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POSTOPERATIVE NAUSEA AND VOMITING IN CHILDREN

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Introduction

Anesthesia and Analgesia — October, 1922

Some Observations on the Value of Pre-Operative Treatment for the Surgical Patient in Relation to Anesthesia*

W. J. DeFries, M. D., Anesthetist, Toronto, Canada



POST-OPERATIVE VOMITING has always been dreaded by the surgeon as well as by the anesthetist. If the patient is not nauseated after the operation, then the anesthetist is quick to take the credit for administering a good anesthetic, but if, on the other hand, persistent vomiting occurs, the surgeon, by his manipulations during the operation, was of course, undoubtedly to blame! But that time has passed when the expressions: “the patient took a good anesthetic” or “he took a poor anesthetic” can be used.

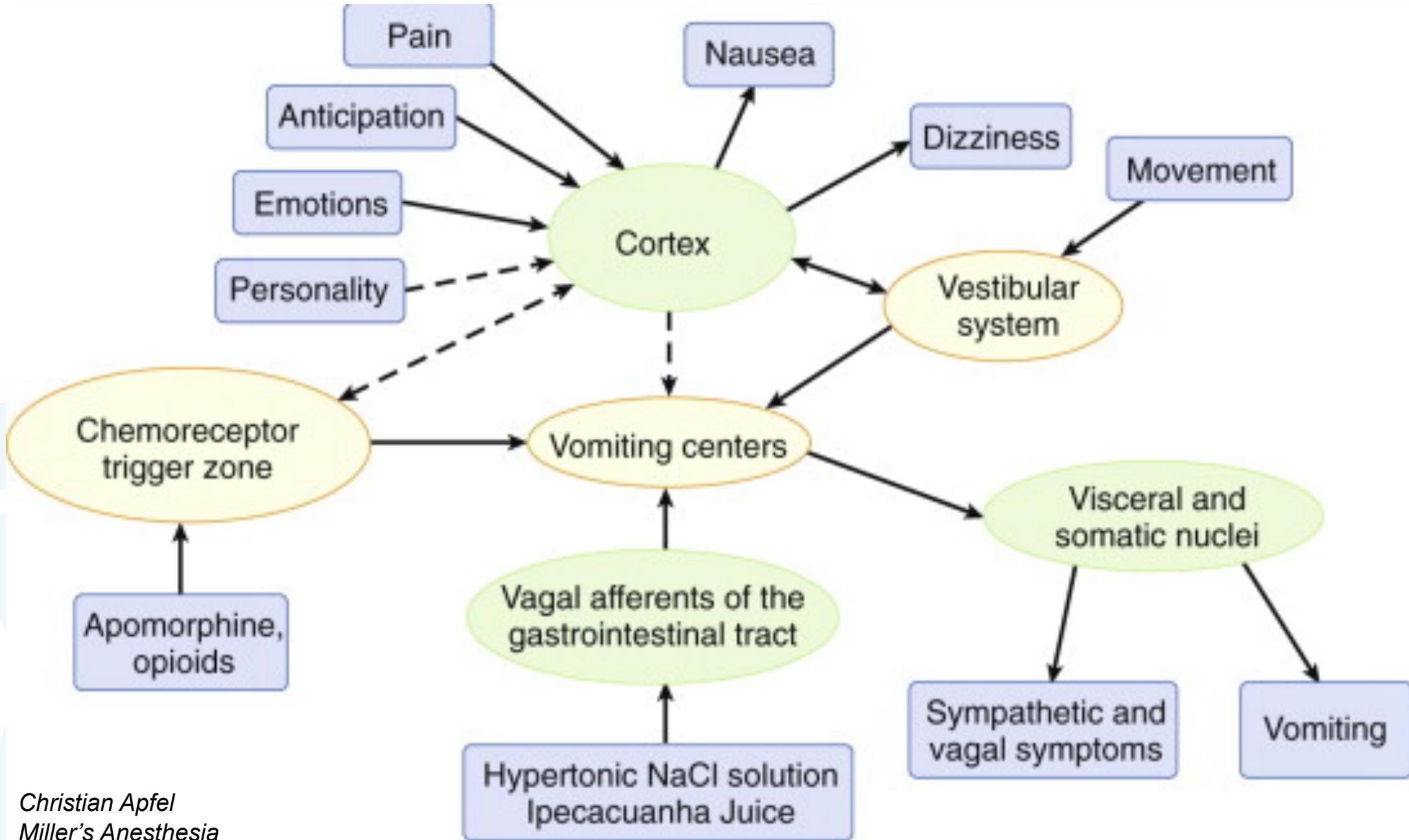


Incidence

- The “big little problem”
- Twice as high as in adults
- Overall incidence: 13 – 42%
- < 3y: 22 – 40%
- > 3y: 42 – 51% (0.2-0.8% / year)



