Vomiting Post Tonsillectomy at the University Hospital of the West Indies

M Scarlett, I Tennant, K Ehikhametalor, M Nelson

ABSTRACT

A three-year observational study of patients undergoing tonsillectomy at the University Hospital of the West Indies was conducted to determine the incidence of postoperative vomiting. Data were collected to assess possible risk factors for vomiting as well as possible alleviating agents. Two hundred and fifty-two patients were included in the study and a thirteen per cent incidence of postoperative vomiting was found. This is significantly less than that quoted in other studies (40-73%). Results also showed that steroids significantly reduced the incidence of postoperative vomiting in the study population. Muscle relaxants reversal agents and antibiotics particularly co-trimoxazole and ceftriaxone significantly increased its incidence. Usual antiemetic agents including dimenhydrinate (gravol) and promethazine (phenergan), as well as drugs known to possess antiemetic properties such as midazolam and propofol, lacked any significant protective effect against emesis. Opioid analgesia, inhalational induction and blood loss of greater than 10% of estimated blood volume appeared to increase emesis but failed to achieve statistical significance.

Vómitos Post Tonsilectomía en el Hospital Universitario de West Indies

M Scarlett, I Tennant, K Ehikhametalor, M Nelson

RESUMEN

Un estudio de observación a pacientes de tonsilectomía en el Hospital Universitario de West Indies, fue realizado durante tres años, a fin de determinar la incidencia de vómitos post-operatorios. Se recogieron datos con el propósito de evaluar los posibles factores de riesgo por vómitos así como los posibles agentes para aliviarlos. Doscientos cincuenta y dos pacientes fueron incluidos en el estudio y se halló una incidencia de trece por ciento de vómitos post-operatorios. Esta cifra es significativamente menor que las citadas en otros estudios (40-73%). Los resultados también mostraron que los esteroides redujeron significativamente la incidencia de vómitos post-operatorios en la población del estudio. Los agentes de reversión de los relajantes musculares y los antibióticos co-trimoxazol y ceftriaxona aumentaron significativamente la incidencia. Los agentes antieméticos usuales, incluyendo incluso el dimenhidrinato (gravol) y la prometazina (fenergan), así como drogas conocidas por sus propiedades antieméticas, tales como el midazolam y el propofol, no mostraron efecto significativo alguno de protección contra la émesis. La analgesia opioide, la inducción por inhalación, y la pérdida de sangre mayor al 10% del volumen de sangre estimada, parecían aumentar la émesis, pero no alcanzaron a tener importancia estadística.

West Indian Med J 2005; 54: (1) 59

INTRODUCTION

The incidence of vomiting after tonsillectomy and/or adenoidectomy has been reported to range between 40 and 73% (1-3). Although generally considered to be a relatively minor postoperative complication, vomiting is very distressing to the patient and can result in dehydration, electrolyte disturbances, delayed discharge from the recovery area or hospital and increased hospital costs (1-5). It also places the patient at risk of aspiration, especially if conscious level is decreased (6).

There are a number of factors that contribute to postoperative nausea and vomiting (PONV). Patient factors include gender and age. PONV is three times more common in adult females than in males and children are approximately twice as susceptible as adults. A previous history of PONV or motion sickness is a known risk factor. Certain surgical procedures are associated with a high incidence of PONV, including strabismus surgery, middle ear surgery, tonsillectomies, laparoscopic procedures, gynaecological

From: Department of Surgery, Radiology, Anaesthesia and Intensive Care, The University of the West Indies, Kingston 7, Jamaica, West Indies.

Correspondence: Dr M Scarlett, Department of Surgery, Radiology, Anaesthesia and Intensive Care, Section of Anaesthesia and Intensive Care, The University of the West Indies, Kingston 7, Jamaica, West Indies. Fax: (876) 977-6160, e-mail: mdscarl@yahoo.com.

and abdominal surgery (5-8). Anaesthetic factors include the use of opioid analgesia (6, 7, 9), nitrous oxide (5, 10) and inhalational agents (3, 5).

