Mark Kania, CRNA, BA Scranton Endoscopy Center

April 8, 2006
Hershey, Pennsylvania
Nurse Anesthetist
Pennsylvania Association of

(PONV)

Pediatric PONV

(PONV)

Pediatric PONV
Disclosure

Mark Kania, CRNA is a member of the speaker’s bureaus of, and/or a paid consultant to the following pharmaceutical companies:

Adolor Corporation
Baxter Healthcare

“Off label” use of drugs will be discussed
Changing Environment: Anesthesia

Inpatient ⇔ Outpatient ⇔ Office-Based
Incidence of PONV

- Historically 75% to 80% with ether
- Currently 25% to 30% overall
- More than 35% of surgical outpatients experience PONV after discharge
- Estimates of PONV > actual occurrence
- Post-discharge PONV not well studied and may be underestimated


*PONV: postoperative nausea and vomiting.
PONV: Risk Factors

- Patient
- Anesthesia
- Surgical
- Postoperative
PONV: Risk Factors

Patient

- Age
- Gender
- Obesity
- Predisposition
- Anxiety
- Nonsmoker
- Pain
- Emetogenic meds
- Medical disease
- Metabolic
- Increased ICP
Age and Obesity

• Age
  – Infancy 5%  Childhood (aged 6-16 years) 34%-51%
  – Stabilizes in adulthood  Decreased after age 70 years

• Obesity
  – Difficult airway management
  – Larger reservoir for anesthetic agents
  – Increased gastric volume
  – Increased gastroesophageal reflux

Anxiety

- $\alpha$-Adrenergic mechanism
  - Increased circulatory levels of catecholamines
  - Epinephrine/norepinephrine induces vomiting
- GI factors
  - Air swallowing
  - Decreased motility
  - Increased gastric volume

PONV: *Risk Factors*

**Anesthesia**

- **Premedications**
  - Benzodiazepines
  - Anticholinergics
  - Opioids

- **Inhalation gases**
  - N\textsubscript{2}O/balanced anesthesia

- **Intravenous agents**
  - Etomidate > ketamine > thiopental > propofol

- **Reversal agents**
  - Anticholinesterase

- **Airway**
  - Gastric distention (mask)
  - Pharyngeal stimulation

- **Regional anesthesia**
  - Hypotension

- **Hydration**

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Etiology of PONV: Anesthesia-Related Factors

- **Type of premedication**
  - Benzodiazepines decrease PONV
  - Opioid analgesics stimulate the CTZ
  - NSAIDs help decrease opioid use

- **Type of anesthesia**
  - General > major regional > peripheral regional
  - Inhalational agents > propofol-based

- **Duration of anesthetic exposure**
  - Each 30 min. ↑`s PONV risk by about 60%

- **Experience of anesthesia provider**

<table>
<thead>
<tr>
<th></th>
<th>Sevoflurane (n=40)</th>
<th>Desflurane (n=40)</th>
<th>Propofol (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PONV &lt; 4 h</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>20%</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>8%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>PONV 4–24 h</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>5%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

PONV: Risk Factors

Surgical

- Surgical site
  - Eye, ENT, laparoscopic, abdominal, OB/GYN, breast, plastics, orthopedics
- Duration of surgery (> 3 hours)
- Gastric distention
  - Food, blood, gastroparesis
- Postoperative pain
  - Pelvic, visceral, bone
- Early ambulation (vestibular)
Postoperative Factors Affecting Incidence of PONV

- Pain
- Dizziness
- Opioid administration
- Premature oral intake
- Movement after surgery

HURRY! THERE'S ONE UNIT SPACE LEFT IN RECOVERY!
The Physiology of Emesis

Adapted from Mitchell and Schein. Toxicity of Chemotherapy. 1984:271.
Anatomy of Emetic Center

The anatomical location of the area postrema and the region of the vomiting center

<table>
<thead>
<tr>
<th>Location</th>
<th>Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Area postrema</td>
<td>Opioids, dopamine (D₂), serotonin</td>
</tr>
<tr>
<td>• Chemoreceptor trigger zone</td>
<td>Enkephalin, dopamine (D₂), opioids</td>
</tr>
<tr>
<td>• Nucleus of solitary tract</td>
<td>Enkephalin, histaminic, muscarinic, cholinergic</td>
</tr>
</tbody>
</table>
Proposed Sites of Action:

