Overnight Call: Nausea

The Scenario:

You're on call for general pediatrics overnight. As you head to the ED to see a new admission, your pager goes off. It's a nurse, calling to tell you that an 8-year-old patient admitted for acute gastroenteritis is experiencing nausea and vomiting. They received a dose of ondansetron 3 hours ago, but they are still symptomatic. Is there anything else we can do?

Pathophysiology of Nausea

1) Mechanical:
    a. Mechanoreceptors **in the gut** measure intestinal distension. If bowel is overly stretched, this stimulates vagal afferent nerves, which work via **serotonin receptors (**5-HT3, 5-HT4) and neurokinin 1 receptors.
    b. Examples: gastroenteritis, food poisoning
2) Toxin-mediated
    a. Chemicals in the blood travel to the brain. There they encounter **the chemoreceptor trigger zone (CTZ),** which is in the fourth ventricle**.** It doesn't have the blood-brain barrier that is present in the rest of your CNS, so it is vulnerable to toxins. Those toxins cause activation of **dopamine receptors**. Signals are then sent to the **vomiting center in the brainstem** using **histamine and muscarinic receptors.**
    b. Examples: opioid-mediated nausea, chemotherapy
3) Motion
    a. Body motion stimulates your **vestibular system** which is in the inner ear. This in turn sets off **muscarinic and histamine receptors**, which triggers an emetic response.
    b. Examples: motion sickness, abdominal migraine, cyclic vomiting syndrome
4) Emotion: Mechanism unknown.
    a. May respond to biofeedback and/or CBT.

Before discussing medications…

It is important to note that not all nausea/vomiting needs to be treated with antiemetics. Remember that nausea/vomiting is the body's way of expelling toxins! However, vomiting and poor PO intake can increase length of stay and create a need for additional intervention such as IV fluids. We want to use antiemetics to get our patients feeling better and home faster!

Remember…Kids may have difficulty differentiating between nausea and abdominal pain. Think about adding on a **PPI or H1 blocker** like famotidine.

M.D. Notified: A Pediatric Podcast

Sources: Lexi-comp. // DeCamp, Byerley et al. Use of antiemetic agents in acute gastroenteritis: a systematic review and meta-analysis. Arch Pediatric Adolescent Med. 2008. // Gan, Belani et al. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesthesia Analgesia. 2020 Aug. // Shields, Lightdale, et al. Vomiting in Children. Pediatrics in Review. Jul 2018. // Manteuffel J. Use of antiemetics in children with acute gastroenteritis: Are they safe and effective?. *J Emerg Trauma*

Anti-emetic Medications:

Medication: *(Brand name)*	Mechanism:	Dosing & Frequency	Age?	Notes
Ondansetron (*Zofran*)	***Serotonin Receptor Blockers*** 5-HT3 receptor inhibitors	IV: 0.15 – 0.3 mg/kg/dose q8h. Oral: q8h dosing. - 8-15kg: 2mg dose - 15-30 kg: 4mg/dose - >30kg: 8mg dose	>1 month of age, >8 kg	Side effects: prolonged QT, headache, stomach issues - constipation OR diarrhea
Granisetron (*Kytril*)		IV: 40 mcg/kg as a single dose; maximum dose: 0.6 mg/dose	>1 month of age	Side effects: prolonged QT
Prochlorperazine (*Compazine*)	***Dopamine Receptor Blockers*** Block D_1 and/or D_2 receptors in the CTZ Metoclopramide also increases pressure at the lower esophageal sphincter; decreases intestinal transit time	Oral: 9-13kg: 2.5 mg BID PRN 13-18 kg: 2.5mg TID PRN 18-39 kg: 5mg BID PRN >39 kg: adult dosing Adult dosing: 5-10mg q6-8 hours IV" 0.1 mg/kg q6h prn	>2 yo **and** >9 kg	Risk of extrapyramidal reactions: Akathisia (restlessness), parkinsonism due to dopamine blockade in basal ganglia. Treat with benztropine (increases dopamine). Risk of dystonic reaction: Involuntary sustained or intermittent muscle spasms. Most common within 72h of administration. Due to imbalance between dopaminergic and cholinergic activity. Rx: Treat with Diphenhydramine (anti-cholinergic) 1st line or Benztropine 2nd line (increases dopamine).
Promethazine *(Phenergan)*		IV/oral: 1mg/kg/dose every 4-6 hours as needed. Max dose: 25mg.	>2 yo	Do NOT use in <2yo due to risk of respiratory depression. Risk of dystonic reaction – treat with: Diphenhydramine (1-2mg/kg/dose)
Metoclopramide (*Reglan*)		IV: 0.1 – 0.2mg/kg/dose q6-8h for postoperative nausea/vomiting Max dose: 10mg	Can use in infants	Prokinetic. Risk of tardive dyskinesia (wide variety of presentations: lip smacking, dystonia, tremors. Treat by stopping offending drug). Can use as a last resort in kids with GERD, gastroparesis, chemotherapy-induced nausea/vomiting, post-op nausea/vomiting.
Diphenhydramine *(Benadryl)*	***Antihistamines*** Vestibular suppressants Anti-cholinergic H1 antagonists	25mg or 50mg	Safe to use in infants	Side effects: sedation
Meclizine (*Antivert*)		25mg or 50mg prior to motion/travel Max dose: 100mg/day	12 years and older	Side effects: sedation
Dimenhydrinate (*Dramamine*)		2-6 yo: 12.5mg q6h prn >6-12 yo: 25mg q6h prn >12 yo: 50 – 100mg q6h prn Max dose: 400mg/day	>2 yo	Side effects: drowsiness, tachycardia, blurred vision, rash
Scopolamine	***Anti-muscarinic***	1mg patch applied behind the ear	Childr en & Teens	Great for motion sickness, preop N/V management (place evening prior to OR)
Lorazepam *(Ativan)*	***Vestibular suppressant***, also a GABA- agonist	Oral, IV: 0.05mg/kg/dose Max dose: 2mg	Safe to use in infants	Good for motion-induced nausea as well as emotion. Potential to be abused – not for long term use. Side effects: sedation