CLINICAL INVESTIGATIONS

Anesthesiology
1996; 85:4–10
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Lippincott–Raven Publishers

Vomiting and Recovery after Outpatient Tonsillectomy and Adenoidectomy in Children

Comparison of Four Anesthetic Techniques Using Nitrous Oxide with Halothane or Propofol

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Background: **The authors' purpose in this study was to compare prospectively four different anesthetic induction and maintenance techniques using nitrous oxide with halothane and/or propofol for vomiting and recovery after outpatient tonsillectomy and adenoidectomy procedures in children.**

Methods: **Eighty unpremedicated children, aged 3–10 yr, were assigned randomly to four groups: group H/H, 0.5–2% halothane induction/halothane maintenance; group P/P, 3–5 mg·kg^{-1} propofol induction and 0.1–0.3 mg·kg^{-1}·min^{-1} propofol maintenance; group H/P, 0.1–0.3 mg·kg^{-1}·min^{-1} halothane induction/propofol maintenance; and group P/H, 3–5 mg·kg^{-1} propofol induction and 0.5–2% halothane maintenance. Nitrous oxide (67%) and oxygen (33%) were administered in all the groups. Other treatments and procedures were standardized intra- and postoperatively. Results of postoperative vomiting and recovery were analyzed in the first 6 h and beyond 6 h.**

Results: **Logistic regression showed that vomiting occurred 3.5 times as often when halothane was used for maintenance of anesthesia (groups H/H and P/H) compared with the use of propofol (groups P/P and H/P; Odds Ratio 3.5; 95% confidence interval 1.3 and 9.4, respectively; $P = 0.012$). A significant association between vomiting (< 6 h: yes/no) and discharge times (> 6 h: yes/no) (Odd's Ratio = 3.6; 95% confidence interval: 1.02, 12.4, respectively) ($P = 0.046$) was shown. However, no significant differences among the groups in the incidence of vomiting beyond 6 h, recurrent vomiting, or hospital discharge times were shown.**

Conclusions: **After tonsillectomy and adenoidectomy procedures, despite reduced postoperative vomiting with use of propofol rather than halothane, along with nitrous oxide for anesthetic maintenance, the authors found no differences in "true" endpoints such as unplanned admissions or discharge times. Among the groups, the main factor that delayed hospital discharge beyond 6 h was vomiting within the first 6 h (Key words: Anesthesia: outpatient. Anesthesia, pediatric: otolaryngologic. Anesthetics, intravenous: propofol. Anesthetics, volatile: halothane. Complications: postoperative vomiting. Surgery: adenoidectomy; otolaryngologic; tonsillectomy.)**

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Received from Georgetown University Medical Center, Washington, D.C. Submitted for publication January 13, 1995. Accepted for publication February 29, 1996. Presented in part at the International Anesthesia Research Congress, Orlando, Florida, March 5–9, 1994, and at the annual meeting of the American Academy of Pediatrics, Anesthesiology Section, Denver, Colorado, April 23–25, 1994.

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THE reported incidence of postoperative vomiting after tonsillectomy and adenoidectomy (T&A) procedures in children ranges from 40% to 70%.[1,2] Postoperative vomiting is a major factor that limits hospital discharge and, at times, results in unanticipated overnight admission in this population.[3,4] Other factors associated with delayed discharge after T&A procedures include primary hemorrhage, airway obstruction, and poor oral intake that requires aggressive nursing care.[3,4]

The incidence of vomiting after pediatric outpatient surgery varies in different studies when propofol anesthesia is compared with inhalation anesthesia. Factors that account for this difference include the type of sur-

gery, use of nitrous oxide, and
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Methods

After institutional review board
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techniques. Randomization cod
patient, physician, and all other
needed for treatment initiation
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the study to avoid bias in measu
The four anesthetic techniques
2% halothane induction and h
group P/P, 3–5 mg·kg^{-1} propo
0.3 mg·kg^{-1}·min^{-1} propofol
P, 0.1–0.3 mg·kg^{-1}·min^{-1} ha
propofol maintenance, with a
mg·kg^{-1} propofol; and group
pofol induction and 0.5–2% h
All children received 67% N_2
maintenance of anesthesia. Fac
rollment in the study were a
previous serious adverse expe
cardiovascular, respiratory, n
nervous system disease; and a
agement problems.