Pathophysiology





Risk Factors

- Patient-related factors
- Surgical factors
- Anesthetic-related factors



Patient related risk factors: AGE

Table 5. Recovery Room Events by Age of Child, 1982–1987 (Rate per 10,000 Anesthetics)

	Age											
	<1 mo (n = 361)		1–12 mo (n = 2,544)		1–5 yr (n = 13,484)		6–10 yr (n = 7,184)		11+ yr (n = 5,647)		Total (n = 29,220)	
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate
None	301	8,338	2,376	9,340	11,971	8,878	6,201	8,632	4,848	8,585	25,696	8,794
Laryngospasm	1	28	11	43	252	187	127	177	93	165	484	166 ^a
Vomiting	0		21	83	552	410	614	855	528	935	1,715	587 ^a
Cardiac arrest	2	55 ^b	1	4	3	2	1	1	0		7	2
Arrhythmia	0		3	12	11	8	11	15	5	9	30	10
Blood pressure	50	1,385 ^b	3	12	13	10 ^b	11	15 ^b	18	32	95	17
Temperature	17	471 ^b	35	138	77	57 ^b	62	86	90	159 ^b	281	96
Airway obstruction	1	28	41	161	599	444	187	260	104	184	932	319 ^a
Other respiratory	42	1,163 ^b	63	248 ^b	142	105	56	78 ^b	58	103	361	124
Drug incident	0		5	20	26	19	14	19	17	30	62	21
Surgical	1	28	16	63	177	131	120	167	43	76	357	122

^a*p* < 0.01, χ^2 test for association.

^b*p* < 0.01, exact tail probability calculation based on Poisson distribution.

Cohen MM. Anesth Analg;1990

Risk of POV increases markedly above 3 years



Patient related risk factors: History of PONV

The Development and Validation of a Risk Score to Predict the Probability of Postoperative Vomiting in Pediatric Patients

L. H. J. Eberhart, MD*, G. Geldner, MD*, P. Kranke, MD†, A. M. Morin, MD*, A. Schäuffelen, MD‡, H. Treiber, MD‡, and H. Wulf, MD*

Anesth Analg 2004

Table 3. Results of the Initial Logistic Regression Analysis in Which All Available Variables, Including the Dichotomized Derivates of the Continuous Data (Age, Duration of Surgery, and Anesthesia) Were Included

	β Coefficient	SE of β	P value	OR	95% Confidence interval of the OR
Strabismus surgery	1.649	0.201	<0.0001	5.200	3.509–7.708
Age (per year)	0.055	0.026	0.032	1.057	1.005–1.112
Age \geq 3 yr	0.862	0.273	0.002	2.368	1.386–4.048
Duration of anesthesia >90 min	0.636	0.182	<0.0001	1.889	1.322–2.699
Duration of surgery >30 min	0.935	0.170	<0.0001	2.548	1.826–3.556
History of PV in the child	0.957	0.277	0.001	2.604	1.512–4.484
History of PV/PONV in the father, mother, or siblings	0.356	0.145	0.014	1.428	1.076–1.896
Constant	-3.080	0.263	<0.0001		

Nagelkerke's R^2 was 0.265 and the area under the receiver operating characteristic curve (and its 95% confidence interval) for patients of the *validation* dataset were 0.76 (0.72–0.80).

OR = odds ratio, PV = postoperative vomiting; PONV = postoperative nausea and vomiting.