Anaesthetists are constantly trying to find methods to decrease the incidence of PONV and its associated morbidity. Preventive measures include avoiding opioids perioperatively (1, 7) substituting with nonsteroidal anti-inflammatory agents or local blocks where appropriate, using antiemetics especially in conjunction with opioids (7, 11, 12) and administering steroids especially dexamethasone (1, 2, 4, 13, 14). Propofol (1, 3, 7, 11, 15) and midazolam (1, 16, 17) appear to have antiemetic properties, hence their use has increased in patients with a high risk of PONV.

Tonsillectomies are now increasingly being performed as day case surgeries worldwide (2, 6, 18, 19). Vomiting in the postoperative period is a major factor in determining whether a patient is fit for early recovery room and hospital discharge. Hence, the objectives of this study were to determine the incidence of vomiting post tonsillectomy at the University Hospital of the West Indies (UHWI), to identify significant risk factors in the patient population and to document possible preventive measures. This would enable the development of an anaesthetic protocol to decrease the incidence of vomiting and encourage day case tonsillectomies in selected patients at the UHWI.

PATIENTS AND METHODS

The medical records of all patients who underwent tonsillectomy between January 1, 2000 and December 31, 2002, with or without other upper airway or aural procedure/s (adenoidectomy, myringotomy, grommet insertion, antral washout or inferior turbinectomy) were analyzed. A balanced anaesthetic technique was used for all patients. Induction of anaesthesia was either inhalational (halothane or sevoflurane) or intravenous (thiopentone, propofol or ketamine). Maintainance was with a combination of halothane or isoflurane, oxygen and nitrous oxide. Not all patients required muscle relaxation and those who needed reversal received atropine and neostigmine. Data collected for each patient included age, gender, body weight, type of anaesthetic induction (inhalational or intravenous), duration of anaesthesia and blood loss during surgery. The administration of any of the following drugs was recorded: premedicant agents, opioid, nonsteroidal analgesics, antibiotics, antiemetics, reversal agents and steroids.

For the purpose of this study, vomiting was defined as the forceful ejection of stomach contents through the mouth, nose or both. Episodes of nausea alone or retching were not considered. Patients were monitored up to the time of discharge from hospital by the nurses in the Post-Anaesthesia Care Unit (PACU) and the ward. Frequency of vomiting was noted and rated as none, mild (once or twice), or severe (three times or more) as described by Tigerstedt *et al* (20). As part of the discharge criteria, all patients were required to tolerate a light meal.

Data were analyzed using the SPSS version 11.0 software package. Demographic data were reported using the mean and standard deviation (age and weight) or as frequencies (gender). Tests for significance were the Mann Whitney U and chi-square tests for non-parametric data and the Student-t test for parametric data. A p-value of less than 0.05 was considered significant. Logistic regression analysis using a backward elimination model was also performed to determine independent significant variables and eliminate possible confounding variables.

RESULTS

A total of 253 patients underwent tonsillectomies during the study period. The medical records of 252 of these patients were analyzed; one record could not be found. All the patients were either class I or II of the American Society of Anesthesiologists Physical Status Scale (*ie* normal, healthy individuals or patients with mild systemic illness). The age range for the study population was 10 months to 47 years with a mean age of 7.5 years. Eighty-seven per cent of the study population (n = 213/249) were children below the age of 13 years. The mean (SD) weight was 28.7 kg ± 20.8 kg (range = 6.4 to 114.5 kg). There were almost equal numbers of males and females in the study population, 125 (49.8%) and 126 (50.2%) respectively (p = 0.950).

Thirty-two patients in the study group vomited post tonsillectomy, an incidence rate of 13.1%. Twenty-eight or 87.5% of these patients were children (p = 0.56). There was no significant difference in the incidence of vomiting between males and females, 12.6% and 13.6% respectively (p = 0.82, Table 1). Severe vomiting (three or more episodes) was only recorded in four patients (12.5%).

Expected relieving factors

Steroids were administered to 109 patients (45%), 135 patients (55%) did not receive steroids and data were missing in seven cases. The incidence of vomiting was 7.3% for the "steroid group" and 17.8% in those who had not received steroids (p = 0.016, Table 2). Logistic regression tables were then used to remove confounding variables and steroid use was still found to be significant (p = 0.04).

