PERIOPERATIVE MULTIMODAL POSTOPERATIVE NAUSEA AND VOMITING PREVENTION STRATEGIES IN THE AMBULATORY SURGICAL SETTING

By

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Abstract

Background/Purpose: Surgery employs a multitude of risks, one of which is postoperative nausea and vomiting (PONV). There are three factors that influence post-op symptoms: patient factors, anesthetic technique, and surgical related causes. The New Millennium Surgery Center (NMSC) located in Southfield, Michigan described an ongoing issue of PONV with patients undergoing Endoscopic Brow Lift and Herniated Orbital Fat Removal surgeries. The purpose of this Doctor of Nursing Practice (DNP) project was to identify potential anesthetic causes of PONV and post-discharge nausea and vomiting (PDNV) by doing a retrospective chart review at the New Millennium Surgery Center. Following the review, and in combination with the literature review findings, recommendations to aid in decreasing the incidence of PONV and PDNV at the surgery center were developed.

Method: A systematic search of current literature was conducted. Inclusion criteria consisted of peer reviewed articles containing data on PONV rates in ambulatory surgery in both male and female patients and possible treatments for prevention. Articles from 2012-2023 that related to the prevention of PONV were included, while the articles related to these surgeries and plastic surgery complications dated back from 2002-2018. A retrospective chart review was then conducted and included 100 total combined cases of endoscopic brow lift and herniated orbital fat removal procedures conducted by Dr. Evan Black at the New Millennium Surgery Center from May 2021 to July 2022. Data was analyzed and recommendations were constructed based on the results of this data and literature review findings.

Results: The data collected allowed three different drugs to be tested for significance with the Wilcoxon ranked sum. Opioids were not included related to findings which were not significant for PONV and PDNV. Results suggest Propofol did not influence observations of PONV ($W = 400.50$, $p = .65$). Ketamine was found to influence PONV ($W = 4252.50$, $p = .05$). Results suggested IV fluid did not influence PONV ($W = 418.50$, $p = .73$).

Discussion/Conclusion: Statistical analysis of results from the retrospective chart review allowed for the development of recommendations for NMSC anesthesia providers and staff. Recommendations included reducing Ketamine dosing: 0.2mg/kg to 0.5mg/kg, adding Dexmedetomidine into the anesthetic technique for those patients that fit the administration criteria, and appropriately assessing NPO status to determine how much fluid a patient should receive throughout the perioperative period. Appropriately assessing NPO status was added to the recommendations based on literature review findings and one outlier found in the retrospective chart review.

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Perioperative Multimodal Postoperative Nausea and Vomiting Prevention Strategies in the Ambulatory Surgical Setting

Background and Significance

Introduction

Surgery employs a multitude of risks, one of which is postoperative nausea and vomiting (PONV). PONV describes nausea and vomiting that occurs within the first 24-48 hours after surgery. Identifying patients at risk is extremely important for preventing PONV from occurring. There are three factors that influence post-op symptoms: patient factors, anesthetic technique, and surgical related causes. Patient factors include female gender, non-smoker, history of PONV, motion sickness, and age <50 years old. Anesthetic factors include general anesthesia, prolonged duration of anesthesia, volatile agents, Ketamine, nitrous oxide, intraoperative and postoperative use of opioid analgesia, and doses greater than three milligrams of neostigmine. Surgical factors include extended surgical procedures and surgical categories (Elvir-Lazo et al., 2020). Surgical categories of interest include ophthalmologic and plastics, which have been found to increase the risk of PONV (Le & Gan, 2010).

PONV causes a multitude of issues for patients. Pulmonary aspiration can result in chemical pneumonitis causing dyspnea, tachycardia, bronchospasm, hypoxia, and pink frothy sputum. Other sequelae include suture rupture, bleeding, electrolyte imbalance, prolonged recovery, fatigue, unanticipated admission to hospital, and increased hospital costs. Complications resulting from PONV can also contribute to a decrease in patient satisfaction (Finch et al., 2019).

The New Millennium Surgery Center (NMSC) located in Southfield, Michigan described an ongoing issue of PONV with patients undergoing Endoscopic Brow Lift and Herniated Orbital Fat Removal surgeries.