A previous history of PONV is an independent risk factor of PONV in children



Patient related risk factors: **Motion sickness**

Motion sickness as a predictor of postoperative vomiting in children aged 1–16 years

MARK THOMAS BSc MBBChir FRCA*, GREG WOODHEAD†, NADIA MASOOD‡ AND RICHARD HOWARD BSc MBChB FRCA*

**Department of Anaesthesia, Great Ormond Street Hospital, London, †Aberdeen Medical School, University of Aberdeen, Aberdeen and ‡St George's Medical School, London, UK*

Pediatric Anesthesia 2007

A previous history of motion sickness is likely to be an independent risk factor of subsequent POV in children



Patient related risk factors: **GENDER**

- Female
- From puberty
- 2 to 4 fold increased risk compared to prepubescent girls

Post-pubertal girls have an increased incidence of POV which may be sex hormone related although phase of the menstrual cycle does not appear to affect the incidence



Patient related risk factors

5) Preoperative anxiety

Preoperative Anxiety and Postoperative Nausea and Vomiting in Children: Is There an Association?

Shu-Ming Wang, MD*, and Zeev N. Kain, MD*†‡

ANESTH ANALG 2000;90:571-5

6) Obesity

7) Smoking



Surgical factors: DURATION OF SURGERY

Effect of duration of anaesthesia.

Duration	Number of patients	% of patients who vomited	Average number of vomiting episodes per patient
Less than 30 minutes	547	34.4%*	0.92
30-60 minutes	291	48.4%	1.29
Over 60 minutes	345	47.2%	1.22

*p < 0.001 for comparison with the other two groups.

Anaesth Intensive care;1982

Table 4. Results of the Logistic Regression Analysis in Which Duplicate Risk Factors (Each with Two Levels) Were Reduced to One Dichotomous Information (age ≥ 3 yr; Duration of Surgery >30 min)

	β Coefficient	SE	P value	OR	95% Confidence interval of the OR
Strabismus surgery	1.465	0.196	<0.0001	4.327	2.945–6.357
Age of ≥ 3 yr	1.204	0.229	<0.0001	3.334	2.130–5.218
Duration of surgery >30 min	1.179	0.155	<0.0001	3.252	2.400–4.408
History of PV in the child or history of PV/PONV in the father, mother, or siblings	1.445	0.342	<0.0001	4.241	2.168–8.296
Constant	-2.786	0.241	<0.0001		

This model is the basis for the final adjustments in which the coefficients were removed to achieve a simplified score. Nagelkerke's $R^2 = 0.250$; area under the curve = 0.71 (95% confidence interval: 0.67–0.74).

OR = odds ratio, PV = postoperative vomiting, PONV = postoperative nausea and vomiting.

ANESTH ANALG; 2004

POV increases significantly if operative procedures under GA last more than 30 minutes



Surgical factors: **TYPE OF SURGERY**

- STRABISMUS SURGERY
- ADENOTONSILLECTOMY
- OTOPLASTY
- GROIN and PENILE SURGERY



Surgical factors: **STRABISMUS SURGERY**

Prevention of vomiting after paediatric strabismus surgery: a systematic review using the numbers-needed-to-treat method

M. TRAMÈR, A. MOORE AND H. MCQUAY

British Journal of Anaesthesia 1995; 75: 556–561

- Early vomiting: 54%
- Late vomiting: 59%

Children undergoing strabismus surgery are at high risk of POV and require a multimodal approach



Surgical factors: **ADENOTONSILLECTOMY**

Paediatric tonsillectomy and PONV -- big little problem remains big! Roberts RG, Jones RM

Anaesthesia. 2002 Jun;57(6):619-20.

70% → 36% (ondansetron)

Paediatric day stay tonsillectomy service: development and audit. Stewart PC, Baines DB

Anaesth Intensive Care. 2002

15,6% (dexamethasone and ondansetron)



Surgical factors: **ADENOTONSILLECTOMY**

Effects of antiemetics in children undergoing tonsillectomy on postoperative vomiting and postoperative nausea and vomiting

