A compartive study between dexamethasone, metoclopramide and ondansetron in the prevention of postoperative nausea and vomiting (PONV) after middle ear surgery.

Thesis presented for partial fulfillment of Master degree in anesthesiology

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Abstract

Postoperative nausea and vomiting is a common distressing symptom.

There are guidelines for management of Postoperative nausea and vomiting.

We will compare efficacy between Dexamethasone, Metoclopramide and Ondansetron in prevention of postoperative nausea and vomiting after middle ear surgery.

Keywords

Dexamethasone, Metoclpramide, Ondansetron, postoperative nausea and vomiting, middle ear surgery.

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List of abbreviations

5-HT_3 receptors: 5-hydroxytryptamine (serotonin).
ASA: American society of anesthesiology.
CNS: central nervous system.
CSF: Cerebrospinal fluid.
CTZ: Chemoreceptor Trigger Zone.
ENT: Ear, nose and throat.
FDA: Food and drug administration
GABA receptors: Gamma-Aminobutyric acid.
IV: Intravenous.
Kg: Kilogram.
MAC: Minimum alveolar concentration.
mcg: Microgram.
mg: Milligram.
min: Minute.
N_2: Nitrogen gas.
NSAID: Non-steroidal anti-inflammatory drug.
N2O: Nitrous oxide.
O2: Oxygen.
P value: Probability value.
PACU: Post-anesthesia care unit.
PaCO2: Arterial carbon dioxide tension.
PCA: Patient controlled analgesia.
PDNV: Post-discharge Nausea and Vomiting
PONV: Postoperative nausea and vomiting.
SD: Standard deviation.
SpO2: Oxygen saturation.
SRA: Serotonin receptor antagonist.
TDS: Transdermal scopolamine.

Introduction

Life-threatening complications associated with anesthesia have become very rare, safety records have encouraged anesthesiologists to focus on minor morbidity. One of these symptoms, postoperative nausea and vomiting (PONV) is the 'big little problem'. [1]

Recent review of literature has reported that the incidence of PONV is 20-30% with little improvement in recent years.[2] The incidence of PONV can be as high as 80% in the high risk patients underlying the importance of its prevention and control by anesthetists .[3]

It may lead to serious surgical complications such as wound dehiscence, surgical site bleeding, wound infection, resulting in prolonged hospital stay.[4]

It is believed that PONV is multifactorial. Among the many factors; female gender, past history of PONV and motion sickness, use of opioids, and no history of smoking are the independent predictors for PONV.[5]

The Society of Ambulatory Anesthesia (SAMBA) advised certain guidelines for management of PONV.

So far several drugs have been used for preventing PONV. Most of them act as antagonist at the receptors which are involved in emesis. The traditional antiemetics include antihistamines, anticholinergics and dopamine-receptor antagonists. However, they have limited efficacy in PONV and are associated with side effects such as sedation and extra-pyramidal signs.[6] In contrast, a single

bolus dose of Dexamethasone for PONV prophylaxis has not been associated with serious side effects.[7] With regard to the effectiveness of Dexamethasone, a systematic review of trials of Dexamethasone mono-therapy found that the 8 mg dose showed both early and late antiemetic efficacy.[7] Newer class of drugs, such as the Serotonin Receptor Antagonists (SRA) provides better efficacy and safety as compared to the traditional drugs. Ondansetron, a prototype of this group, binds to the 5-Hydroxytryptamine subtype 3 (5HT3) receptors, selectively blocking the emetogenic stimuli during anesthesia and surgery.[8]

Aim of Work

This is prospective randomized study designed to compare efficacy between Dexamethasone, Metoclopramide and Ondansetron in prevention of postoperative nausea and vomiting after middle ear surgery.

Physiology of Nausea & Vomiting

Definitions:

1-Vomiting: Forceful expulsion of gastric contents through the mouth involving rhythmic contractions of respiratory muscles including diaphragm and abdominal muscles.(9)

2-Retching: No expulsion takes place but the same muscles group are activated as in vomiting.(9)

3-Nausea: A subjective unpleasant sensation in the throat and epigastrium associated with the urge to vomit. Nausea is often associated with vomiting but the two symptoms do not necessarily occur together.(9)