Age, weight, sex, and type of
tomy, T&A, and T&A with bilat
recorded. Parents were allowe
induction of anesthesia. All c
dicated and received 67% N_2O
mask before halothane inducti
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that consisted of electrocardio
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gery, use of nitrous oxide, and opioids.[5–8] Propofol, when used for anesthetic induction and/or maintenance for outpatient surgery in children, is associated with rapid recovery and less vomiting.[5,6,8] However, the interactive effects of different induction and maintenance anesthetic techniques using halothane and/or propofol are unknown during T&A surgery. In this prospective study, four anesthetic techniques were compared using nitrous oxide with halothane and/or propofol for postoperative vomiting and recovery after outpatient T&A procedures in children.

Methods

After institutional review board approval and parental consent, 80 unpremedicated American Society of Anesthesiologists physical status 1 or 2 children, aged 3–10 yr, scheduled for tonsillectomy with or without adenoidectomy were assigned randomly to four anesthetic techniques. Randomization codes were masked to the patient, physician, and all other clinical personnel until needed for treatment initiation. Postoperative nurses who cared for the patients were blinded throughout the study to avoid bias in measuring patient outcomes. The four anesthetic techniques were group H/H, 0.5–2% halothane induction and halothane maintenance; group P/P, 3–5 $mg \cdot kg^{-1}$ propofol induction and 0.1–0.3 $mg \cdot kg^{-1} \cdot min^{-1}$ propofol maintenance; group H/P, 0.1–0.3 $mg \cdot kg^{-1} \cdot min^{-1}$ halothane induction and propofol maintenance, with a loading dose of 1–3 $mg \cdot kg^{-1}$ propofol; and group P/H, 3–5 $mg \cdot kg^{-1}$ propofol induction and 0.5–2% halothane maintenance. All children received 67% N_2O and 33% O_2 during maintenance of anesthesia. Factors that excluded enrollment in the study were a history of an allergy or previous serious adverse experience with anesthesia; cardiovascular, respiratory, metabolic, and central nervous system disease; and anticipated airway management problems.

Age, weight, sex, and type of surgery (*i.e.*, tonsillectomy, T&A, and T&A with bilateral myringotomy) were recorded. Parents were allowed to be present during induction of anesthesia. All children were unpremedicated and received 67% N_2O and 33% O_2 *via* a face mask before halothane induction or insertion of an intravenous catheter. All children had routine monitors that consisted of electrocardiogram, automatic blood pressure cuff, finger pulse oximeter probe, peripheral nerve stimulator, and a precordial stethoscope placed before or soon after induction of anesthesia. Groups P/P and P/H were induced with intravenous doses of 3 $mg \cdot kg^{-1}$ propofol, with additional doses of 1 $mg \cdot kg^{-1}$ propofol given until loss of eyelid reflex, to a maximum of 5 $mg \cdot kg^{-1}$. Group H/P received a loading intravenous dose of 1 $mg \cdot kg^{-1}$ propofol, with additional doses of 1 $mg \cdot kg^{-1}$ given as needed to maintain blood pressure within ±20% of baseline, to a maximum of 3 $mg \cdot kg^{-1}$. All children received 0.3–0.5 $mg \cdot kg^{-1}$ intravenous atracurium and 20 $\mu g \cdot kg^{-1}$ intravenous alfentanil in two incremental doses of 10 $\mu g \cdot kg^{-1}$ after tracheal intubation and before surgery.