Rose et al. ^[137]	136	2–12	Midazolam 0.5 mg/kg PO Dexamethasone 0.1 mg/kg Ondansetron 0.15 mg/kg Ondansetron 0.075 mg/kg Placebo	Ondansetron 0.15 = dexamethasone 0.1 > midazolam > ondansetron 0.075 = placebo
Splinter and Rhine ^[138]	240	2–12	Ondansetron 0.15 mg/kg Ondansetron 0.05 mg/kg	Ondansetron 0.15 > ondansetron 0.05
Splinter and Rhine ^[139]	216	2–12	Ondansetron 0.15 mg/kg Perphenazine 0.07 mg/kg	Ondansetron = perphenazine
Sukhani et al. ^[75]	149	2–12	Dexamethasone 1 mg/kg Ondansetron 0.15 mg/kg Dolasetron 0.5 mg/kg Placebo	Ondansetron = dolasetron = dexamethasone > placebo
Stene et al. ^[140]	132	2–12	Metoclopramide 0.25 mg/kg IV Ondansetron 0.15 mg/kg Placebo	Ondansetron > metoclopramide = placebo
Hamid et al. ^[141]	74	2–10	Ondansetron 0.1 mg Dimenhydrinate 0.5 mg/kg Placebo	Ondansetron > dimenhydrinate > placebo
Fujii et al. ^[142]	90	4–10	Granisetron 40 µg/kg IV Ramosetron 6 µg/kg	Ramosetron > granisetron
Jensen et al. ^[143]	71	2–14	Tropisetron 0.2 mg/kg Placebo	Tropisetron > placebo



Surgical factors: **ADENOTONSILLECTOMY**

Children undergoing tonsillectomy are at increased risk of POV, decrease swallowed blood, avoid long-acting opioid analgesia and give prophylactic anti-emetics



Surgical factors: **Otoplasty**

- Incidence of 60% without prophylaxis

Otoplasty in children has emetic potential, propofol infusion gives significantly lesser POV and prophylaxis with anti-emetics is recommended



Anaesthetic factors: **Premedication**

- Transdermal scopolamine
- Midazolam
- Clonidine



Anaesthetic factors: Nitrous oxide

Nitrous Oxide Does Not Increase Vomiting After Dental Restorations in Children

William M. Splinter, MD, FRCPC, and Lydia Komocar, RN

Department of Anaesthesia, Children's Hospital of Eastern Ontario and University of Ottawa, Ottawa, Ontario, Canada

Vomiting After Outpatient Tonsillectomy and Adenoidectomy in Children: The Role of Nitrous Oxide

Uma A. Pandit, MD, Shobha Malviya, MD, and Ian H. Lewis, MBBS, MRCP, FFARCS

Department of Anesthesiology, C. S. Mott Children's Hospital, University of Michigan Medical Center, Ann Arbor, Michigan

Omitting nitrous oxide in general anaesthesia: meta-analysis of intraoperative awareness and postoperative emesis in randomized controlled trials

M. TRAMÈR, A. MOORE AND H. MCQUAY



Anaesthetic factors: Nitrous oxide

Table 2 Baseline risk, risk reduction, and numbers-needed-to-treat (NNT) to prevent early vomiting by omitting nitrous oxide. ∞ = Infinite value. Def. = Definition; PONV = postoperative nausea and vomiting; V = vomiting; R = retching; N₂O = nitrous oxide; Extra-abd = extra-abdominal; Abd = abdominal; Gyn = gynaecological; Uro = urological; Laps = laparoscopy; diff = different operations; Paed strab = paediatric strabismus surgery; Paed tons = paediatric tonsillectomies; Ortho = orthopaedic operations; ENT = ear, nose and throat