Premedicants used in this study included midazolam, trimeprazine tartrate (vallergan) and pethidine. However, the majority of patients did not receive any premedications (71.4%). The incidence of vomiting was highest in the pethidine group (28.6%) followed by the midazolam group (21.1%). The group that did not receive any premedicant and those who were given vallergan had lower incidences of vomiting, 13.9% and 2.7% respectively. These results did not achieve statistical significance (p = 0.106).

The frequency of vomiting with an intravenous induction was 8.3% compared to 15.2% after inhalational induction. However, this difference was not statistically significant (p = 0.148). When the type of induction was further analyzed according to the agents used, thiopentone

Table 1: Vomiting post tonsillectomy by age and gender

		Vomiting		p-value
		Yes (n %)	No (n %)	
Age	< 12 years	28 (13.1 %)	185 (86.9%)	
	> 13 years	4 (11.1 %)	32 (88.9%)	0.56
Gender	Female	17 (13.6%)	108 (86.4%)	0.82
	Male	15 (12.6%)	104 (87.4%)	

Table 2: Comparison of expected relieving factors with aggravating factors

Expected factor		Vomiting		p-value
		Yes (n %)	No (n %)	
Steroids	Yes	8 (7.3%)	101 (92.7%)	0.016 *
	Nil	24 (17.8%)	111 (82.2%)	
Premedication	Midazolam	4 (21.1%)	15 (78.9%)	0.106
	Vallergan	1 (2.7%)	36 (97.3%)	
	Pethidine	2 (28.6%)	5 (71.4%)	
	None	25 (13.9%)	155 (86.1%)	
Inhalational	Halothane	23 (20.4%)	90 (79.6%)	0.148
vs	Sevoflurane	3 (5.2%)	55 (94.8%)	
intravenous	Propofol	5 (11.9%)	37 (88.1%)	
induction agents	Thiopentone	1 (3.7%)	26 (96.3%)	
	Ketamine	0	3 (100%)	
Antiemetics	Yes	21 (12.7%)	144 (87.3%)	0.796
	Nil	11 (13.9%)	68 (86.1%)	
Reversal agents	Yes	18 (20.9%)	68 (79.1%)	0.008 *
	Nil	14 (8.9%)	144 (91.1%)	

* significant

and sevoflurane had lower incidences of vomiting, 3.7% and 5.2% respectively. The propofol group was 12% and the halothane group was 20.4%. Further analyses were done to assess the confounding effect of steroid use on the results obtained for the inhalational agents (Table 3). Patients who received both halothane and steroids had a 13.2% incidence of vomiting, compared with a 24.0% incidence in those without steroid (p = 0.176, OR = 2.08). Vomiting occurred in 2.3% of patients given both sevoflurane and steroids while 13.3% of patients who did not get steroids vomited (p = 0.097, OR = 6.46).

There was no difference in the incidence of vomiting between those who received antiemetic agents (12.7%) and those who did not (13.9%, p = 0.796).

When atropine and neostigmine were used for reversal, the incidence of vomiting was 20.9% and 8.9% when they were omitted (p = 0.008).

Expected aggravating factors

Vomiting occurred in 12.7% of patients who received both nonsteroidal and opioid analgesics (which accounted for the majority of patients) and 20% of those who were only given nonsteroidal agents. Only three patients were given opioids alone and none of these vomited. These results, however, were not statistically significant, (p = 0.520, Table 4). Data were missing for nine patients.

Fourteen per cent of those who did not receive antibiotics vomited compared to a frequency of 13% in those who were given antibiotics (p = 0.789). Further analysis of the specific antibiotics showed higher incidences of vomiting with co-trimoxazole (34.8%) and ceftriaxone (26.9%) than with metronidazole (9.7%) and amoxicillin/ clavulanic acid (5.7%). This was statistically significant (p = 0.001, Table 5).

There was an increase in the incidence of vomiting in patients who lost greater than 10% of their blood volume, 20% compared to 13.7% in the group with minimal blood loss and 5.1% in the group that lost 5-9% of their estimated blood volume. This was not statistically significant (p = 0.300).