During surgery, maintenance doses of halothane or propofol were adjusted to maintain blood pressure within ±20% of baseline. At the end of surgery, halothane was adjusted to 0.5% and propofol to 0.1 $mg \cdot kg^{-1} \cdot min^{-1}$. Atropine (0.02 $mg \cdot kg^{-1}$) was given intravenously for bradycardia or as an antisialogogue at the surgeon's request. At the surgeon's request, 0.2–0.3 $mg \cdot kg^{-1}$ dexamethasone was given intravenously. Intravenous fluids were administered in a volume sufficient to restore calculated fluid deficits, fulfill maintenance requirements, and compensate for measured blood loss. Gastric contents were aspirated before extubation in all children. At the end of surgery (defined as removal of the mouth gag by the surgeon), the anesthetics were turned off, and neuromuscular blockade was antagonized with 0.05 $mg \cdot kg^{-1}$ intravenous neostigmine and 0.02 $mg \cdot kg^{-1}$ atropine. The trachea was extubated in the operating room when criteria for extubation were met. Complications, such as airway obstruction, laryngospasm, or desaturation not responding to airway interventions, such as jaw thrust, continuous positive airway pressure, or insertion of an oral airway, and requirement of emergent endotracheal intubation during anesthetic induction or after emergence of anesthesia were noted.

Postoperatively, an experienced nurse observer blinded to the anesthetic technique documented recovery events at specified intervals, including the modified Aldrete score in the postanesthesia care unit (PACU), the length of the stay in the PACU, the number and frequency of emetic episodes, analgesic requirements, oral intakes, discharge-to-home times, and complications, such as airway obstruction and primary hemorrhage. After discharge to home, the same nurse, after a follow-up phone call to the parents 24 h postoperatively, noted analgesic requirements, the number and frequency of emetic episodes, and side effects. Pain was treated with 10 $mg \cdot kg^{-1}$ acetaminophen or 10 $mg \cdot kg^{-1}$ acetaminophen plus 1 $mg \cdot kg^{-1}$ codeine elixir

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Table 1. Demographic Data

Parameter	Group H/H	Group P/P	Group H/P	Group P/H	*P* Value
Number (N)	20	20	20	20	
Age (yr)	6.3 ± 1.9	5.4 ± 2.2	5.3 ± 1.6	5.5 ± 1.8	0.27
Weight (kg)	26.5 ± 9.3	23.1 ± 11.1	21.6 ± 8.2	22.6 ± 6.7	0.35
Sex (M/F)	13/7	12/8	11/9	11/9	
Tonsillectomy	4	4	3	6	
T & A	12	14	12	11	
T & A, BMT	4	2	5	3	

Values are mean ± SD.

H = halothane; P = propofol; T & A = tonsillectomy and adenoidectomy; BMT = bilateral myringotomy and tubes.

orally every 4 h as needed. Vomiting in the hospital was treated after two episodes with 0.2 $mg \cdot kg^{-1}$ intravenous metoclopramide. Subsequent recurrent vomiting was treated at the physician's discretion.

Anesthesia time was defined as the time from anesthetic induction until arrival in the PACU. The surgical time was measured from surgical incision to removal of the mouth gag by the surgeon. The times to extubation and eye opening were measured from the end of anesthesia to the time of tracheal extubation and spontaneous eye opening, respectively. Tracheal extubation occurred in the operating room when criteria for extubation were met. Extubation criteria were based on the return of protective airway reflexes, spontaneous regular breathing and purposeful movements by the patient, and a 5-s sustained response to a 50-Hz tetanic stimulation. The PACU time was recorded from the time of extubation until a modified Aldrete score of 10 was reached. The discharge time was defined as the time from reaching a modified Aldrete score of 10 until the discharge to home criteria were met. Discharge to home criteria included having a minimum stay of 2 h postextubation and having drank 100–200 ml of clear liquid without vomiting.