Ref.	Surgery	Main anaesthetic	Mode of ventilation	Opioid use	Gastric suction	Duration of intervention (mean) an = anaesthetic	Def. of PONV	%PONV N ₂ O (control)	%PONV air-O ₂ (active)	Risk reduction (%)	Odds ratio (95% CI)	NNT (95% CI)
Studies with low baseline risk (<17%)												
[32]	Extra-abd	Isoflurane	Intubation	No	Yes	>30 min (an)	V	13%	6%	50%	2.0 (0.2, 21.2)	16 (3.8, ∞)
[32]	Extra-abd	Isoflurane	Intubation	Yes	Yes	>30 min (an)	V	6%	13%	-113%	0.5 (0.04, 4.7)	∞
[34]	Gyn major	Propofol	Intubation	Yes	No	30-68 min	V	0%	0%	0%	0	0
[35]	Gyn minor	Propofol	Mask	No	No	5-10 min	V	0%	0%	0%	0	0
[26]	Adults diff	Enflurane	Intubation	Yes	No	80 min (an)	R+V	7%	6%	15%	1.2 (0.5, 2.7)	104.9 (17.6, ∞)
[26]	Adults diff	Isoflurane	Intubation	Yes	No	80 min (an)	R+V	8%	5%	43%	1.8 (0.8, 4.1)	29.1 (12.1, ∞)
[42]	Paed strab	Propofol	Intubation	Yes	No	29 min	R+V	4%	4%	0%	1.0 (0.1, 16.5)	0 (9.2, ∞)
Combined data								7%	5%	27%	1.4 (0.8, 2.4)	57.8 (21.4, ∞)
Combined data without large trials ([26-28])												
Studies with high baseline risk (>17%)												
[37]	Ortho minor	Desflurane	Intubation	Yes	No	94 min (an)	V	50%	13%	75%	5.6 (1.2, 2.6)	2.7 (1.5, 14.9)
[30]	Gyn laps	Enflurane	Intubation	Yes	No	40 min (an)	V	29%	4%	85%	6.2 (2, 19.4)	4.0 (2.5, 10.2)
[38]	Paed tons	Halothane	Intubation	Yes	Yes	37 min	R+V	50%	40%	20%	1.5 (0.5, 4.1)	10 (2.9, ∞)
[40]	Abd major	Isoflurane	Intubation	Yes	Yes	121 min (an)	R+V	35%	17%	52%	2.5 (0.7, 8.7)	5.6 (2.4, ∞)
[41]	Ortho minor	Desflurane	Intubation	Yes	No	57 min	V	33%	23%	32%	1.7 (0.5, 6.0)	9.4 (2.8, ∞)
[43]	Laps	Enflurane	Intubation	Yes	No	15 min	V	33%	13%	61%	3.1 (0.97, 9.7)	4.9 (2.5, ∞)
[46]	Paed strab	Propofol	Intubation	Yes	Yes	54 min	V	47%	17%	64%	3.9 (1.3, 11.5)	3.3 (1.9, 13)
[31]	Paed ENT	Halothane	Mask	No	No	10 min (an)	R+V	21%	4%	80%	4.6 (1.4, 15.5)	5.8 (3.3, 24.3)
[47]	Ortho minor	Desflurane	Intubation	Yes	No	29 min	V	29%	0%	100%	8.9 (1.1, 71.2)	3.5 (1.9, 20.4)
Combined data								35%	14%	60%	3.1 (2.1, 4.6)	4.8 (3.6, 7.3)
Combined data without large trials ([26-28])												

Table 3 Baseline risk, risk reduction, and numbers-needed-to-treat (NNT) to prevent late vomiting by omitting nitrous oxide. ∞ = Infinite value. (Abbreviations as in table 2)