Antiemetic Drug Classes

Cortical
Cannabinoids
Benzodiazepines

Vomiting Center
Antihistamines
Anticholinergics

Chemoreceptor Trigger Zone
Phenothiazines
Butyrophenones
Metoclopramide
Serotonin antagonists

Visceral Afferents
Metoclopramide (high dose)
Serotonin antagonists

Adapted from Tortorice PV, O'Connell MB. Pharmacotherapy. 1990;10:129-145.
## Antiemetic Agents: Receptor-Site Affinity

<table>
<thead>
<tr>
<th>Pharmacologic Group/Drug</th>
<th>Dopamine (D&lt;sub&gt;2&lt;/sub&gt;)</th>
<th>Muscarinic Cholinergic</th>
<th>Histaminic</th>
<th>Serotonin (5-HT&lt;sub&gt;3&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenothiazines</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Fluphenazine</td>
<td>++++</td>
<td>+</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Chlorpromazine</td>
<td>++++</td>
<td>++</td>
<td>++++</td>
<td>+</td>
</tr>
<tr>
<td>Prochlorperazine</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butyrophenones</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Droperidol</td>
<td>++++</td>
<td>–</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>++++</td>
<td>–</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Domperidone</td>
<td>++++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Antihistamines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphenhydramine</td>
<td>+</td>
<td>++</td>
<td>++++</td>
<td>–</td>
</tr>
<tr>
<td>Promethazine</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>–</td>
</tr>
<tr>
<td>Anticholinergic</td>
<td>+</td>
<td>++++</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Scopolamine</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Benzamides</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>+++</td>
<td>–</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>5-HT&lt;sub&gt;3&lt;/sub&gt;-receptor antagonists</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ondansetron</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>++++</td>
</tr>
<tr>
<td>Granisetron</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>++++</td>
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<tr>
<td>Tricyclic antidepressants</td>
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<tr>
<td>Amitriptyline</td>
<td>+++</td>
<td>+++</td>
<td>++++</td>
<td>–</td>
</tr>
<tr>
<td>Nortriptyline</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>–</td>
</tr>
</tbody>
</table>

Number of positive signs (+) indicates degree of activity; negative sign (–) indicates no activity.

Adapted from Watcha MF, White PF. Anesthesiology. 1992;77:162-184.
Medical Consequences of PONV

- Patient discomfort
- Wound dehiscence
- Electrolyte imbalance and dehydration
- Interruption in or delay of oral drug therapy, fluid intake, or eating
- Aspiration of vomit

Andrews PL. Br J Anaesth. 1992;69 (suppl 1): 2S-19S.
Sources of Direct and Indirect Costs Associated with PONV

• Cost to Surgery Center
  – Nursing labor costs for extra PACU time
  – Personnel time for emesis management
  – Drugs and supplies
  – Revenue lost as a result of extended PACU stay

• Cost to Patient
  – Charges for extra PACU time
  – Drug and supply charges
  – Hospitalization charges
  – Lost wages of patient/caretaker and/or caretaker compensation expense

Surgical Patients’ Perspective – Does PONV Affect Patient Satisfaction?

Patient Satisfaction with their anesthesia experience – VAS scores at 24 hours post surgery (rescued versus not rescued for PONV – values are means)

<table>
<thead>
<tr>
<th>No need for rescue antiemetic</th>
<th>88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rescue antiemetic administered</td>
<td>75</td>
</tr>
</tbody>
</table>

Who Should Receive Prophylaxis Therapy?
PONV Prophylaxis is Cost Effective

Median total cost per patient*

- Ondansetron 4 mg: $16.44
- Droperidol 0.625 mg: $0.63
- Droperidol 1.25 mg: $0.51
- Placebo: $51.20

*Includes cost for drug acquisition, materials, personnel time, PACU delay, and hospital admission.