The chemoreceptor trigger zone (CTZ) lies outside the blood brain barrier and is exposed to drugs that facilitate nausea and vomiting. “Dopamine, opioid, histamine, acetylcholine, 5-hydroxytryptamine 3 (serotonin [5HT] 3) receptors, and neurokinin-1 (NK1) receptors have been shown to be related to the emetic center, and these diverse stimuli suggest that treatment with combinations of different drugs is essential in preventing PONV" (Moon, 2014, para. 3).

Medications are often utilized to reduce PONV. Cholinergic receptor antagonists are effective antiemetics with side effects of dry mouth, altered eye accommodation, and sedation. H1 histamine antagonists have been shown to inhibit PONV but have not been well studied (Le & Gan, 2010). 5HT-3 antagonists are usually the first line antiemetics used (Cao et al., 2017). Dopamine 2 (D2) receptor antagonists are used to increase GI emptying. Glucocorticoids decrease the incidence of PONV but because of their delayed onset, should be given at induction (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Each medication comes with its own side effects, resulting in the need for clinicians to weigh risks versus benefits. Not one combination or single use has been shown to be more effective than the other.

To promote patient comfort and safety, endoscopic brow lifts and herniated orbital fat (HOF) procedures are performed utilizing local anesthesia in the form of a field block administered by the surgeon, as well as intravenous administration of sedative medications (Servat et al., 2012). The HOF procedure consists of repositioning the prolapsed fat around the eye and suturing the fat to the sclera (Nakamura et al., 2015). The main side effects of this procedure are recurrence of orbital fat and eye dryness with irritation. The endoscopic brow lift

surgery is performed by the surgeon first marking the orbital rims at the level of the lateral canthal angle, hair is then tied off for visualization, and local anesthetic injected along the forehead. Incision is then made at the temporal markings and the endoscope is introduced through the incisions allowing for dissection. Once the periosteum is released, the surgeon performs the fixation. Fixation consists of multiple techniques including the endotine and ultratine technique which use implants that attach to the skull. Fascia is closed using absorbable sutures and skin closure done using staples (Servat et al., 2012). Side effects of this surgery include facial asymmetry, facial nerve injury, elevated hairline, and eye irritation. One of the greatest complications seen most often in plastic surgeries is postoperative nausea and vomiting leading to extended stays (Majumdar et al., 2021). Current methods used to minimize the incidence of PONV in this setting have not been efficacious, as reported by the healthcare team.

Literature Search

The purpose of this literature review was to answer the following question: When completing a retrospective chart review at the New Millennium Surgery Center for patients undergoing an endoscopic brow lift or herniated orbital fat removal, what common anesthetic choices are contributing to an increase in PONV and post discharge nausea and vomiting (PDNV)?

Methods

A systematic search of current literature was conducted, utilizing the following databases: Cochrane Database of Systematic Reviews (CDSR), CINAHL Complete (Cumulative Index to Nursing and Allied Health Literature), Ovid, and PubMed Medline. Bibliographies were hand-searched, and abstracts were screened. Key search terms included “postoperative nausea vomiting,” “ambulatory surgery,” “PONV,” “outpatient surgery,” “post-discharge PONV,”

"plastic and cosmetic surgery," "oculoplastic surgery," "TIVA," "men and women in plastic surgery," and "brow lift complications." Inclusion criteria consisted of peer reviewed articles which contained data on PONV rates in ambulatory surgery and possible treatments in prevention.

