Creating a New Paradigm for Management of Postoperative Nausea and Vomiting (PONV)

Via Risk Identification and Implementing Best Practices

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Definitions

- Nausea
  - Subjective experience of unpleasant flushing, pallor, swallowing, tachycardia, an urge to vomit
- Vomiting
  - Reflexive, rapid and forceful oral expulsion of upper GI tract contents due to powerful, sustained contractions in abdominal and thoracic musculature
- Post-operative Nausea and Vomiting (PONV)
  - Nausea and/or vomiting occurring within the first 24 hours of surgery
- Post-discharge Nausea and Vomiting (PDNV)
  - Nausea and/or vomiting occurring beyond the initial 24 hours of surgery

Incidence

Nausea and vomiting continues to be a problem in the post anesthesia setting for one-third of all patients who require anesthesia for surgery. The incidence can be as high as 70-80% in high risk patients. As many as 30% of outpatients will continue to struggle with post-discharge nausea and vomiting (PDNV) after arrival home (and may persist for up to five days after surgery).

PONV affects quality of recovery, the potential for morbidity and hospitalization in high risk patients and loss of satisfaction. Annual cost of PONV in US is thought to be several hundred million dollars.


Potential Consequences of PONV

- Medical
  - Electrolyte imbalance
  - Aspiration
  - Tension on suture line
  - Venous hypertension
  - Hematoma
- Hospital
  - Delayed discharge, unanticipated admission, increased cost
- Patient
  - Discomfort
  - Dissatisfaction

Why Change Our Practice?

- Current practice practitioner dependent—not every patient assessed in same manner
- Need for standardization of care—establish a process that ensures every patient, every time approach
- Early identification of pts with assessment tool (ASPAN guidelines recommend early intervention/prevention)
- Standard order sets for preop prophylaxis/postop rescue
- Resource guide for nursing staff with algorithms to determine proper pharm/nonpharm interventions

Risk for PONV

- Patient-related Factors
- Anesthetic-related Factors
- Surgery-related Factors
Patient-related Risk Factors

PRIMARY FACTORS
- Female gender
- Non-smoking status
- History of PONV
- History of motion sickness

SECONDARY FACTORS
- Age: Children are at higher risk with peak age 11-14
- Obesity
- Anxiety
- Tactile stimulation of posterior pharynx
- Post-op hypoxemia, hypotension, and hypoglycemia

Anesthetic-related Risk Factors
- Use of volatile anesthetics (isoflurane, sevoflurane, enflurane)
- Use of nitrous oxide
- Post-operative use of opioids
- Duration of anesthesia

Surgery-related Risk Factors
- **Duration of surgery**—for every 30 min increase in surgical time, a study revealed there was a 60% increase in baseline risk of PONV (Sinclair, et al. 1999)
- **Type of surgery**—associated with increased risk include ENT, gynecological, breast, orthopedic, plastic and intracranial/neurosurgery.

Risk Factor Identification Tool

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Gender</td>
<td>1</td>
</tr>
<tr>
<td>Non-Smoker</td>
<td>1</td>
</tr>
<tr>
<td>History of PONV/motion sickness</td>
<td>1</td>
</tr>
<tr>
<td>Postoperative opioids</td>
<td>1</td>
</tr>
<tr>
<td>Sum</td>
<td>0-4</td>
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</tbody>
</table>

Prophylaxis Treatment of PONV Based on Patient’s Level of Risk

<table>
<thead>
<tr>
<th>Level of Risk</th>
<th>Low Risk</th>
<th>Moderate Risk</th>
<th>Severe Risk</th>
<th>Very Severe Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Chance of PONV</td>
<td>10 - 20%</td>
<td>40%</td>
<td>60%</td>
<td>80%</td>
</tr>
<tr>
<td>Number of prophylactic interventions to consider</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3 or more</td>
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</tbody>
</table>

Mechanism of Nausea and Vomiting

- There are multiple afferent pathways involved in stimulating vomiting center (VC) in brainstem:
  - Chemoreceptor Trigger Zone (CTZ)
  - Vagal mucosa (GI)
  - Vestibular system
  - Reflex afferent from cerebral cortex
  - Midbrain afferents

Stimulation of one or more of these pathways can activate the vomiting center, often leading to the physical act of vomiting.