P=0.001, active treatment groups vs placebo.
# Koivuranta Scores

<table>
<thead>
<tr>
<th>Factors</th>
<th>Risks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>0</td>
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<tr>
<td>Previous PONV</td>
<td>1</td>
</tr>
<tr>
<td>Motion sickness</td>
<td>2</td>
</tr>
<tr>
<td>Duration &gt; 60 minutes</td>
<td>3</td>
</tr>
<tr>
<td>Nonsmoker</td>
<td>4</td>
</tr>
</tbody>
</table>

Simplified Risk Scoring

• Four predictors
  – Female gender
  – History of motion sickness/PONV
  – Nonsmoking
  – Use of postoperative opioids

• Incidence of PONV
  – 0 -10%
  – 1 -21%
  – 2 -39%
  – 3 -61%
  – 4 -79%

### Estimated PONV Incidence by Baseline Risk and Number of Interventions

<table>
<thead>
<tr>
<th>Baseline Risk</th>
<th>No. of Interventions</th>
<th>Overall Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>1</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4%</td>
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<td></td>
<td>4</td>
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<td>20%</td>
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<tr>
<td></td>
<td>2</td>
<td>11%</td>
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<td>8%</td>
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<td>29%</td>
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<td>80%</td>
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<td>44%</td>
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<tr>
<td></td>
<td>3</td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>24%</td>
</tr>
</tbody>
</table>

Assumes each intervention reduces risk by about 26%; interventions=dexamethasone, droperidol, nitrogen, ondansetron, propofol, or remifentanil.

Prophylactic Antiemetic Intervention Assessment Scale

3 Points Each
- History of PONV
- History of motion sickness
- Gynecological laparoscopy
- Breast reconstruction

2 Points Each
- Facelift surgery
- Strabismus or middle-ear surgery
- Neurosurgery
- Obesity

3 or More Points
Prophylactic Antiemetic is Indicated

1 Point Each
- Preadolescent
- Female
- Anxiety
- Laparoscopic cholecystectomy
- Intraoperative or postoperative opioid
- Duration of anesthesia > 60 minutes
Surgical Prophylactic Antiemetic Intervention Assessment Tool

High-risk Patient Factors
- History of PONV
- History of motion sickness
- Preoperative nausea and vomiting
- Young female

Prophylactic Antiemetic Recommended

High-risk Surgical Procedures
- Craniotomy
- ENT
- Laparoscopy
- Major breast
- Plastic
- Shoulder
- Strabismus

Other Considerations

Patient Factors
- Age <50
- ASA status
- Dehydration
- Anxiety
- Obesity
- Pain

Surgical Factors
- Gynecologic procedures
- Major intra-abdominal procedures
- Oral surgery
- Procedure w/duration greater than 1 hour
- Intra- and post-operative opioids
- Outpatient procedure

Based upon individual or a combination of patient factors, surgical procedures and/or other contributing risk factors outlined below, a prophylactic antiemetic may be appropriate. Multiple selections in each category may be made.

There are many factors that influence the incidence of postoperative nausea and vomiting (PONV). Some factors are associated with significantly greater risks than others. Based on a number of studies that stratify these factors and subject them to logistic regression analysis, an assessment scale for prophylactic antiemetic intervention is presented. Note, however, that prophylactic antiemetic intervention is desirable for any patient in whom emesis postoperatively could compromise recovery. The opinions expressed are those of Dr. T.J. Gan and do not necessarily reflect those of GlaxoSmithKline.

T.J. Gan, MB, FRCA
Department of Anesthesiology
Duke University Medical Center

References:

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A Risk Score to Predict the Probability of Postoperative Vomiting in Adults

- PONV Risk (probability) = \frac{1}{1 + e^{-z}}

Where \( Z = (\text{no} = 0, \ \text{yes} = 1) \)
+ 1.28*(female gender)
- 0.029*(age)
- 0.74*(smoking)
+ 0.63*(history of motion sickness or PONV)
+ 0.26*(duration)
- 0.92

Creating a Prevention /Treatment Algorithm

• Risks of PONV may be calculated...