Results

The initial keyword search of the databases yielded 219 articles. Inclusion criteria were applied and thirty-four remained. Ultimately, twenty-three articles were used, with the remaining 11 excluded based on duplication and relevancy. Of the 23 articles chosen, four were RCTs (Hofman et al., 2017; Hyman et al., 2020; Marcus et al., 2002; Stallings-Weldon et al., 2018), nine were meta-analysis/systematic reviews (Cao et al., 2017; Elivir-Lazo et al., 2020; Jewer et al., 2019; Jones et al., 2020; Joshi et al., 2020; Kassel et al., 2018; Malchow et al., 2017; Manahan et al., 2018; Weibel et al., 2020), two were retrospective reviews/studies (Rohrich et al., 2019; Taghinia et al., 2008), three were quality improvement projects (Chiu et al., 2018; Dziadzko et al., 2020; Majumdar et al., 2021), two were cross-sectional studies (Finch et al., 2019; Stjernberg et al., 2018), and one for secondary analysis and cohort study (Masiongale et al., 2018; Bartlett et al., 2017 respectively) (Appendix A). One article was informational for the brow lift procedure (Servat et al., 2012).

Literature Review

Physiology and Medications for PONV

Nausea can be defined as an unpleasant sensation causing discomfort in the stomach which gives a feeling of an impending need to vomit or retch (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). This sensation is frequently followed by active retching, tachycardia, and increased salivation. Vomiting is the involuntary, forceful expulsion of stomach content through

the nose and mouth (Elvir-Lazo et al., 2020). It is important to clarify that PDNV is often included in the definition of PONV in the literature (Manahan et al., 2018).

Chemoreceptor Trigger Zone (CTZ)

The "vomiting center" is the central coordinating site for nausea and vomiting and is located in the lateral reticular formation of the brainstem (Le & Gan, 2012). The chemoreceptor trigger zone (CTZ) is located at the base of the fourth ventricle and detects emetogenic agents in blood and cerebrospinal fluid (CSF). The CTZ then communicates to the nucleus tractus solitarius (NTS) which then projects to the central pattern generator (CPG) in the medulla resulting in emesis (Le & Gan, 2012). Cao et al., 2017 discusses five neurotransmitter receptor systems that include serotonergic, dopaminergic, histaminergic, cholinergic, and neurokininergic.

5-HT3 Receptor Antagonist.

This subset of serotonin receptor antagonists works in two places in the body. First, peripherally at the vagal nerve endings in the gastrointestinal system. When serotonin is released, it binds to the 5HT3 receptors and can cause nausea and vomiting. The second site is centrally in the CTZ at the area postrema of the fourth ventricle (Theriot et al., 2021). 5-HT3 receptor antagonists are usually used as the first line of defense for nausea and vomiting and are administered towards the end of the surgery (Elivir-Lazo et al., 2020). Ondansetron is the most commonly used drug from this class and is found to be very effective in treating PONV. Granisetron and ramosetron are both more selective for the 5-HT3 site compared to ondansetron and studies have found that they both last longer than ondansetron (Elivir-Lazo et al., 2020). This class of medications can lead to unwanted outcomes, such as a prolonged QT interval (leading to arrhythmia) and serotonin syndrome (Theriot et al., 2021). It is best to avoid 5-HT3 receptor

antagonists if the patient has a prolonged QT interval or is taking other medications that can cause prolongation, as well as taking any other selective serotonin reuptake inhibitors (SSRIs).

Dopamine Antagonist

There are three classes of antidopaminergic agents: butyrophenones, benzamides, and phenothiazines. These all work to decrease nausea and vomiting by acting on the central D2 receptors in the CTZ and area postrema (Le & Gan, 2012).

The drugs included in the butyrophenone class are droperidol and haloperidol. Droperidol is currently the most cost-effective drug for PONV, compared to the 5-HT3 and NK-1 inhibitors (Cao et al., 2017). There is, however a black-box warning on this drug for risk of arrhythmia with the prolonging of the QT interval with increased doses (Le & Gan, 2012). The dose that is used for PONV is much smaller than the other Dopamine receptor antagonists (0.625-1.25mg) and has proved to be very safe for patients (Manahan et al., 2018). An EKG is required for the patient before this is given, as well continuous heart rate monitoring for three hours after administration (Le & Gan, 2012). Another downside to this drug is the risk of extrapyramidal side effects, which include acute dyskinesia, tardive dyskinesia, dystonia, akathisia, or parkinsonism. Haloperidol works faster and has a longer half-life than droperidol but does not last as long due to having a weaker affinity for the receptor than droperidol (Le & Gan, 2012). Haloperidol is reported to work just as well as the 5-HT3 antagonists with the same incidence of QT prolongation (Cao et al., 2017).