Table 3: Effect of steroid use on the incidence of vomiting post tonsillectomy with inhalational agents

Agent		Vomiting		p-value	OR	95% Confidence Interval
		Yes (n %)	No (n %)			
Halothane	With steroid	5(13.2%)	33(86.8%)	0.176	2.96	0.07, 1.31
	Without steroid	18(24.0%)	57(76.0%)			
Sevoflurane	With steroid	1(2.3%)	42(97.7%)	0.097	6.46	0.54, 77.14
	Without steroid	2(13.3%)	13(86.7%)			

Table 4: Postoperative vomiting by expected aggravating factors

Expected factor		Vomiting		p-value
		Yes (n %)	No (n %)	
Analgesics	Opioids	0	3 (100%)	0.520
	Nonsteroidals	4 (20.0%)	16 (80.0%)	
	Both	28 (12.7%)	192 (87.3%)	
Antibiotics	Yes	24 (12.9%)	162 (87.1%)	0.789
	Nil	8 (14.3%)	48 (85.7%)	
Blood loss	Minimal	19 (13.7%)	120 (86.3%)	0.300
	5-9%	2 (5.1%)	37 (94.9%)	
	10%	1 (20.0%)	4 (80.0%)	
Anaesthetic time	< 1 hour	8 (12.5%)	56 (87.5%)	0.865
	>1 hour	24 (13.3%)	156 (86.7%)	

Table 5: Effect of antibiotics on postoperative vomiting

Antibiotic	Vomiting	
	Yes	No
Nil	8 / 14.3%	48 / 85.7%
Cotrimoxazole	8 / 34.8%	15 / 65.2%
Ceftriaxone	7 / 26.9%	19 / 73.1%
Metronidazole	3 / 9.7%	6 / 5.7%
Amoxycillin/clavulanic acid	19 / 73.1%	100 / 94.3%

* p-value = 0.001

Table 6: Odds risk ratio of factors affecting vomiting post tonsillectomy

Factor	OR (nil/yes)	95% Confidence Interval
Steroids	2.730 *	1.173, 6.350
Reversal agents	0.367 *	0.173, 0.782
Antibiotics	1.125	0.475, 2.665
Inhalational/intravenous induction	1.972	0.775, 5.020
Antiemetics	1.109	0.506, 2.431

* significant

Patients whose anaesthetic time was less than one hour had an incidence of vomiting of 12.5%, compared to 13.3% in those whose anaesthetic time was greater than one hour (p = 0.865). Most patients (96%) were discharged within 24 hours postoperatively. The four patients who were discharged after 24 hours were not as a result of vomiting.

DISCUSSION

This study showed an incidence of 13% for vomiting post tonsillectomy at the University Hospital of the West Indies, a figure well below the 40-73% quoted in most of the literature (1-3). It is difficult to surmise possible causes for this, as a large percentage of patients in this study were exposed to well known emetogenic agents, including opioids (91.2%), antibiotics (73.8%) and inhalational anaesthetic induction agents (67.9%) (1, 6, 8). Prophylactic antiemetic agents were administered to only 65.5% of the study population; and even fewer received steroids perioperatively (43.3%). One explanation could be an intrinsic variation between races. Harvey (21) reported an overall incidence of 2.9% PONV in the recovery room in Guyana, which was significantly lower than that reported among Caucasian populations. A study from Nigeria also reported a lower incidence of vomiting of 1% in the recovery room and 19.6% for the first 24 hours postoperatively (22). In this study, episodes of nausea and retching were not included as was the case in some studies and could have accounted for the lower incidence. That decision was made because of the difficulty in objectively assessing nausea and retching in the paediatric patient population which accounted for the majority of the study population.