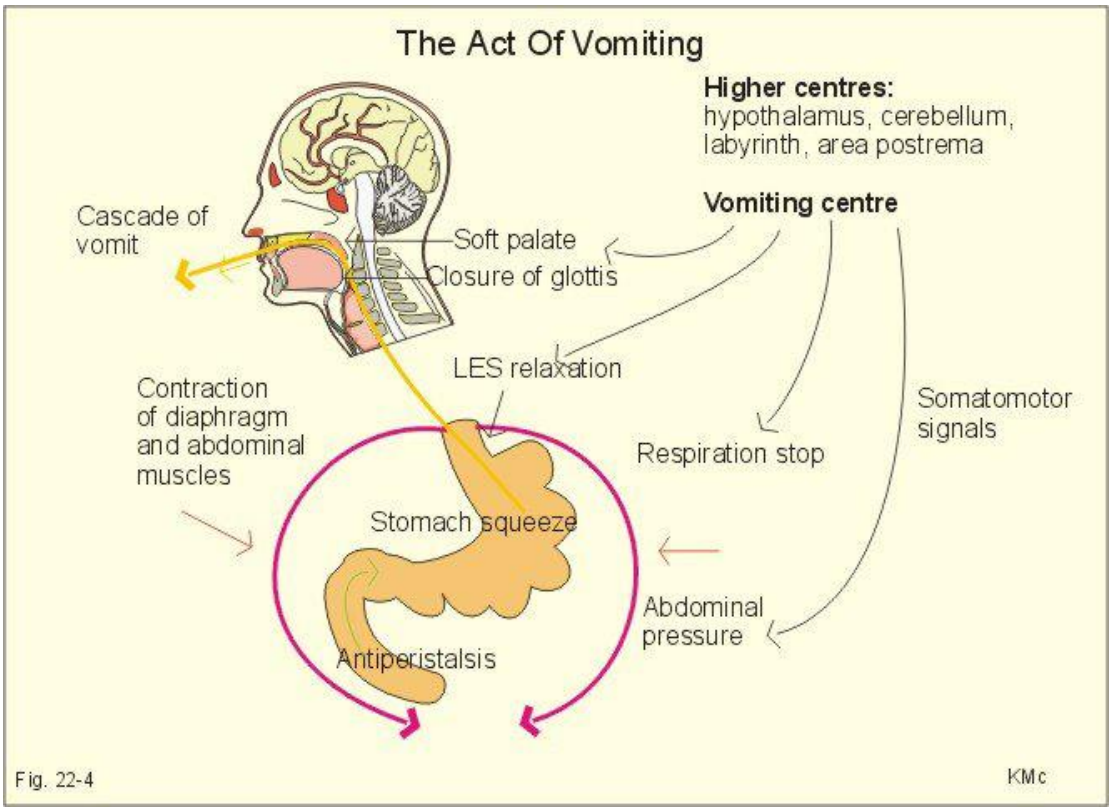

Figure 1: Act of Vomiting.

Pathways of Nausea and Vomiting:

The mechanism of emesis is a complex process dependent on multiple biological, chemical and neural electrical pathways. Emesis is controlled and centralized within the brainstem in an entwined neural network on the dorsal surface of the medulla oblongata. This region is referred to as the "brainstem emetic (vomiting) control center" or dorsal vagal complex.[10]

It contains three sub-regions: the nucleus tractus solitarius, the area postrema, and the dorsal motor nucleus of the vagus nerve. The vomiting center presumably receives convergent afferent stimulation from several central neurologic pathways, including the following.[10]

- A chemoreceptor trigger zone (CTZ).
- The cerebral cortex and the limbic system in response to sensory stimulation (particularly smell and taste), psychological distress, and pain.
- The vestibular-labyrinthine apparatus of the inner ear in response to body motion.
- Peripheral stimuli from visceral organs and vasculature (via vagal and spinal sympathetic nerves) as a result of exogenous chemicals and endogenous substances that accumulate during inflammation, ischemia, and irritation.

The CTZ is located in the floor of fourth ventricle, in the area of Postrema. It is ahighly vascularized area in which blood brain barrier is not effective. The CTZ is activated by direct chemical

stimulation through cerebrospinal fluid and blood, but not by direct electrical stimulation.[10]

The neurotransmitter implicated in the control of nausea and vomiting include acetylcholine, dopamine, histamine (H-1 receptor)[11], substance P(NK-1 receptor)and serotonin (5-HT3 receptor).There are also opioid receptors present, which may be involved in the mechanism by which opiate cause nausea and vomiting.[12]

To date, no universal antiemetic agent has been found.