Ref.	Surgery	Main anaesthetic	Mode of ventilation	Opioid use	Gastric suction	Duration of intervention (mean) an = anaesthetic	Def. of PONV	%PONV N ₂ O (control)	%PONV air-O ₂ (active)	Risk reduction (%)	Odds ratio (95% CI)	NNT (95% CI)
Studies with low baseline risk (<30%)												
[29]	Gyn + Uro	Propofol	Mask	No	No	12 min (an)	V	6%	0%	100%	7.7 (0.8, 75.8)	16.7 (8, ∞)
[35]	Gyn minor	Propofol	Mask	No	No	5-10 min	V	0%	0%	0%	0	0
[26]	Adults diff	Enflurane	Intubation	Yes	No	80 min	R+V	29%	26%	9%	1.1 (0.7, 1.8)	37.3 (8.4, ∞)
[26]	Adults diff	Isoflurane	Intubation	Yes	No	80 min	R+V	24%	21%	14%	1.2 (0.7, 2)	30.2 (8.4, ∞)
[28]	Paed ENT	Halothane	Mask	No	No	12 min (an)	V	13%	13%	2%	1 (0.5, 2)	304.7 (1.3, ∞)
Combined data								20%	18%	12%	1.2 (0.9, 1.6)	43.5 (14.9, ∞)
Combined data without large trials ([26-28])												
Studies with high baseline risk (>30%)												
[27]	Adults diff	Isoflurane	Intubation	Yes	No	178 min (an)	V	46%	34%	25%	1.6 (1, 2.7)	8.5 (4.3, ∞)
[33]	Gyn laps	Desflurane	Intubation	Yes	No	25 min (an)	V	43%	40%	7%	1.1 (0.3, 4.8)	35 (2.6, ∞)
[30]	Gyn laps	Enflurane	Intubation	Yes	No	40 min (an)	V	49%	17%	64%	4.1 (1.7, 10.2)	3.2 (2, 8)
[38]	Paed tons	Halothane	Intubation	Yes	Yes	37 min	R+V	67%	60%	10%	1.3 (0.5, 3.8)	15 (3.3, ∞)
[39]	Gyn major	Isoflurane	Intubation	Yes	No	99 min	V	71%	42%	40%	3.1 (0.8, 11.3)	3.5 (1.7, ∞)
[42]	Paed strab	Propofol	Intubation	Yes	No	29 min	R+V	44%	28%	36%	2 (0.6, 6.2)	6.3 (2.4, ∞)
[46]	Paed strab	Propofol	Intubation	Yes	Yes	54 min	V	60%	23%	61%	4.4 (1.6, 12.2)	2.7 (1.7, 7.4)
Combined data								51%	33%	35%	2.1 (1.5, 2.9)	5.6 (3.9, 10.1)
Combined data without large trials ([26-28])												



Anaesthetic factors: **Nitrous oxide**

The use of nitrous oxide does not appear to be associated with a high risk of POV in children



Anaesthetic factors: **Volatile agents**

- Modern volatile agents (VA) less emetogenic
- Volatile agents cause early POV in high risk patients
- Dose-response relationship between POV and duration of exposure
- Maintenance of anaesthesia more emetogenic with VA than with propofol

Volatile anaesthetic agents are associated with increased risk of emesis particularly in children with other risk factors for POV



Anaesthetic factors: Opioids

The Development and Validation of a Risk Score to Predict the Probability of Postoperative Vomiting in Pediatric Patients

L. H. J. Eberhart, MD*, G. Geldner, MD*, P. Kranke, MD†, A. M. Morin, MD*, A. Schäuffelen, MD‡, H. Treiber, MD‡, and H. Wulf, MD*

*Department of Anesthesia and Intensive Care, Philipps-University, Marburg; †Department of Anesthesiology and Intensive Care, University of Würzburg, Würzburg; and ‡Ambulatory Surgical Center Söflingen, Ulm, Germany

Table 5. Factors That Were Not Included in the Initial Risk Model

	β Coefficient	SE	P value	OR	95% Confidence interval of the OR
Administration of local or regional anesthesia	-0.543	0.281	0.065	0.581	0.331-1.032
Intraoperative opioid administration	-0.520	0.310	0.080	0.595	0.347-1.094
Postoperative opioid administration	0.492	0.366	0.139	1.636	0.838-3.52
Female gender	0.230	0.150	0.126	1.259	0.938-1.691
Surface surgery	-0.284	0.212	0.180	0.753	0.497-1.140

Only the five most important factors are listed. These were determined by an explorative *backward* logistic regression analysis using the maximum likelihood function.

OR = odds ratio.

Opioids may be associated with increased risk of POV particularly if long-acting opioids are used postoperatively



Anaesthetic factors

Use of anticholinesterase drugs may increase POV in children

Perioperative IV fluids may reduce POV in children after day-case surgery.

POV in children may be increased if tolerance of oral fluids is mandatory before discharge from day case surgery.