Because the prevailing trend for outpatient surgery at our institution is to discharge children to home within 6 h, discharge times beyond 6 h would be considered for an unplanned overnight hospital admission in a 23-h observation unit. Therefore, the results of vomiting and recovery were analyzed in the first 6 h and beyond 6 h. The factors that contributed to the delay of discharge beyond 6 h, which included age (older or younger than 6 yr), vomiting, and anesthetic technique, were explored.

Statistical Analysis

The incidence of vomiting was predicted at 64% in the halothane control group and at 24% in the propofol group.[7] The sample size of 20 subjects per treatment arm was sufficient to detect a statistical significance ($\alpha = 0.05$ and $\beta = 0.2$ and a one-sided test). Parametric data were compared using a one-way analysis of variance with Bonferroni corrections for multiple comparisons between groups. The data for discharge times showed a broad, nonGaussian distribution and were analyzed by the Kruskal-Wallis one-way analysis of variance. Categorical data were expressed as counts

Table 2. Propofol Doses

Parameter	Group P/P	Group H/P	Group P/H	*P* Value
Induction ($mg \cdot kg^{-1}$)	3.4 ± 0.6	—	4.2 ± 0.9	0.0008*
Maintenance ($\mu g \cdot kg^{-1} \cdot min^{-1}$)	190 ± 50.1	186 ± 41.1	—	0.76
Total dose ($mg \cdot kg^{-1}$)	11.4 ± 3.0	8.7 ± 4.2†	4.2 ± 0.85‡	0.0001*

Values are mean ± SD. *P* values are adjusted for Bonferroni correction factor.

H = halothane; P = propofol.

* Statistically significant.

† $P < 0.05$ *versus* group P/P.

‡ $P < 0.001$ *versus* group P/P and group H/P.

and analyzed with 4 × 2 chi-sq
ferences among the study grou
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test was used when expected fre
5.0. Logistic regression analyses
plore the relation between indu
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operative vomiting. Logistic re
explored the relation between
discharge time (< or ≥ 6 h)
variables: treatment group (H/
age group (< or ≥ 6 yr: yes/n
≥ 6 h: yes/no). The odds ratio
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Results

No significant differences w
four groups in age, gender, we
procedure (table 1). The differ
among the groups is tabulate
loading dose of propofol in g
$mg \cdot kg^{-1}$. Anesthesia and surg
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eye opening, extubation and
nificantly earlier in group P/
H/H ($P < 0.05$; table 3). Th

Table 3. Anesthesia, Surgery, and

Parameter	Group H
Surgery time	40.4 ±
Anesthesia time	74.0 ±
Extubation time	11.6 ±
Eye opening	15.1 ±
PACU time	31.3 ±

Values are mean ± SD (minutes). *P* values
H = halothane; P = propofol.
* $P < 0.05$ *versus* group H/H.
† $P < 0.05$ *versus* group P/P.
‡ $P < 0.001$ *versus* group P/P.
§ Statistically significant.

and analyzed with 4 × 2 chi-square test to detect differences among the study groups. If significant differences were found, follow-up subset analyses were done and adjusted for multiple comparisons. Fisher's exact test was used when expected frequencies were less than 5.0. Logistic regression analyses were conducted to explore the relation between induction and maintenance with halothane and the presence or absence of postoperative vomiting. Logistic regression analyses also explored the relation between the outcome variable: discharge time (< or ≥ 6 h) and a set of predictor variables: treatment group (H/H, P/P, H/P, or P/H), age group (< or ≥ 6 yr: yes/no), and vomiting (< or ≥ 6 h: yes/no). The odds ratio with a 95% confidence interval showed how much more likely it was for the outcome to be present when exploring the relation between these variables. The induction and maintenance doses of propofol were compared between groups P/P and P/H and between P/P and H/P, respectively, using Student's *t* test. A P value < 0.05 was considered statistically significant.