The most common benzamide used is metoclopramide and this is the most commonly used antiemetic when the 5-HT3 compounds and/or droperidol prophylaxis has failed (Cao et al., 2017). This drug works on both the central D2 receptors above and peripherally in the GI tract by

increasing gastric motility (Le & Gan, 2012). Metoclopramide has the same extrapyramidal side effects that the butyrophenones have.

The phenothiazines are drugs that were commonly used in the past. Use has decreased, attributable to side effects associated with them (Le & Gan, 2012). A randomized control trial reported that olanzapine decreased the incidence of PONV when used in conjunction with dexamethasone and ondansetron with only a slight increase in sedation (Hyman et al., 2020), however it did not decrease the incidence alone, so it is not recommended as a first line treatment.

Dopamine antagonists have significant PONV benefits but should not be given to patients with Parkinson's disease.

Antihistamine

"Diphenhydramine, dimenhydrinate, cyclizine, doxylamine, and promethazine block the histamine H1 receptor in the NTS, at the vomiting center, and vestibular system; having little or no direct action at the CTZ" (Le & Gan, 2012). The use of antihistamines has not been well studied (Le & Gan, 2012). Antihistamine drugs produce anticholinergic activity causing sedation, dry mouth, blurred vision, and urinary retention (Le & Gan, 2012).

Anticholinergic

Anticholinergics block muscarinic cholinergic antiemetic receptors from vestibular nuclei to higher centers in the CNS that communicates to the "vomiting center" (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Atropine and scopolamine are both common anticholinergics; however, atropine has weaker antiemetic effects and is generally not used related to its cardiovascular effects (Le & Gan, 2012). Scopolamine has been found to be successful in reducing PONV in early and late postoperative periods (Elivir-Lazo et al., 2020). The patient

places the scopolamine patch on the night before surgery: the patch releases a bolus dose on application and has an onset of four hours. It is designed to release one milligram over seventy-two hours and it is recommended to remove the patch twenty-four hours after surgery (Kassel et al., 2018). Scopolamine is suggested to be a first-line or second-line antiemetic therapy (Elivir-Lazo et al., 2020). Despite its efficacious effects on PONV it comes with side effects that include sedation, blurred vision, dizziness, and dry mouth (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). It is not recommended in the pediatric patient population related to central anticholinergic syndrome (Kassel et al., 2018), but with the older adult population there seems to be swaying information. Central anticholinergic syndrome is caused by anticholinergic medications that cross the blood-brain barrier. Anticholinergics with central nervous system effects block muscarinic cholinergic receptors, resulting in a wide range of symptoms. Symptoms range from coma, dry mouth, mydriasis, tachycardia, urine retention, delirium, and even seizures (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Kassel et al., 2018 states that incidence of anticholinergic effects among the adult and older adult populations vary, making application to practice difficult. It is up to the clinician to weigh the benefits against the risk.