\[ P = \frac{1}{1+e^{-\text{logit}(p)}} \text{ where} \]
\[ \text{logit}(p) = -5.97 - 0.014[\text{age}] - 1.03X(1-\text{[female]}) - 0.4291-\text{[non-smoker]} + 1.14[\text{previous PONV}] + 0.46 \]
\[ [\text{duration of surgery}] / 30 + 2.36 + 1.48 ] \]
\[ [\text{ENT surgery}] + ............ \]

Risk Score To Predict Probability Of PONV in Pediatric Patients (POVOC)

- Adult risk scores do not directly apply to pediatrics
- Some risk factors are difficult to assess (ie. smoking)

POVOC Risk Scores

1257 patients

Evaluation data set (n=657)
Validation data set (n=600)

Pre-op eval. - Hx PONV or motion sickness in pt., or PONV in pt., parents, or siblings
Premedicated with midazolam
Non-opioid analgesics intra, or immediately post-op
POV/Retching assessed (nausea is difficult to assess in peds).

POVOC Risk (cont)

Toddlers are less susceptible to emetic stimulation than school children or adolescents.

Risk of POV ↑↑’s dramatically around age 3.

Younger age = ↑’s risk for POV (above age 3).

Other Factors ↑ing POV in Peds

• Strabismus surgery (manipulation of eye, & release of neurotransmitters in CTZ [ie. Dopamine, serotonin, Ach]

• Duration of surgery (longer exposure to emetic stimulus)

• Previous PV/PONV (possible genetic link – monozygotic twins have more frequent congruent behavior re:PONV than heterozygotic twins)
Factors Affecting POVOC

• Administration of local or regional anesthesia
  – ↓ POVOC – possibly due to ↓ needs for opioids and volatile anesthetics

• Intra-operative opioids
  – ↓ POVOC – possibly due to ↓ need for volatile anesthetics

• Post-op opioids
  – ↑ POVOC

POVOC Risk Conclusions

Eberhart & colleagues concluded that the following factors ↑ risk of POVOC

1) Age ≥ 3 years old
2) Surgery lasting > 30 minutes
3) Hx of PV in pt., or PV/PONV in parents or siblings

What Are Our Options?
PONV: Multimodal Drug Approaches

- Antiemetic drugs
  - Anticholinergics
  - Benzodiazepines
  - Phenothiazines
  - Butyrophenones
  - Benzamides
  - Ephedrine
  - 5-HT₃-receptor antagonists
  - Antihistamines
  - Steroids

Antihistamines

• Act by blocking acetylcholine receptors in the vestibular apparatus & histamine $H_1$ receptors in the nucleus of the solitary tract
• Include dimenhydrinate, diphenhydramine, & meclizine
Phenothiazines

- Act by blocking D2 receptors in the CTZ
- Have moderate antihistaminergic and anticholinergic actions
- Promethazine < prochlorperazine
Benzamides

• Block D2 receptors in the GI tract, & centrally at the CTZ, & area postrema
• Increase lower esophageal sphincter tone
• Enhance gastric motility
• Metoclopramide – prokinetic agent, or antiemetic?
5-HT3 Receptor Antagonists

- Bind to the 5-HT3 receptor in the CTZ, & at vagal afferents in the GI tract
  - Dolasetron
  - Ondansetron
  - Granisetron
  - Tropisetron
Corticosteroids

- Mechanism of action not clear
  - ? Anti-inflammatory or membrane-stabilizing effect
  - ? Release of endorphins
    - Dexamethasone – 8-10 mg. in adults
    - Most effective if given \(\textbf{BEFORE}\) the induction of anesthesia
Anticholinergics

- First generation class of antiemetics
- Scopolamine most potent in class
- May act by blocking cholinergic transmission from the vestibular nuclei to higher centers, & from the reticular formation to the vomiting center
Butyrophenones

- Strong D2 receptor antagonists that act at the CTZ, and the area postrema
- Q-T issue pts. At risk:
  - CHF, bradycardia, hypokalemia, hypomagnesemia, pts. on diuretics, or drugs known to cause Q-T interval prolongation
Droperidol
FDA Warnings About Droperidol