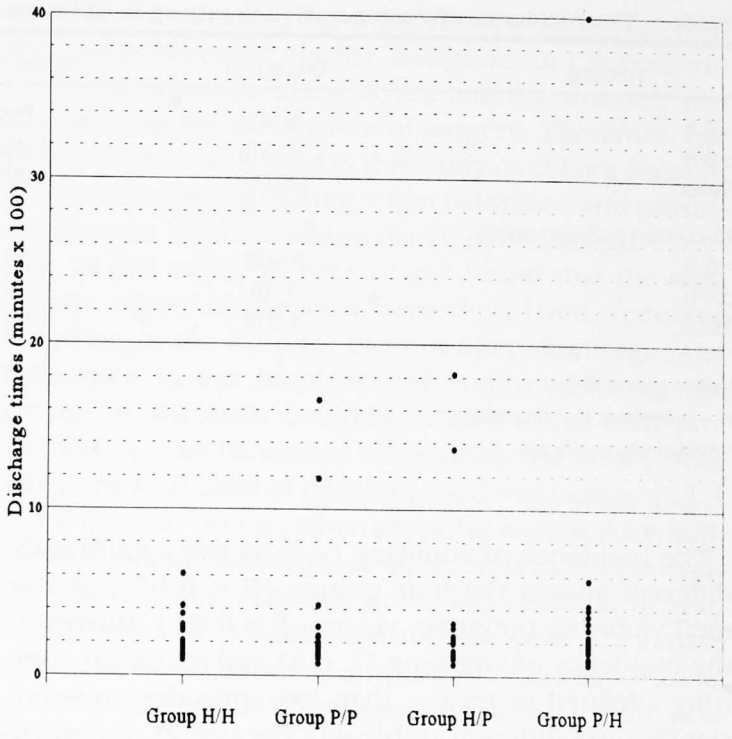

Fig. 1. Discharge time for each child by group.

Results

No significant differences were detected among the four groups in age, gender, weight, and type of surgical procedure (table 1). The differences in propofol dosing among the groups is tabulated in table 2. The mean loading dose of propofol in group H/P was 1.2 ± 1.1 $mg \cdot kg^{-1}$. Anesthesia and surgical times were not significantly different among the four groups. However, eye opening, extubation, and PACU time occurred significantly earlier in group P/P compared with group H/H ($P < 0.05$; table 3). The median (range) values for discharge times for groups H/H, P/P, H/P, and P/H were 193 (95–610), 179 (75–1660), 198 (70–2820), and 197 (70–4000) min, respectively, and were not significantly different among the groups ($P = 0.79$; fig. 1). The percentages of children whose discharge times were within 6 h were 85% each in groups H/H and P/P, 90% in group H/P, and 75% in group P/H ($P = 0.63$). The results of logistic regression analyses showed a significant association between vomiting (< 6 h: yes/no) and discharge times (≥ 6 h: yes/no) (odds ratio 3.6; 95% confidence interval 1.02 and 12.4, respectively; $P = 0.046$).

Table 3. Anesthesia, Surgery, and Recovery Times

Parameter	Group H/H	Group P/P	Group H/P	Group P/H	*P* Value
Surgery time	40.4 ± 16.8	31.4 ± 10.9	40.2 ± 28.9	33.1 ± 10.4	0.28
Anesthesia time	74.0 ± 20.6	60.8 ± 14.7	73.0 ± 31.8	68.9 ± 13.3	0.20
Extubation time	11.6 ± 4.3	6.5 ± 2.5*	9.6 ± 4.3	12.4 ± 5.5‡	0.0002§
Eye opening	15.1 ± 5.0	6.9 ± 4.0*	12.33 ± 5.9†	15.3 ± 6.3‡	0.0001§
PACU time	31.3 ± 15.7	20.6 ± 11.3*	22.7 ± 9.7	22.1 ± 8.6	0.021§

Values are mean ± SD (minutes). *P* values are adjusted for Bonferroni correction factor.