Risk scoring system

Validated, simplified PONV prognosis systems for adults and children, stating the risk factors involved and calculated incidences of PONV

Prognosis system	Koivuranta et al. (7)	Apfel et al. (1)	Eberhart et al. (12)
Patient population	Adults	Adults	Children
Risk factors	Female sex	Female sex	Age >3 years
	Prior history of PONV	History of PONV History of motion sickness	History of PONV or motion sickness in the child or a first-degree relative
	Prior history of motion sickness		
	Nonsmoker status	Nonsmoker status	Strabismus surgery
	Length of operation >60 min	Expected postoperative administration of opioids	Length of operation >30 min
Calculated incidence of PONV with n risk factors present (sum of the risk factors listed above)			
n	%	%	%
0	17	10	9
1	18	21	10
2	42	39	30
3	54	61	55
4	74	79	70
5	87	Not stated	Not stated



ANTI-EMETIC DRUGS: 5 HT₃ Antagonists

ONDANSETRON:

- The only 5 HT₃ antagonist with US FDA approval in children > 1 month
- UK licensed for 2-18y
- Safe first line anti-emetic for children
- Undesirable effects in children are rare and clinically unimportant
- Dose-related respons:

0.1mg/kg → NNT: 4,6	} for early POV
0.15mg/kg → NNT: 2,82	
- Oral route is as effective as IV route
- Timing of ondansetron less important
- More clinically effective than droperidol and metoclopramide
- Equally effective to dexamethasone for early POV



ANTI-EMETIC DRUGS: Corticosteroids

Dexamethasone

What is the optimal dose of dexamethasone for reducing POV in children?

Steroids for improving recovery following tonsillectomy in children

David L Steward¹, Jedidiah Grisel², Jareen Meizen-Derr^{3,4}

The Cochrane Library 2011, Issue 8

Effect of dexamethasone on nausea, vomiting, and pain in paediatric tonsillectomy

V. Hermans^{1*}, F. De Pooter¹, F. De Groote¹, S. De Hert² and P. Van der Linden¹

British Journal of Anaesthesia 2012; 427–31

Dexamethasone (0.1-0.15 mg/kg) given alone reduces the risk of POV (late) in children.



ANTI-EMETIC DRUGS: Corticosteroids

Dexamethasone

- Tumor lysis syndrome
- Increased bleeding risk?
- Effect on blood glucose?



ANTI-EMETIC DRUGS: Butyrophenones

Droperidol

- Treatment and prevention of POV
- Dose: 10 µg/kg
- Prolongation of QT-interval
- Black box warning
- Not as first line anti-emetic medication?



NON-PHARMACOLOGIC ANTI-EMETIC APPROACHES

- Isopropyl alcohol

An Alternative Method to Alleviate Postoperative Nausea and Vomiting in Children

Shu-Ming Wang, MD,* Maura B. Hofstadter, PhD,†
Zeev N. Kain, MD,‡

Table 3. Outcome of Treatment Across Time

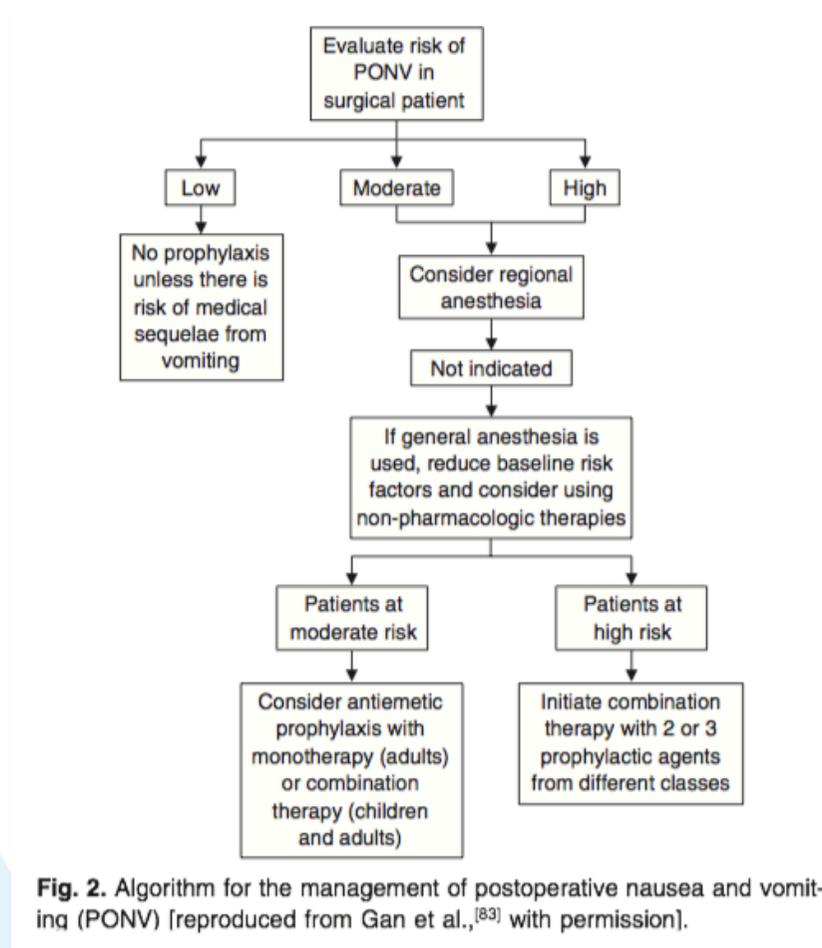
Initial Symptom	Treatment Group	First Treatment [% ^a (n)]	Second Treatment [% ^a (n)]	Third Treatment [% ^a (n)]
Nausea	Placebo ^b	10.5 (2)	10.5 (2)	10.5 (2)
	Treatment ^c	15 (3)	20 (4)	50 (10)
Vomiting ^d	Placebo ^b	10.5 (2)	15.5 (3)	15.5 (3)
	Treatment ^c	15 (3)	15 (3)	15 (3)
Nausea + vomiting ^e	Placebo ^b	21 (4)	26 (5)	26 (5)
	Treatment ^c	30 (6)	35 (7)	65* (13)