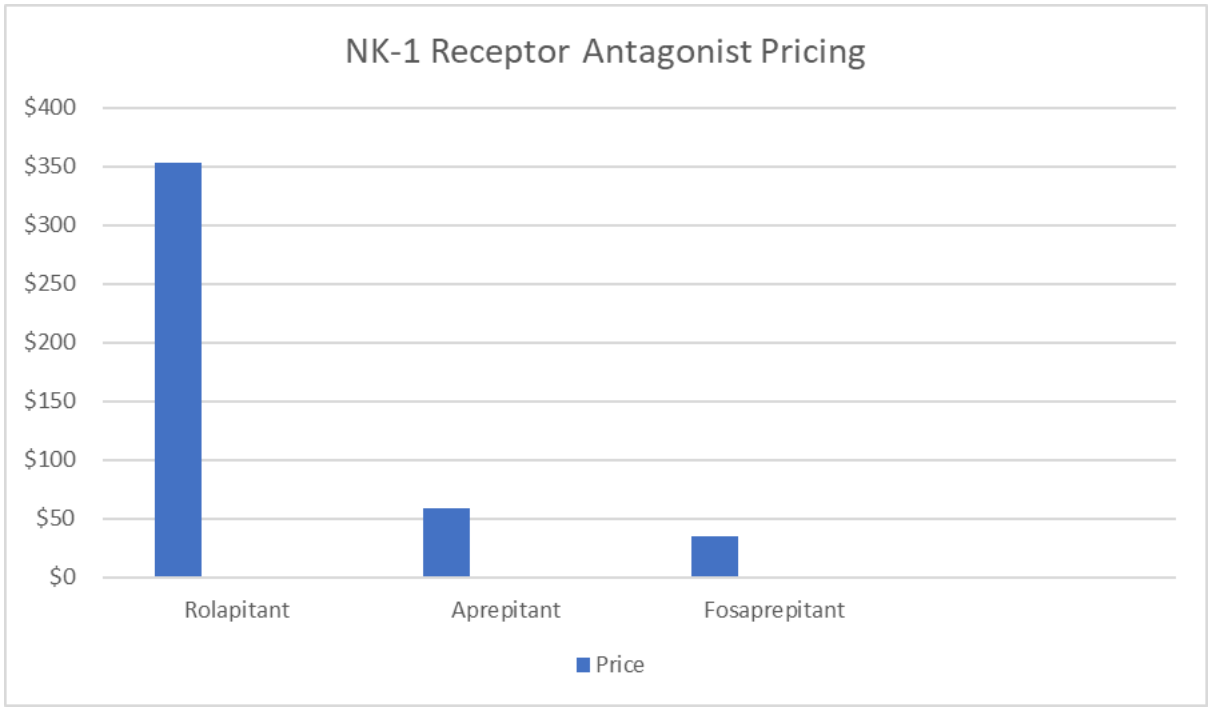
NK-1 Receptor Antagonist

Neurokinin-1 receptor antagonists inhibit substance P, which plays an important role in emesis (Le & Gan, 2012). Neurokinin receptors are found in the nucleus of NTS, where it suppresses vagal afferents from the GI tract that converge with inputs from postrema and other regions of the brain that initiate emesis (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). This decreases the intensity of emetogenic signals sent to the CPG. Le & Gan, 2012 discuss a clinical trial that used Aprepitant (Emend) and found that prevention of PONV was greatest when a 125-milligram dose was used compared to ondansetron, four milligrams in a twenty-four-hour

period. Aprepitant is useful in ambulatory surgical settings related to its oral and newer intravenous form, fosaprepitant, with minimal side effects that include fatigue, constipation, and hiccups (Elivir-Lazo et al., 2020). Rolapitant (Varubi) is different from Aprepitant in that it has a longer half-life of 180 hours, making it more effective for PDNV (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). It is not used as much due to the high cost. Two 90mg pills (180mg total), cost $707 (~$353/tablet); whereas Fosaprepitant (IV Emend) is $35 per powder for injection (drugs.com, 2022). Aprepitant (oral Emend) costs $59 for one 40mg capsule. It is suggested that aprepitant should only be used in high-risk PONV patients since it is associated with higher cost compared to other antiemetic medications (Elivir-Lazo et al., 2020). Figure 1 illustrates the price differences between the different NK-1 receptor antagonists.

Figure 1

Comparison of NK-1 Receptor Antagonists



Plastic Surgery

Complications

Extended hospital stays are one of the biggest complications of PONV in plastic surgery patients. Marcus (2002) conducted a randomized prospective study that found that PONV led to increased recovery periods leading to overnight stays. Manahan (2018) reported similar consequences. Majumdar (2021) conducted a retrospective review and designed a multi-faceted protocol to decrease PONV in plastic surgery patients. The protocol consisted of total IV anesthetic (TIVA) vs. general anesthetic (GA), and this significantly decreased extended stays due to PONV; no antiemetics were documented in this study (Majumdar et al., 2021).