H = halothane; P = propofol.

* $P < 0.05$ *versus* group H/H.

† $P < 0.05$ *versus* group P/P.

‡ $P < 0.001$ *versus* group P/P.

§ Statistically significant.

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Table 4. The Incidence of Postoperative Vomiting in Children: Comparison of Four Different Anesthetic Techniques

Vomiting	Group H/H	Group P/P	Group H/P	Group P/H	*P* Value
<6 h	9 (45)	2 (10)	3 (15)	5 (25)	<0.05*
≥6 h	4 (20)	3 (15)	4 (20)	4 (20)	0.97
Total	12 (60)	4 (20)	5 (25)	8 (40)	0.04*
Recurrent (>2 episodes)					
<6 h	2 (10)	0 (0)	1 (5)	0 (0)	0.28
≥6 h	1 (5)	0 (0)	0 (0)	1 (5)	0.56
Total	3 (15)	1 (5)	2 (10)	1 (5)	0.52

Values are no. (%).

H = halothane; P = propofol.

* Statistically significant.

The incidence of vomiting (< 6 h) was significantly different among the four groups ($P < 0.05$), as was total vomiting (anytime: yes/no; $P = 0.04$). However, the incidence of vomiting (≥ 6 h) and recurrent vomiting (defined as greater than two episodes) was not significantly different (table 4). The results of logistic regression analysis showed that vomiting occurred 3.5 times (odds ratio 3.5; 95% confidence interval 1.3 and 9.4, respectively) as often among children who received halothane and nitrous oxide during maintenance (groups H/H and P/H) than among children who received propofol and nitrous oxide for maintenance (groups P/P and H/P; $P = 0.012$).

Two children in group H/H and three children in group H/P received one dose of intravenous metoclopramide. One child in group H/P continued to vomit in the hospital and received intravenous droperidol. One child in group P/H had recurrent vomiting at home and received a promethazine suppository. Ten children received intravenous atropine, seven for bradycardia and three as an antisialogogue. All children were included in the final analysis because there were no significant differences among the groups in the number of children who received atropine. No significant differences were detected among the groups in the number of children who received intraoperative dexamethasone, postoperative acetaminophen, or acetaminophen with codeine (table 5). No airway complications that required emergent endotracheal extubation were noted among the groups during anesthesia. One patient in group P/P received racemic epinephrine by nebulization in the PACU for croup. No postoperative complications of airway obstruction or primary hemorrhage occurred.

Discussion

In a recent editorial, Fisher[9] defined "true" endpoints as patient satisfaction, discharge times, and unplanned admissions rather than the incidence of vomiting that he considered a "surrogate" endpoint. Although the results of our study showed that children aged 3–10 yr undergoing tonsillectomies and/or adenoidectomies had 3.5 times the incidence of vomiting when halo-

Table 5. Number of Patients Given Dexamethasone, Acetaminophen, or Acetaminophen/Codeine

Parameter	Group H/H	Group P/P	Group H/P	Group P/H	*P* Value
Dexamethasone given	16 (80)	15 (75)	14 (70)	11 (55)	0.34
Acetaminophen given					
Predischarge	19 (95)	18 (90)	20 (100)	19 (95)	0.55
Postdischarge	15 (75)	11 (55)	16 (84)	15 (75)	0.31
Acetaminophen/codein given					
Predischarge	4 (20)	8 (40)	7 (35)	6 (30)	0.56
Postdischarge	10 (50)	13 (65)	11 (55)	10 (50)	0.75

Values are no. (%).

H = halothane; P = propofol.

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thane rather than propofol was part of the maintenance anesthetic, this study found no differences with respect to "true" endpoints (*i.e.*, discharge times or unplanned admissions). Many children (10–25%) in all the groups in this study had discharge times beyond 6 h and by recent trends in outpatient surgery would be considered for an unplanned overnight hospital admission in a 23-h observation unit.