Pathways

- CTZ - susceptible to stimulation from release of dopamine and serotonin in blood and CSF; can be activated by opioids and anesthetic agents
- Vagal afferent - sensitive to changes in volume of stomach and GI tract, activating VC via vagal nerve stimulation; GI tract also releases serotonin
- Vestibular system - sends input to VC in response to changes in motion and pressure
- Cerebral cortex - stimulates VC due to pain, anxiety, visual sensory, or cognitive overload
- Midbrain - stimulates VC with changes in intracranial pressure

Multi-modal Approach Needed

- Multi-factorial etiology of PONV
  - type of anesthesia
  - patient risk factors
  - surgical procedure
- Unlikely that one medication or method will prevent its occurrence
- Multi-modal approach recommended
  - Combinations of pharmacologic, nonpharmacologic, and complementary therapies

Prevention of PONV

- Anesthesia/Pain Control
  - Multimodal
  - Total IV anesthesia (TIVA)
  - Consider NSAIDS/IV acetaminophen
  - Regional Blocks
- Therapeutic
  - Hydration
  - O2 therapy
- Complementary
  - Acupressure/P6 acupoint stimulation
  - Aromatherapy-peppermint oil and alcohol

PONV Prophylaxis

Algorithm 1: Perioperative nausea management

- Dexamethasone
- Serotonin 5-HT3 receptor blockers (Ondansetron)
- Transdermal Scopolamine patch
- Droperidol (currently has a black box warning that drug can prolong QT interval) Fatal dysrhythmias have occurred when doses given in upper end of dose limit
- H1 receptor blockers-Antihistamines
- Neurokinin-1 (NK1) antagonist “Aprepitant”-new drug class primarily treat chemo related N/V
P6 Acupoint Stimulation

Acupoint Stimulation:
A technique of stimulating acupoints to achieve a therapeutic response. Stimulation can be achieved by:
- Insertion of a fine, wire-thin needle (acupuncture)
- Transcutaneous, electrical stimulation (acustimulation)
- Physical pressure from fingers or wristband.

The P6 acupoint is most commonly used in the treatment of nausea and vomiting and is located on the plantar aspect of the wrist, between the tendons of palmaris longus and flexor carpi radialis muscles, 4 to 5 centimeters proximal to the wrist crease.

-Lee & Fan, 2009

Pharmacologic Treatment

- Late considerations may include:
  - Low dose Promethazine
  - Prochlorperazine
  - Metoclopramide
  - Ephedrine

-ASPAN (2006); Wahrman & Clark (2011)

Most importantly— if a rescue antiemetic is required, a drug from a class not previously administered should be used.

Receptor Site and Drug Interaction

Anti-emetics and Receptor Site Affinity

<table>
<thead>
<tr>
<th>DRUG</th>
<th>Serotonin</th>
<th>Dopamine</th>
<th>Histamine</th>
<th>Muscarinic</th>
<th>Neurokinin</th>
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<tbody>
<tr>
<td>Ondansetron</td>
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<tr>
<td>Dolasetron</td>
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<tr>
<td>Granisetron</td>
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<tr>
<td>Palonosetron</td>
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<tr>
<td>Metoclopramide</td>
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<tr>
<td>Aprepitant</td>
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<tr>
<td>Prochlorperazine</td>
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<tr>
<td>Promethazine</td>
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<tr>
<td>Scopolamine</td>
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<td>Droperidol</td>
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<tr>
<td>Dexamethasone</td>
<td>(not FDA approved for PONV)</td>
<td>(believe to have antagonistic effect on prostaglandins or influence the release of endorphins)</td>
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Anti-emetic Dose and Timing

McCracken, et al. (2008)
Strategies to Address PDNV

Algorith 3. Management of PDNV.

- Created risk assessment tool to be used with every surgical patient in collaboration with anesthesiologists
- Developed standard order sets for both preop prophylaxis and postop rescue
- Designed resource guide as reference for management of PONV
- Power point presentation to inform nursing and anesthesiology staff about new plan of action

ASPAN (2006)

Standard Order Sets

- Preop includes:
  - scopolamine transdermal patch
  - IV fluid bolus
  - P6 acupoint stimulation
- Postop includes:
  - odansetron IV
  - dexamethasone IV
  - metoclopramide IV
  - IV fluids
  - P6 acupoint stimulation

Resource Guide

Reference guide for staff for management of PONV includes:
- Risk factors
- Mechanism of nausea and vomiting
- PONV prophylaxis/rescue
- ASPAN algorithms

Nursing Interventions

A New Paradigm

- New paradigm-varies from old practice.
- Emphasizes pre-planning, coordination, standardization, and a multi-modal approach to prevent and treat a vital issue facing our patient population

Clifford (2009)
References


References (continued)