Marcus (2002) and Manahan (2018) also discussed PONV leading to hematoma formation and ecchymosis through transient increases in blood pressure during retching. When the action of vomiting occurs, intracranial pressure (ICP) is increased through the process of mean arterial pressure (MAP) transiently increasing (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). This transient but acute increase in pressure inside of blood vessels can lead to the blood vessels breaking and thus causing hematoma formation. Increased bleeding and ecchymosis at the surgical site from increased blood pressure is one of the more common complications in this patient population (Marcus et al., 2002).

PONV is the leading cause of admission into the hospital in ambulatory surgical patients (Hofman et al., 2017). These admissions are related to dehydration, electrolyte imbalances, pulmonary aspiration, wound dehiscence, and bleeding (Elivir-Lazo et al., 2020). Increased hospital spending comes mostly from the cost of additional IV hydration, medications being used, and paying staff for extended shifts (Finch et al., 2019). “The negative outcomes stated above lead to a decrease in patient satisfaction (Weibel et al., 2021).” Most patients rank PONV

as one of the worst aspects of surgery, saying that they wish to avoid it even more than postoperative pain (Jewer et al., 2019).

Patient Population

Men vs. Women

The target population for endoscopic brow lift surgery is well defined (Rohrich et al., 2019). We found that over a ten-year span, the average age for the brow lift procedure was 59-year-old with 96% of patients being female. This highlights the association of PONV at the surgical center since women are found to have a higher incidence of this complication (Elivir-Lazo et al., 2020).

Apfel score

Risk factors are important for identifying who stands to gain the greatest benefit in antiemetic prophylaxis (Elivir-Lazo et al., 2020). There was a total of nine articles that described the Apfel score as a measuring tool for risk of PONV (Finch et al., 2019; Cao et al., 2017; Hofman et al., 2017; Elivir-Lazo et al., 2020; Majumdar et al., 2021; Manahan et al., 2018; Marcus et al., 2002; Masiongale et al., 2018; Stjernberg et al., 2018). The Apfel risk-scoring system for PONV predictors include female gender, history of PONV or motion sickness, non-smoking status, and postoperative opioid use (Elivir Lazo et al., 2020). The score given is related to how many risk factors a patient has. Scores range from zero to four with four being high risk; four represents a 79 percent risk for developing PONV. “Apfel’s risk-scoring system is more sensitive and specific compared to predicting PONV based on history of PONV or type of surgery” (Elivir-Lazo et al., 2020). Risk factors pertinent to the surgical center include women, non-smokers, age <50 years old, previous history of PONV/motion sickness, and use of opioids during and after surgery, yielding a score of four (See Appendix B for APFEL score table).

PONV

Incidence

The incidence of PONV can occur in 30% of patients with low-risk factors/low APFEL scores and up to 70-80% of patients with high-risk factors/high APFEL scores, up to 24 hours after ambulatory surgery (Stallings-Weldon et al., 2018). A patient who develops PONV has a threefold increased risk for PDNV (Cao et al, 2017). Manahan et al. (2018) stated "There are varying estimates on the incidence of PONV, likely resulting from diversity among patients, surgical procedures, and pharmaceuticals used." Patients who experience PDNV may not experience PONV which highlights the need for further evaluations (Manahan et al, 2018). This data suggests that there are a significant number of patients having PONV which can lead to PDNV not only after endobrow and herniated orbital fat procedures, but also in other outpatient settings.

General vs. TIVA; Use of Opioids

Different anesthetic choices have a large impact on PONV. Specifically, Cao et al writes "opioids, volatile anesthetics, nitrous oxide, and neostigmine are high anesthetic risk factors for PONV" (2017). Opioids are used in surgery to decrease pain at the spinal and supraspinal levels. The opioid receptors in the body, when activated, suppress calcium influx leading to a decrease in different neuropeptides, mainly substance P. These receptors block potassium channels, preventing an action potential which may be interpreted as pain. PONV is a common side effect of opioid use related to the stimulation of the CTZ (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Volatile anesthetics and nitrous affect the same area of the brain causing nausea and vomiting. Neostigmine, an anticholinesterase, has an increased incidence of PONV. It allows

more acetylcholine (ACh) to bind to parasympathetic nerve fibers causing an increase in gastric motility and thus PONV (Nagelhout CRNA PhD FAAN, John J. et al., n.d.).