Further analyses of the results revealed that the main factor that delayed hospital discharge beyond 6 h was vomiting within the first 6 h. This was probably related to mandatory oral intake and age less than 6 yr rather than due to the anesthetic technique. In other studies, researchers reached similar conclusions of postoperative vomiting resulting in unanticipated overnight admission in this patient population.[3,4] Mandatory oral intake also could account for the lack of variation in the discharge times among the groups. After T&A procedures, Schreiner *et al.*[10] showed a significant decrease in emetic episodes in elective drinkers compared with mandatory drinkers when the hospital stay was slightly prolonged. In previous studies of this population, age younger than 3–4 yr was associated with a higher risk of poor oral intake, fever, and dehydration, which required more than routine nursing care.[3,4,11,12] Until there are further studies in which the safety of earlier discharge is proven, most institutions and surgeons favor a minimum postoperative stay of 4–6 h to detect early bleeding, poor oral intake, and recurrent vomiting.[13] Discharge to home should be considered individually in children younger than 6 yr who elect not to drink.

The incidence of vomiting in this patient population ranges from 40% to 70%; its cause is unclear and probably multifactorial in origin.[14] In this study, the incidence of vomiting was 60% when halothane was used for induction and maintenance of anesthesia, which was consistent with the incidence reported in other studies.[1,2] Pharyngeal and laryngeal airway reflexes (gagging and coughing) and swallowed blood are strong emetic stimuli. Pain, anxiety, anesthetic agents, gastric distension, and the use of premedications and perioperative narcotics have been implicated in postoperative vomiting. Carithers *et al.*[3] reported that meperidine administration after T&A was a significant predictor of increased risk of subsequent vomiting 4 h postoperatively. In other studies, researchers found that, despite anesthetic maintenance with propofol, the risk of vomiting was increased when intraoperative morphine,[5] postoperative morphine, or meperidine[6,7] was used. To control for these factors, all children in this study received similar analgesic and antiemetic regimens in standardized doses, and the stomach was suctioned at the conclusion of surgery. Therefore, the choice of narcotics used in this study could not account for the increased vomiting when halothane and nitrous oxide were used for maintenance of anesthesia.

As in this study, Reimer *et al.*[6] found that the antiemetic effects of propofol were short-lived, reducing vomiting in the hospital but not after discharge. The difference in the incidence of vomiting among the groups in this study could be related to the total propofol dose. The incidence of vomiting was least (20%) when the total dose of propofol used was highest (11.4 $\pm$ 3.0 $mg \cdot kg^{-1}$) (*i.e.*, when propofol was used for both induction and maintenance of anesthesia). However, the mechanisms, effective dose, and duration of antiemetic effects of propofol remain unknown.[15] In a study of outpatient strabismus surgery in children, Watcha *et al.*[5] found reduced vomiting in children when propofol/oxygen was used for maintenance of anesthesia compared with the use of propofol/nitrous oxide (23% *vs.* 60%, respectively). It was unclear, however, whether the increased vomiting in the nitrous oxide group reflected the effects of nitrous oxide or the reduced dose of propofol.

We found no difference in the incidence of vomiting among the children who received dexamethasone compared with those who did not. Caitlin *et al.* reported similar results in tonsillectomy patients who received a single intravenous dose of dexamethasone compared with placebo.[16]

In conclusion, on the basis of the current study, postoperative vomiting was reduced when propofol rather than halothane was used with nitrous oxide for anesthetic maintenance. This could be considered a "surrogate" endpoint, and our data revealed no difference in "true" endpoints, such as unplanned admissions or discharge times. Consistent with other studies, vomiting in the first 6 h was associated with delayed hospital discharge, despite the anesthetic technique used.