The sample population in this study did not show an increased risk of postoperative vomiting in female patients but as the majority of the patients was in the paediatric age group, this was not surprising. The gender difference is not noted in the pre-adolescent age group or in patients over 80 years, suggesting hormonal variations as a contributing factor to the increased incidence of emesis in females (6, 23). Beattie *et al* noted that PONV was greatest on the fourth and fifth days of the menstrual cycle in women undergoing laparoscopic surgery (24). There was no significant difference in the incidence of vomiting between children (< 12 years) and those over 12 years, in contrast to the literature worldwide (7, 8). However, this study had a very small group of patients over 12 years (36/252) which could have skewed the results (Table 1).

Steroid use was the only factor shown to significantly reduce the incidence of vomiting post tonsillectomy. Patients

who did not receive steroids were 2.7 times more likely to vomit (Table 6). Dexamethasone was the steroid of choice but its mechanism of action in preventing emesis is unknown (23). It has been postulated that it exerts its antiemetic effect by antagonizing prostaglandins and reducing inflammation. Its onset of action is approximately two hours, hence it was given just after induction of anaesthesia. Its long half-life of 36–72 hours accounts for a pronounced late antiemetic effect (6, 23, 25).

At the UHWI, premedicant agents prescribed varied according to the availability of the drugs. Midazolam is usually preferred because of its shorter onset of action (20 minutes compared to 90 minutes for vallergan) and a shorter duration of action (1 hour *vs* 4 – 5 hours for vallergan) (17). Both midazolam and vallergan have been reported to have antiemetic properties (1, 16, 17). In this study, more patients who received midazolam vomited than those given vallergan (21.1% and 2.7% respectively). The significance of this finding is questionable as the number of patients in each group was small. Two out of five patients who received an opioid agent for premedication vomited despite it being co-administered with an antiemetic (promethazine hydrochloride). A large number of patients were not premedicated and this was due to concerns of possible respiratory depression in those with significant preoperative upper airway obstruction.

More anaesthetic inductions were inhalational rather than intravenous and this reflects the fact that the majority of the study population was in the paediatric age group. There was no significant difference in the frequency of vomiting between these two groups. Propofol has been shown in the literature to be antiemetic (1, 3, 7, 11, 15) and possibly the agent of choice for intravenous induction in older patients. The results showed slightly lower incidences of vomiting with thiopentone and sevoflurane, than with propofol in this study. Further analysis revealed that the low incidence of vomiting seen with sevoflurane could have been due to the confounding effect of steroid use. The odds risk ratio calculated showed a six-fold increase in vomiting in patients who were induced with sevoflurane and did not receive steroid.

Atropine is used routinely to counteract the side effects of anticholinesterase drugs used to reverse neuromuscular blockade. It has antiemetic effects that appear to be due to its ability to block central afferent cholinergic pathways involved in emesis (26, 27). In contrast, the muscarinic actions of cholinesterase inhibitors such as neostigmine on the gastrointestinal tract may increase postoperative vomiting (28). In this study, patients who received atropine and neostigmine for reversal had an increased incidence of vomiting (20.9% *vs* 8.9%). This may be related to the fact that the atropine was given in lower doses than recommended (0.02 mg/kg) to reverse the muscarinic side effects of neostigmine, and hence, the emetogenic effects of the neostigmine predominated.

Analgesia was most commonly a combination of a nonsteroidal anti-inflammatory agent and an opioid, which allowed smaller doses of each to be used, thereby decreasing the side effects of each. The incidence of vomiting in this patient group was lower (12.7%) than in those who received nonsteroidal agents only (20.0%). The higher incidence of vomiting in the latter group could be due to inadequate analgesia, as pain is also a trigger for vomiting (6, 18). However, of the 32 patients who vomited, 28 received opioid analgesia (87.5%). Fifteen of these patients (53.6%) were given antiemetics prophylactically. This suggests that opioids play a role in producing postoperative vomiting and that the usual antiemetics (dimenhydrinate and promethazine hydrochloride) may not provide sufficient protection.

The antibiotics co-trimoxazole and ceftriaxone produced more vomiting than metronidazole and amoxicillin/clavulanic acid. A number of antibiotics are well known to produce nausea and vomiting and both co-trimoxazole and ceftriaxone have been documented to be emetogenic. Amoxicillin/clavulanic acid and intravenous metronidazole have minimal gastrointestinal side effects (29).