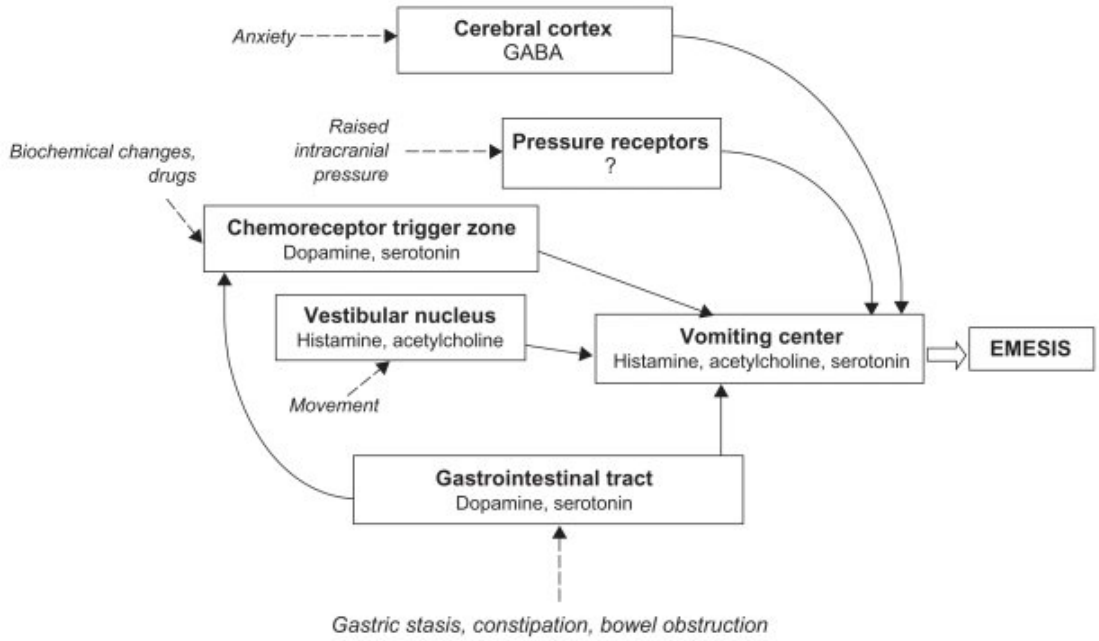

Figure 2: Pathways of Nausea and Vomiting.

Causes of PONV:

1-Neurological

Subarachiniod hemorrhage, Epidural hematoma, Hydrochephalus, Vestibular disorders (Ménière's disease, Acoustic neuroma and labyrnthitis), Increased intracranial tension, Meningitis, Encephalitis, CNS tumor and Migraine.

2-Cardiovascular

Myocardial ischemia/infarction, Aortic dissection, Aortic aneurysm and Mesenteric ischemia.

3-Gastrointestinal

Functional disorders, Chronic intestinal pseudo-obstruction Gastroparesis, Irritable bowel syndrome, Non-ulcer dyspepsia, Obstruction, Adhesions, Esophageal disorders/achalasia, Intussusception, Malignancy, Pyloric stenosis, Strangulated hernia, Volvulus, Organic disorders, Appendicitis, Cholecystitis/cholangitis , Hepatitis, Inflammatory bowel disease, Mesenteric ischemia, Pancreatitis, Peptic ulcer disease and Peritonitis.

4-Genitourinary and Obstetric

Renal colic/nephrolithiasis, UTI/pyelonephritis, Testicular torsion, Ovarian torsion, Pregnancy (ectopic, molar, uterine), Preeclampsia and hyperemesis gravidarum.

5-Endocrine

DKA, Adrenal disorders, Paraneoplastic syndromes, Parathyroid disorders, Thyroid disorders, Uremia and Electrolyte abnormalities.

6-Infections

Acute otitis media, Bacterial toxins, Food-borne toxins, Pneumonia, Spontaneous bacterial peritonitis, Urinary tract infection/pyelonephritis, Viruses (Adenovirus, Norwalk and Rotavirus).

7- Medications/Toxins

Antiarrhythmics, Antibiotics, Anticonvulsants, Chemotherapeutics , Digoxin, Ethanol overdose, Hormonal preparations, Illicit substances, Non-steroidal anti-inflammatory drugs, Opiates, Radiation therapy, Toxins, Arsenic, Organophosphates/pesticides, Ricin,Some anesthetic agents.

8-Miscellaneous

Acute glaucoma, Pain, Psychiatric disorders, Anorexia nervosa, Anxiety, Bulimia nervosa, Depression and Psychogenic/emotional.