A retrospective observational study revealed there is a dose-dependent association between intraoperative remifentanil administration and an increased risk of PONV (Cao et al., 2017). Strategies to minimize the use of opioids should be considered for all moderate and high-risk patients. Enhanced recovery after surgery (ERAS) pathways for various surgery types have been successful in reducing opioid consumption, PONV, and hospital length of stay (Chiu et al., 2018).

Articles reviewed agree that inhaled anesthetics escalate the likelihood of developing PONV vs. TIVA. Manahan et al states that when general anesthesia was introduced in 1840, PONV became a common problem (2018). If a patient has increased risk factors of PONV the clinician should avoid inhaled anesthetics, etomidate, and ketamine due to their increased risk of PONV (2018). Hyman et al discussed that using propofol will reduce PONV but does not reduce the incidence of PDNV, due to its short half-life of forty minutes (2020).

Five studies discussed the increased risk of PONV after narcotic intraoperatively and postoperatively (Cao et al., 2017; Stjernberg et al., 2018; Masiongale et al., 2018; Manahan et al., 2018; Hyman et al., 2020). Stjenberg et al highlighted that use of opioids increased PONV, yet pain causes PONV (2018). Cao et al found that pain was a factor for PDNV (2017). The pain pathway can be complex, but when an intense painful stimulus occurs, neuropeptides are released and travel to the vomiting center and CTZ in the brainstem again leading to nausea and vomiting (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Within the Stjenberg et al study TIVA, remifentanil, and fentanyl was used intraoperatively; acetaminophen or Toradol was used preoperatively, and patients received opioids postoperatively; some for up to three days (2018).

Patients performed a survey or telephone questionnaire and researchers found that 16% had PDNV, 79% were women (Stjernberg et al., 2018). The literature supported the idea that TIVA decreases the incidence of PONV not PDNV, while opioids and GA increase it.

Treatment/Management

Prevention plays a major role in PONV/PDNV. There are many different medications and modalities that have been studied to decrease this complication.

Pharmacologic

Multimodal antiemetic therapy is the use of multiple drugs from different drug classes to treat and prevent PONV and PDNV. Elivir-Lazo (2020) found that there is no evidence currently that shows that any specific drug works on specific patients or surgeries. However, a combination of antiemetic drug therapies that act at different neuroreceptor sites has been recommended for patients; it was shown to decrease the incidence of PONV to less than 10% (Elivir-Lazo et al., 2020). A meta-analysis suggested using one antiemetic per positive score on the APFEL system (Cao et al., 2017). Each antiemetic must work on a different receptor for it to properly decrease the incidence of nausea and vomiting.

Dziadzko (2020) recommended the use of long acting antiemetics, palonosetron 0.075mg intravenously or aprepitant 40mg by mouth (PO), in addition to the short acting, ondansetron 4mg or dexamethasone 4-8mg intraoperatively, to decrease the incidence of PDNV. A meta-analysis used findings from other studies to make recommendations to use agents with different mechanisms of action (multimodal approach) as well as considering time to onset of medications to best control PONV (Manahan et al., 2018). Metoclopramide in combination with ondansetron was associated with significantly less PONV among participants at moderate to high risk of PONV and triple therapy with dexamethasone, metoclopramide, and ondansetron

revealed a similar effect, compared to a single dose of metoclopramide (Masiongale et al., 2018).The single use of olanzapine had no significant effect on PONV rates, but when it was added into a treatment with dexamethasone and ondansetron it decreased PONV significantly ($p<0.05$) (Hyman et al., 2020).

The combination of dexamethasone and ondansetron, or droperidol was used consistently in multimodal therapy. Dziadzko (2020) recommended using a combination of dexamethasone, 4-8mg, and droperidol 0.625mg in moderate risk patients that have an APFEL score of one to two.

Research was conducted on the use of scopolamine and its effects on different populations. Scopolamine is an effective antiemetic, but it should be avoided in specific patient populations like pediatrics. Careful considerations should be applied for older adult patients, 65 and older, with certain comorbidities (i.e. cardiovascular disease) (Kassel et al., 2018).