- Cases of QT prolongation and/or torsades de pointes have been reported in patients receiving droperidol at or below recommended doses.
Antiemetics: *Associated Side Effects by Class*

- **Phenothiazines**
  - Sedation, hypotension, extrapyramidal reactions, dry mouth, urinary retention, tachycardia, NMS

- **Butyrophenones**
  - Sedation, dystonic reactions, hypotension, tachycardia, extrapyramidal reactions, anxiety, restlessness, NMS

- **Benzamides**
  - Drowsiness, restlessness, fatigue, anxiety, extrapyramidal reactions, NMS

- **Anticholinergics**
  - Sedation, dry mouth, visual disturbances, memory loss, confusion, hallucinations, urinary retention

- **Antihistamines**
  - Sedation, blurred vision, dry mouth, urinary retention, tachycardia

- **5-HT₃-receptor antagonists**
  - Headache, dizziness, mild drowsiness, constipation, arrhythmias (rare)

<table>
<thead>
<tr>
<th>FDA Approvals of 5HT3 Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Injection (Adults)</strong></td>
</tr>
<tr>
<td>Prevention</td>
</tr>
<tr>
<td>Prevention of further episodes</td>
</tr>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td><strong>Oral (Adults)</strong></td>
</tr>
<tr>
<td>Prevention</td>
</tr>
<tr>
<td>Prevention of further episodes</td>
</tr>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td><strong>Injection (Pediatrics Age 2–12 Years)</strong></td>
</tr>
<tr>
<td>Prevention</td>
</tr>
<tr>
<td>Prevention of further episodes</td>
</tr>
<tr>
<td>Treatment</td>
</tr>
</tbody>
</table>

Antiemetics And Pediatric Applications

- **Prochlorperazine** – Not for use < 2 yrs. old/ 20 lb
- **Droperidol** – Not for use < 2 y/o. May have ↑ side effects
- **Promethazine** - Not for use < 2 y/o.
- **Scopolamine** - ↑ side effects, including ↑ temp.
- **Metoclopramide** - ↑ side effects
- **Dexamethasone** – 0.25 mg/kg IV (Madan, R., et al Anesth Analg 2005; 100 (6)1622-6)
Antiemetics And Pediatric Applications

- **Granisetron** – NOT approved for pediatrics for PONV. Approved for peds 2 y/o for CINV. NOT for use in neonates (contains benzyl alcohol)

- **Dolasetron** – 2-16 yrs. 0.35 mg/kg IV (12.5 mg MAX) 1.2 mg/kg PO (100 mg. MAX)

- **Ondansetron** – 0.1 mg/kg IV (up to 4 mg)
Combination Therapy

aka: Multimodal Therapy
PONV: Ideas

- Multi-modal drug therapy
- Volume replacement
- Anesthetic choice
- High FiO$_2$
- Postoperative pain relief
- Combined anesthetic technique
- Patient training
Supplemental Oxygen

Does It Work For Everyone?
How Does Supplemental Oxygen Work As An Antiemetic?

- It is speculated that supplemental oxygen administration might work by ameliorating regional intestinal hypoxia (although tissue oxygenation was not measured in any studies referenced)

Purhonen et al, Anesth Analg 2003;91-6
The Non-Pharmaceutical answer to PONV that also reduces post-op infections by 50%.

Recent randomized controlled trials demonstrated that brief treatment with >80% oxygen reduced post-op infections by 50% as well as halved post-op nausea.*

Only the Hi-Ox™ can deliver this level of oxygen with a disposable mask at only 8 LPM.

Ask for it by name Hi-Ox™
The New Technology in Oxygen Masks


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What About Fluid Administration For The Prevention Of PONV?
- Crystalloids expand only the extracellular compartment, and only increase the intravascular volume by 1/5th of the volume infused.
- Colloids are larger molecules, and are maintained in the intravascular volume longer, reducing interstitial edema, endothelial swelling, and less parenchymal injury.

