A significant reduction in paediatric post-tonsillectomy vomiting through audit

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ABSTRACT

INTRODUCTION Postoperative vomiting occurs more frequently after tonsillectomy than any other commonly performed paediatric operation. Postoperative vomiting is also the commonest cause of morbidity and re-admission following tonsillectomy. We present a successful completed audit cycle and literature review on the subject.

PATIENTS AND METHODS Data on the risk factors for postoperative vomiting, whether the patient vomited and details of the patient's vomitus were collected prospectively on consecutive patients and compared with a gold standard. Changes in practice were agreed and a second cycle performed.

RESULTS Two cycles and a total of 107 patients were included in the audit. A significant reduction in vomiting from 27% to 11% was achieved following the introduction of routine use of intravenous dexamethasone during surgery.

CONCLUSIONS This simple prospective audit of paediatric post-tonsillectomy vomiting has resulted in a statistically significant reduction in vomiting which would appear to be due to use of intra-operative steroids.

KEYWORDS

Postoperative – Vomiting – Paediatric – Tonsillectomy

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Vomiting is an important complication after paediatric tonsillectomy. In a survey of the 16 most commonly performed paediatric operations, tonsillectomy was found to have the highest rate of postoperative vomiting.¹ Vomiting is also the commonest cause of morbidity; re-admission after day-case tonsillectomy accounts for 30% of re-admissions (Fig. 1).² This makes it an excellent topic for audit as improvements in practice may bring about both health benefits on an individual level and financial benefits at a trust level.

A review of the literature indicated many reasons for the high rate of vomiting after paediatric tonsillectomy. These can be divided into surgical, anaesthetic and patient factors (Table 1).

Surgical factors

SURGICAL TECHNIQUE

Vomiting is a reflex behaviour controlled by the vomiting centre in the medulla oblongata. Afferent inputs to this centre are found in the faucial mucosa and posterior oropharynx; thus, operations on this area which cause trigeminal nerve stimulation are associated with a higher rate of vomiting.³

Diathermy tonsillectomy is anecdotally associated with a higher rate of postoperative vomiting than cold steel as it is thought to be more painful although no evidence exists for this in the literature.

Figure 1 Reason for re-admission following day-case ENT surgery.

Table 1 Reasons for the high rate of vomiting after paediatric tonsillectomy

Surgical factors	Trigeminal nerve stimulation Diathermy Swallowed blood
Anaesthetic factors	Opiates Steroids Anti-emetics Inhalational anaesthesia Laryngeal mask airway
Patient factors	Age Sex

A patient prepared and positioned for tonsillectomy is more likely to ingest blood from the operative site as: (i) the Boyle–Davis gag and neck extension positioning may open the hypopharynx and laryngopharynx altering cricopharyngeal pressure; and (ii) muscle relaxants are frequently given. This ‘swallowed’ blood causes gastrointestinal irritation and thus increases the likelihood of postoperative vomiting. The amount of blood ingested is difficult to measure but a recently published study showed a trend of increased postoperative vomiting in patients where greater than 10% of total blood volume was lost: a significant amount may have been ingested in these patients.⁴ It is, therefore, important to suction the oropharynx during surgery. Some surgeons have suggested packing the throat before removing the tonsils or suctioning the stomach with a nasogastric tube afterwards.

Anaesthetic factors

OPIATES

Opiates are a well-known cause of nausea and vomiting. This is caused by stimulation of the chemoreceptor trigger zone which sends afferents to the vomiting centre. There is reluctance to change to NSAIDs and simple analgesics despite evidence that they provide adequate analgesia without causing increased bleeding.^{5,6}

STERIODS

Evidence from a recent Cochrane review, which included 8 studies with a total of 640 patients, suggests that a single, intravenous, intra-operative dose of dexamethasone between 0.15–1 mg/kg halves the risk of vomiting. Of the 312 patients given dexamethasone, there were no adverse effects recorded. It is interesting to note that no mechanism of action is known for this effect.⁷

ANTI-EMETICS

Prophylactic ondansetron works better than either droperidol or metaclopramide in reducing postoperative vomiting.⁸ Anti-emetics work best in combination because of their different mechanisms of action.⁹

INHALATIONAL ANAESTHESIA

About 25% of patients suffer from postoperative nausea and vomiting after general anaesthesia with volatile anaesthetics. This appears to be independent of the agent given (*e.g.* Halothane versus Isoflurane). When total intravenous anaesthetic with Propofol is substituted for the volatile anaesthetic, the risk of vomiting is reduced by 20%.⁹ Nitrous oxide is commonly used to reduce the amount of volatile anaesthetic required; however, it is associated with a 28% increased risk of vomiting.¹⁰

LARYNGEAL MASK AIRWAY

There appears to be no consensus in the literature on whether laryngeal mask airway (LMA) reduces vomiting or not; however, theoretically, one would expect there to be less as no muscle relaxant reversal is required and there should be less swallowed blood.^{11,12}

Patient factors

AGE

The incidence of postoperative vomiting is low at birth and increases to a peak in late childhood (between 6–16 years) before decreasing in adulthood.¹³ This pattern is observed regardless of the operation performed and this age group are consistently found to vomit more, despite the fact that drugs which increase the risk of vomiting (such as premedication and opioids) are commonly avoided in paediatric surgery. Children of this age group have a greater awareness of what is going on than younger children but a poorer understanding than adults. This leads to greater levels of anxiety, fear, and pain and may explain the increased risk of vomiting. Unfortunately, this is the commonest age group in which tonsillectomy is performed.