In this study, the duration of anaesthesia did not appear to affect the incidence of vomiting. A prolonged anaesthetic time is usually due to a more difficult operation and may be associated with increased blood loss and a possible increased risk of vomiting (6, 29).

The majority of patients were discharged within 24 hours postoperatively, and in those for whom discharge was delayed, it was for reasons other than emesis. Therefore, in this study, postoperative emesis did not affect the time to discharge.

Limitations of the study

This was not a randomized clinical trial but an observational study and hence the results can be considered level three evidence as described by the United States Agency for Health Care Policy and Research (30). Problems with interpreting data from this study included the small size of the study population and the numerous variables that were not standardized and could affect the outcome (emesis).

However, a number of facts have emerged: (i) the incidence of vomiting is significantly lower than that reported in most of the literature and may be due to a racial difference; (ii) prophylactic use of dexamethasone at a dose of 150 mcg/kg was shown to be of benefit in reducing the incidence of vomiting post tonsillectomy; (iii) atropine and neostigmine used for reversal of neuromuscular blockade increased the incidence of vomiting; and (iv) usual prophylactic antiemetics (dimenhydrinate, promethazine hydrochloride) and other agents known to have antiemetic properties - such as midazolam (premedicant) and propofol (induction agent) lacked any significant protective effects.

The information obtained from this study can be used to formulate a protocol for the conduct of anaesthesia for

patients undergoing tonsillectomies at this institution. Day case tonsillectomies should be considered in selected patients, as they could provide considerable savings to the hospital and families. It would also decrease the emotional cost to the patient, by minimizing the period of separation from family and familiar surroundings. We also highly recommend the use of dexamethasone at a dose of 150cg/kg prophylactically in all patients undergoing tonsillectomies. Although this dose was of benefit in our patients, the literature quotes a wide range of 150 mcg/kg to 1 mg/kg (1, 2, 28). A follow-up randomized controlled trial would help to clarify the optimum dose of dexamethasone in the reduction of vomiting post tonsillectomy.

ACKNOWLEDGEMENTS

We would like to thank the consultants, residents and nurses of the Section of Anaesthesia and Intensive Care and those of otorhinolaryngology, especially Dr Hugh Ashman, for their assistance with this study.