References

1. Ferrari LR, Donlon JV: Metoclopramide reduces the incidence of vomiting after tonsillectomy in children. Anesth Analg 1992; 75: 351–4

2. Furst SR, Rodarte A: Prophylactic antiemetic treatment with ondansetron in children undergoing tonsillectomy. ANESTHESIOLOGY 1994; 81:799–803

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3. Carithers JS, Gebhart DE, Williams JA: Postoperative risks of pediatric tonsilloadenoidectomy. Laryngoscope 1987; 97:422–9

4. Crysdale WS, Russel D: Complications of tonsillectomy and adenoidectomy in 9409 children observed overnight. Can Med Assoc J 1986; 135:1139–42

5. Watcha MF, Simeon RM, White PF, Stevens JL: Effect of propofol on the incidence of postoperative vomiting after strabismus surgery in pediatric outpatients. ANESTHESIOLOGY 1991; 75:204–9

6. Reimer EL, Montgomery CJ, Bevan JC, Merrick PM, Blackstock D, Popovic V: Propofol anesthesia reduces early postoperative vomiting after paediatric strabismus surgery. Can J Anaesth 1993; 40: 927–33

7. Weir PM, Munro HM, Reynolds PI, Lewis IH, Wilton NCT: Propofol infusion and the incidence of emesis in pediatric outpatient strabismus surgery. Anesth Analg 1993; 76:760–4

8. Martin TM, Nicolson SC, Bargas MS: Propofol anesthesia reduces emesis and airway obstruction in pediatric outpatients. Anesth Analg 1993; 76:144–8

9. Fisher DM: Surrogate end points: Are they meaningful (editorial)? ANESTHESIOLOGY 1994; 81:795–6

10. Schreiner MS, Nicolson SC, Martin T, Whitney L: Should children drink before discharge from day surgery? ANESTHESIOLOGY 1992; 76:528–33

11. Shott SR, Myer CM, Cotton RT: Efficacy of tonsillectomy and adenoidectomy as an outpatient procedure: A preliminary report. Int J Pediatr Otorhinolaryngol 1987; 13:157–63

12. Tom LWC, DeDio RM, Cohen DE, Wetmore RF, Handler SD, Potsic WP: Is outpatient tonsillectomy appropriate for young children? Laryngoscope 1992; 102:277–80

13. Guida RA, Mattucci KF: Tonsillectomy and adenoidectomy: An inpatient or outpatient procedure? Laryngoscope 1990; 100:491–3

14. Watcha MF, White PF: Postoperative nausea and vomiting: Its etiology, treatment, and prevention. ANESTHESIOLOGY 1992; 77:162–84

15. Smith IA, White PF, Nathanson M, Gouldson R: Propofol: An update on its clinical use. ANESTHESIOLOGY 1994; 81:1005–43

16. Catlin FI, Grimes WJ: The effect of steroid therapy on recovery from tonsillectomy in children. Arch Otolaryngol Head Neck Surg 1991; 117:649–52

Anesthesiology
1996; 85:11–20
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Preemptive Anal… Anesthetic in La…

A Randomized, Doub…

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Giovanni Terrosu, M.D.,‖ Annibale D…

Background: **A controversy exists … clinical value of preemptive analge… needed to define the optimum inten… of analgesia relative to incision and…**

Methods: **One hundred twenty pa… scopic cholecystectomy under gene… peritoneal local anesthetic or salin… esthetic (0.5% bupivacaine with ep… lutions were given as follows: imm… of a pneumoperitoneum (blocking … end of the operation (blocking aft… randomly assigned to one of four g… Group A (placebo) received 20 ml 0… after surgery, group B received 20… gery and 20 ml local anesthetic afte… 20 ml local anesthetic both before … received 20 ml local anesthetic be… after surgery. Pain was assessed u… and a verbal rating scale at 0, 4, 8,…**

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Received from the Department of … Udine, Udine, Italy. Submitted for pu… cepted for publication February 29, …

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