SEX

Postoperative vomiting is 2–3 times more common in adult females than adult males.¹³ This finding is thought to be due to fluctuations in female sex hormones with the greatest incidence occurring during the third and fourth week of the menstrual cycle.

Patients and Methods

We performed a prospective audit on 51 consecutive children (aged less than 16 years) undergoing tonsillectomy alone between 23 February 2005 and 11 May 2005. Age, sex, weight, risk factors for vomiting, whether they vomited and details of the vomit were recorded (see Appendix 1). A gold standard

Table 2 Epsom children's ENT day-case anaesthetic protocol

- Clear fluids until 2 h pre-operatively
- EMLA or Ametop over 2 suitable veins
- Propofol 4 mg/kg
- i.v. ondansetron 0.1 mg/kg
- Maintenance: sevoflurane in air and O₂
- Reinforced laryngeal mask airway in children 3 years and above
- Spontaneous breathing via a suitable breathing system
- Dexamethasone 0.15 mg/kg
- Rectal diclofenac 1 mg/kg
- Rectal paracetamol 20 mg/kg
- i.m. codeine phosphate 1 mg/kg
- i.v. crystalloids 10 ml/kg (4–5 ml/kg/h)

against which to compare our operative/anaesthetic technique and rate of vomiting was set using published data including the Epsom Protocol (Table 2).¹² Changes were implemented as a result of the findings of the first cycle and the audit was repeated in 56 consecutive patients from 5 March 2006 to 18 June 2006.

Results

First cycle

The first audit cycle revealed that 27% of patients vomited. This compared unfavourably with a recent published figure of 13%.⁴ Figure 2 gives a breakdown of the percentage of the cohort exposed to the various risk factors. LMAs were not used, 96% of patients were maintained on NO₂ and opiates were given to 89% of patients. Overall, 88% of patients were given ondansetron but no patients received dexamethasone.

Presentation of results to a joint ENT/anaesthetic audit meeting

We decided to present our literature review and results to a joint ENT/anaesthetic audit meeting. There exists a great variation in the way patients undergoing tonsillectomy are anaesthetised by different anaesthetists. Some felt that using NO₂ as a carrier gas would reduce nausea and vomiting by reducing the amount of volatile anaesthetic required. Others felt strongly that the risk of vomiting associated with opiate analgesia was outweighed by the need to achieve satisfactory pain relief. All anaesthetists did, however, agree to give all patients intravenous dexamethasone 0.1 mg/kg and ondansetron 0.1 mg/kg intra-operatively.

Second cycle

In the second cycle, complete compliance was achieved with

Figure 2 Paediatric post-tonsillectomy vomiting audit – first cycle.

intra-operative dexamethasone and ondansetron with no significant differences in any other factor recorded (Fig. 3). The vomiting rate in the second audit cycle was found to be 11%.

The SE of 27–11% = 7.49 gives a 95% confidence interval of $16 \pm (7.49 \times 1.96)$ which gives a *P*-value < 0.05 confirming a significant reduction.

Discussion

The significant reduction in vomiting rates appears to be a result of the complete compliance in giving dexamethasone and ondansetron (Fig. 3). *P*-values were obtained for all the changes in risk factors between the first and second cycle to

Table 3 Paediatric post-tonsillectomy vomiting audit summary

	First cycle (<i>n</i> = 51)		Second cycle (<i>n</i> = 56)		<i>P</i> -value
	All	Vomiters	All	Vomiters	
Coblation (%)	39	18	25	2	0.31
Starved and clear fluids only until 2 h pre-operatively	?	?	100	100	?
Premedication (other than simple analgesia/NSAIDs)	0	0	0	0	1
Laryngeal mask airway used	0	0	0	0	1
Maintenance with N ₂ O	96	100	100	100	0.48
Intra-operative i.v. dexamethasone 0.15 mg/kg given	0	0	100	100	0
Intra-operative i.v. ondansetron given	88	92	100	100	0.53
Opiates (including morphine, pethidine, fentanyl, alfentanil, codeine) given	89	100	100	100	0.55
Blood loss (ml)		?	72	89	?
Length of operation (min)	41	30	36	35	0.4
Overall vomiting rate	27	100	11	100	0.036

determine whether any other features (such as an increase in coblation tonsillectomy) could have influenced the outcome but no other significant change were found (Table 3).

Conclusions

This simple, prospective audit of paediatric post-tonsillectomy vomiting included two cycles and a total of 107 patients. A small change in practice has resulted in a statistically significant reduction in vomiting which would appear to be as a result of intra-operative steroids use.

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APPENDIX 1: Paediatric tonsillectomy postoperative audit – data collection sheet

Age	-----	Sex	-----	Weight (kg)	-----
Hospital number	-----				
FOR COMPLETION AT OPERATION (delete as applicable)					
Operation	Tonsillectomy	Adenotonsillectomy			
Starved from 6 h and clear fluids only until 2 h pre-operatively	Yes	No			
Premedication (other than simple analgesia/NSAIDs)	Yes	No			
Laryngeal mask airway used	Yes	No			
Maintenance with N ₂ O	Yes	No			
Intra-operative i.v. dexamethasone 0.15 mg/kg given	Yes	No			
Intra-operative i.v. ondansetron given	Yes	No			
Opiates (including morphine, pethidine, fentanyl, alfentanil, codeine) given	Yes	No			
Blood loss (ml)	-----				
Length of operation (min)	-----				
FOR COMPLETION AT DISCHARGE					
Postoperative vomiting	Yes	No			
Hours postoperatively	-----				
Volume (ml)	-----				
Consistency	Vomit only	Vomit + blood	Blood only		