Moretti et al, Anesth Analg 2003;96:611-7
Antiemetic Timing
Timing of Antiemetics

- Antiemetic prophylaxis always has higher efficacy than treatment/rescue
- Timing is a crucial and controversial issue
PONV: Timing of Antiemetic Administration

• Options
  – Prior to induction
  – Prior to narcotic dose
  – Near the end of operation
  – Rescue
Antiemetic Dosing: *Timing*

- Potential questions
  - Outpatient vs inpatient
  - Short vs long procedure
  - Split dosing
  - Repeat dosing
Complete Response at 24-Hours Post-Surgery

Droperidol and Ondansetron Effectiveness in Strabismus Surgery

- 240 children ASA I & II, age 1-15 years
- No premeds. Standardized anesthetic used
- Randomized to 4 groups
  - PP- Placebo after induction, & end of procedure
  - DP- Droperidol 25 mcg/kg @ induction, & placebo @ end
  - OP- Ondansetron 150 mcg/kg @ induction, & placebo @ end
  - DO- Droperidol 15 mcg/kg @ induction, & ondansetron 100 mcg/kg @ end
    - Shende, D. et al., Act Anaesthesiol Scand 2001; 45: 756-760
## Group Findings

<table>
<thead>
<tr>
<th></th>
<th>PP (n=60)</th>
<th>DP (n=60)</th>
<th>OP (n=60)</th>
<th>DO (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 H</td>
<td>21 (35%)</td>
<td>14 (23%)</td>
<td>11 (18%)</td>
<td>5 (8%)</td>
</tr>
<tr>
<td>2-6 H</td>
<td>29 (47.5%)</td>
<td>9 (15%)</td>
<td>14 (23%)</td>
<td>1 (1.6%)</td>
</tr>
<tr>
<td>6-24 H</td>
<td>12 (20%)</td>
<td>0 (0%)</td>
<td>2 (3%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Adapted from Shende, D., et al., Acta Anaesthesiol Scand 2001; 45: 756-760
NAUSEA AND VOMITING:
OTHER OPTIONS

- Alcohol swab
- Ginger root
- Natural vitamins
- TENS
- Hypnosis
- Accupressure/Accupuncture
Laser Acupuncture vs Metoclopramide
"Whoa! Is that a needle, Doc? 'Cause Zack don't like needles."
Laser Acupuncture vs Metoclopramide (cont.)

- 0-2 H Metoclopramide (0.1 mg/kg) & laser acupuncture @ P6 performed equally well, & both performed better than placebo or sham acupuncture.

Electroacupuncture Prophylaxis of PONV Following Pediatric Tonsillectomy

• Thought to modulate serotonin, dopamine, substance P, & endogenous endorphins in CNS.

• Intact peripheral and CNS are needed for efficacy of acupuncture (ie awake patients)

• Has been shown to be more effective in adults than peds.

Electroacupuncture Prophylaxis of PONV Following Pediatric Tonsillectomy (cont)

<table>
<thead>
<tr>
<th>Incidence of PONV</th>
<th>Electroacupuncture</th>
<th>Control</th>
<th>Sham acupuncture</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 of 40 (63%)</td>
<td>37 of 40 (93%)</td>
<td>35 of 40 (88%)</td>
<td></td>
</tr>
</tbody>
</table>

**Patients receiving sham acupuncture vomited significantly earlier than other groups.**

Electroacupuncture Prophylaxis of PONV Following Pediatric Tonsillectomy (cont)

Efficacy of the P6 electroacupuncture was comparable to the most effective pharmacotherapies, but was more labor intensive.

Rusy, L. et al. Anesthesiology 2002; 96: 300-05
The Great Unknown: Postdischarge *PONV*
Postdischarge Nausea

INFORMATION EXPLOSION
It is important to remember that in spite of our best efforts, both pharmacologically, as well as in our technique, there is a patient population that will experience post operative nausea, and/or vomiting. A part of this group will also be refractory to any and all efforts on our part to alleviate their symptoms.
An instant later, both Professor Waxman and his time machine are obliterated, leaving the cold-blooded/warm-blooded dinosaur debate still unresolved.
“Whoa! Is that a needle, Doc? ’Cause Zack don’t like needles.”
“There are very few people who don’t become more interesting when they stop talking.”

Mary Lowry