REFERENCES

1. Splinter W, Roberts DJ. Prophylaxis for vomiting by children after tonsillectomy: dexamethasone versus perphenazine. Anesth Analg 1997; **85:** 534-7.
2. Pappas AL, Sukhani R, Hotaling AJ, Mikat-Stevens M, Javorski JJ, Donzelli J et al. The effect of preoperative dexamethasone on the immediate and delayed postoperative morbidity in children undergoing adenotonsillectomy. Anesth Analg 1998; **87:** 57-61.
3. Ved SA, Walden TL, Montana J, Lea DE, Tefft MC, Kataria BK et al. Vomiting and recovery after outpatient tonsillectomy and adenoidectomy in children. comparison of four anesthetic techniques using nitrous oxide with halothane or propofol. Anesthesiology 1996; **85:** 4-10.
4. Splinter WM, Rhine EJ. Low dose ondansetron with dexamethasone more effectively decreases vomiting after strabismus surgery in children than does high-dose ondansetron. Anesthesiology 1998; **88:** 72-5.
5. Divatia JV, Vaidya JS, Badwe RA, Hawaldar RW. Omission of nitrous oxide during anesthesia reduces the incidence of postoperative nausea and vomiting. A meta-analysis. Anesthesiology 1996; **85:** 1055-62.
6. Watcha MF, White PF. Postoperative nausea and vomiting. Its etiology, treatment and prevention. Anesthesiology 1992; **77:** 162-84.
7. Maxwell LG, Yaster M. Perioperative management issues in pediatric patients. Anesthesiol Clin North America 2000; **18:** 601-32.
8. Kenny GN. Risk factors for postoperative nausea and vomiting. Anaesthesia 1994; **49** (Suppl): 6-10.
9. Weinstein MS, Nicholson SC, Schreiner MS. A single dose of morphine sulphate increases the incidence of vomiting after outpatient inguinal surgery in children. Anesthesiology 1994; **3:** 572-7.
10. Ralsey PG, Smith G. Anaesthetic factors contributing to postoperative nausea and vomiting. Br J Anaesth 1992; **69** (Suppl)**:** 40-55.
11. Barst SM, Leiderman JU, Markowitz, Rosen AM, Abramson AL, Bienkowski RJ. Ondansetron with propofol reduces the incidence of emesis in children following tonsillectomy. Can J Anaesth 1999; **46:** 359-62.
12. Splinter WM, Roberts DJ. Perphenazine decreases vomiting by children after tonsillectomy. Can J Anaesth 1997; **44:** 1308-10.
13. Vosdoganis F, Baines DB. The effect of single dose intravenous dexamethasone in tonsillectomy in children. Anaesth Intensive Care 1999; **27:** 489-92.
14. Tom LW, Templeton JJ, Thompson ME, Marsh RR. Dexamethasone in adenotonsillectomy. Int J Pediatr Othorhinolaryngol 1996; **37:** 115-20.
15. Martin TM, Nicolson SC, Bargas MS. Propofol anesthesia reduces emesis and airway obstruction in pediatric outpatient. Anesth Analg 1993; **76:** 144-8.
16. Splinter WM, MacNeill HB, Menard EA, Rhine EJ, Roberts DJ, Gould MH. Midazolam reduces vomiting after tonsillectomy in children. Can J Anaesth 1995; **42:** 201-3.
17. Sasada MP, Smith SP. Drugs in Anaesthesia and Intensive Care, 2nd ed, Oxford Medical Publications, 1999.
18. Romsing J, Ostergaard D, Drozdziewicz D, Schultz P, Ravn G. Diclofenac or acetaminophen for analgesia in paediatric tonsillectomy outpatients. Acta Anaesthesiol Scand 2000; **44:** 291-5.
19. Stewart PC, Baines DB, Dalton C. Paediatric day stay tonsillectomy service: development and audit. Anaesth Intensive Care 2002; **30:** 641-6.
20. Tigerstedt I, Salmela L, Aromaa U. Double-blind comparison of transdermal scopolamine, droperidol and placebo against postoperative nausea and vomiting. Acta Anaesthesiol Scand 1988; **32:** 454-7.
21. Harvey AB. Postoperative nausea and vomiting in the recovery room. A report from Guyana. West Indian Med J 2001; **50:** 31-6.
22. Soyannwo OA, Ajuwon AJ, Amanor-Boadu SD, Ajao OG. Post operative nausea and vomiting in Nigerians. East Afr Med J 1998; **75:** 243-5.
23. Acalovschi I. Postoperative nausea and vomiting. Current Anaesthesia & Critical Care 2002; **13:** 37-43.
24. Beattie WS, Lindblad T, Buckley DN, Forrest JB. The incidence of postoperative nausea and vomiting in women undergoing laparoscopy is influenced by the day of the menstrual cycle. Can J Anaesth 1991; **38:** 298-302.
25. Splinter WM, Roberts DJ. Dexamethasone decreases vomiting by children after tonsillectomy. Anesth Analg 1996; **83:** 913-6.
26. Chhibber AK, Lustik SJ, Thakur R, Francisco DR, Fickling KB. Effects of anticholinergics on postoperative vomiting, recovery and hospital stay in children undergoing tonsillectomy with or without adenoidectomy. Anesthesiology 1999; **90:** 697-700.
27. Salmenpera M, Kuoppamaki R, Salmenpera A. Do anticholinergic agents affect the occurrence of postanaesthetic nausea? Acta Anaesthesiol Scand 1992; **36:** 445-8.
28. Rose JB, Watcha MF. Postoperative nausea and vomiting in paediatric patients. Br J Anaesth 1999; **83:** 104-17.
29. Cunha BA. Antibiotic side effects. Med Clin North Am 2001; **85:** 149-85.
30. US Department of Health and Human Services. Agency for Health Care Policy and Research. Rockville (MD): The Agency; 1993. Clinical Practice Guideline No 1. AHCPR Publication No 92-0023: 107.