Journal of Clinical Anesthesia; 1999: 231–234

- P6 Acupuncture and Acupressure



GUIDELINES





GUIDELINES

Strategies to reduce baseline PONV risk factors

Use of regional anesthesia

Use of propofol for induction and maintenance of anesthesia

Use of intraoperative supplemental oxygen

Use of hydration

Avoidance of nitrous oxide

Avoidance of volatile anesthetics

Minimization of intraoperative and postoperative opioids

Minimization of neostigmine

Pediatr Drugs 2007;



GUIDELINES

Table VIII. Recommended antiemetic intravenous doses for children^[167-170]

Drug	Dose
Ondansetron ^[11,171] a	50–100 µg/kg up to 4mg
Dolasetron ^[73,74]	350 µg/kg up to 12.5mg
Dexamethasone ^[84,172,173]	150 µg/kg up to 5mg
Droperidol ^[85] b	50–75 µg/kg up to 1.25mg
Dimenhydrinate ^[121]	0.5 mg/kg up to 1.2mg
Perphenazine ^[139,174]	70 µg/kg up to 5mg
Granisetron ^[80]	40 µg/kg up to 0.6mg
Tropisetron ^[175]	0.1 mg/kg up to 2mg

a Approved for postoperative vomiting in pediatric patients aged 1 month or older.

b US FDA black box warning.



GUIDELINES

Anti-emetic treatment for patients with PONV who did not receive prophylaxis or in whom prophylaxis failed

Initial therapy	Treatment
No prophylaxis or dexamethasone	Administer small-dose serotonin (5-hydroxytryptamine; 5-HT ₃) antagonist
5-HT ₃ antagonist ^a plus second agent ^b	Use drug from different class
Triple therapy with 5-HT ₃ antagonist ^a plus two other agents ^b when PONV occurs <6h after surgery	Do not repeat initial therapy Use drug from different class or propofol 20mg as needed in postanesthesia care unit (adults)
Triple therapy with 5-HT ₃ antagonist ^a plus two other agents ^b when PONV occurs >6h after surgery	Repeat 5-HT ₃ antagonist ^a and droperidol ^c (not dexamethasone or transdermal scopolamine) Use drug from different class

a Ondansetron, granisetron, dolasetron.
b Dexamethasone, transdermal scopolamine.
c US FDA black box warning.



Conclusion

- Vomiting occurs twice as frequently in children as in adults
- Differences between boys and girls are not observed before puberty (after puberty females have 2- to 3-fold the incidence of PONV as males)
- As children grow older, the POV risk increases until puberty, then decreases
- Strabismus repair and tonsillectomy are specific surgeries that have a high POV risk.



CONCLUSION

- Incidence is still too high
- Reduce baseline risks
- Prophylactic should be used in adaptation to the risk: inpatients and outpatients, surgical procedure and individual risk