<tr>
<td>Ondansetron</td>
<td>Associated with high incidence of anticholinergic side effects</td>
</tr>
</tbody>
</table>

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immediately following intubation (0.625-1.25 mg IV), it was very effective in outpatients undergoing laparoscopic tubal sterilization. In addition, as a result of the decreased nausea and vomiting, the patients receiving droperidol had a shorter PACU stay.

One study evaluated droperidol (5, 10, and 20 µg/kg IV), metoclopramide (5 and 10 mg orally), a combination of the two drugs, and a placebo group. Metoclopramide alone had no effect on decreasing the incidence of nausea and vomiting. Droperidol alone and in combination with metoclopramide significantly decreased the incidence. Only 20% of patients receiving 20 µg/kg of droperidol, 25% in the 10 µg/kg of droperidol group, and 65% in the placebo group suffered postoperative nausea and vomiting. In addition patients in the high-dose droperidol group did not require any further antiemetic after discharge. Droperidol can potentiate drowsiness if given during the final phase of recovery or in a dose exceeding 1.25 mg. Extrapyramidal reactions such as restlessness, anxiety, and acute dystonia have been reported even with a low dose of 0.65 mg droperidol.

The combination of ephedrine, 25 mg IV, and hydroxyzine, 25 mg IM, given on admission to the PACU has been effective in patients with a history of motion sickness and previous postanesthetic nausea and vomiting. One study found ephedrine, 0.5 mg/kg IM, before the conclusion of surgery to be as effective as droperidol, 0.01 mg/kg IM, and significantly more effective than placebo in reducing postoperative nausea and vomiting.

Transdermal scopolamine reduces nausea, retching, and vomiting and, when used, should be applied behind the ear the night before surgery. However, it is associated with a high incidence of anticholinergic side effects.

Ondansetron, a new 5 HT3 receptor antagonist, appears to be an effective antiemetic without causing drowsiness and postoperative sedation. When 16 mg of ondansetron or a placebo were given orally, as premedication, the incidence of nausea and vomiting was 52% and 40% in the placebo group and 17% and 12% in the ondansetron group, respectively. Wetchler and coworkers reported among patients in the PACU at home after 24 hours, 76% and 69%, respectively, in the ondansetron group, had no emetic symptoms, whereas 58% and 49%, respectively, in the placebo group, were symptom free in the PACU and at home. Bodner and White administered either 8 mg of ondansetron or saline (placebo) to patients who developed postoperative nausea and/or vomiting in the PACU. In the placebo group, 92% of the patients experienced subsequent episodes of vomiting compared with 51% in the ondansetron group. Rescue antiemetics were required in 43% of the ondansetron-treated patients compared with 86% in the placebo group.

A nondrug approach to the control of nausea and vomiting is acupuncture. One study observed that acupuncture at the P6 point significantly reduced postoperative nausea and vomiting.

**Treatment in Pediatric Patients**

Droperidol has been effective in pediatric patients undergoing strabismus surgery. When 75 µg/kg of droperidol was administered during induction of anesthesia, before manipulation of the extraocular muscles, the incidence of vomiting was reduced to 10% in the droperidol group compared with 47% in the control group.

Either 0.15 mg/kg metoclopramide or normal saline was administered in the PACU to pediatric poststrabismus patients. The incidence of postoperative vomiting in the metoclopramide group was significantly reduced; 35% versus 59% in the placebo group.

The effect of propofol and halothane with and without droperidol on poststrabismus emesis was studied in pediatric patients. The incidence of postoperative emesis was lowest (23%) in the propofol group, 43% in the propofol plus droperidol group, and 50% in the halothane group.

In addition to drug therapy, complete replacement of the preoperative fluid deficit and stomach decompression before extubation is advisable in pediatric patients.

**Conclusions**

There can be a reverse relationship between the decreased time to full recovery resulting from the use of newer anesthetics and the occurrence of postoperative nausea and vomiting. We must carefully consider preoperative and intraoperative factors that can promote nausea and vomiting and, when the problem is anticipated, use the most appropriate control measures. In selecting a drug or combination of drugs to control nausea and vomiting, their appropriateness to the patient population and possible side effects must be considered. Currently, droperidol is the drug with the widest evidence of effectiveness, although its side-effects profile must be taken into consideration. The new drug ondansetron holds promise, but more clinical experience in the anesthesia setting is required before it can be recommended without reservation.
References