Adequate intravenous (IV) fluid hydration perioperatively is also an effective strategy for decreasing the baseline risk for PONV (Cao et al., 2017). Studies have reported that the administration of perioperative IV colloid and crystalloid were associated with decreased incidence of PONV (Elivir-Lazo et al., 2020). Jewer (2019) found that the use of IV fluid decreased the use of other antiemetics.

Decreasing the use of certain medications was researched to determine if it decreases the incidence of PONV. “In patients who have previously experienced PONV or have other risk factors, agents such as nitrous oxide, inhalational agents, etomidate, and ketamine should be avoided as these are known to have nausea and vomiting as a side effect.” A decreased dosage of narcotics given and employing multimodal pain regimens like non-steroidal anti-inflammatory drugs (NSAIDS), have been shown to decrease PONV rates (Manahan et al., 2018).

The effects of dexmedetomidine were studied in a retrospective study. Two groups were established: a dexmedetomidine and no dexmedetomidine group. The no dexmedetomidine group received propofol, ketamine, fentanyl, and midazolam. Fewer patients in the dexmedetomidine group required postoperative antiemetics (14% versus 29%, $p< 0.05$) (Taghinia et al., 2008). Cao et al., 2017 notes that using dexmedetomidine decreases PONV by decreasing the use of intraoperative opioids. Dexmedetomidine is an alpha-2 agonist and modulates the sympathetic nervous system. It prevents the release of pain neurotransmitters which reduces intraoperative and postoperative opioid requirements (Taghinia et al., 2008). At high doses patients can breathe spontaneously. It induces sedation, anxiolysis, analgesia, and hypnosis while also lowering and stabilizing heart rate and blood pressure by inhibiting norepinephrine release (Taghinia et al., 2008). Lower blood pressure in the postoperative period decreases the risk of hematoma formation. When local anesthetics are injected dexmedetomidine will blunt the swings in heart rate and blood pressure that are normally seen (Taghinia et al., 2008). Clonidine is also an alpha 2 adrenoreceptor agonist yet Dexmedetomidine is seven to ten times more selective for alpha 2 (Naaz & Ozair, 2014). Clonidine is usually reserved for short-term oral treatment of severe hypertension and severe rebound hypertension is seen after abrupt discontinuation. Although Clonidine exhibits the same sedative, analgesic, and anxiolytic properties as Dexmedetomidine, the onset is much slower; thirty to sixty minutes. Clonidine has a longer duration of action with a half-life of five to thirteen hours compared to Dexmedetomidines' three hours (Nagelhout CRNA PhD FAAN, John J. et al., n.d.).

Nonpharmacologic

Six articles discussed the non-pharmacologic options in the prevention and treatment of PONV (Stallings-Weldon et al., 2018; Hofman et al., 2017; Elivir-Lazo et al., 2020; Cao et al.,

2017; Manahan et al., 2018; Dziadzko et al., 2020). There were mixed results on the use of aromatherapy for PONV. Stallings-Weldon (2018) did not find any significance in the use of it ($p=0.86$). However, alcohol swab aromatherapy for PDNV once a patient is at home has been found to be significant (Dziadzko et al., 2020). Acupressure use at pressure point P6 preoperatively was statistically significant in reducing PONV (Hofman et al., 2017). A systematic review of P6 acupoint stimulation (versus sham or non-acupoint treatments) for PONV demonstrated that acustimulation reduced nausea, vomiting, and the need for rescue antiemetic therapy after surgery (Cao et al., 2017). These modalities can be used in addition to pharmacologic therapy to produce additive effects without increasing side effects or the potential for adverse drug interactions. Non-pharmacological approaches may also be used as a last line intervention.

ERAS

ERAS is a pathway that uses evidence-based, multimodal, multidisciplinary interventions to reduce surgical response (Joshi et al., 2020). Implementation of said pathway reduces postoperative complications; including PONV, and shortens hospital length of stays (Joshi et al., 2020).

Majumder et al conducted a study that implemented TIVA using propofol, three antiemetics including aprepitant, reduced morphine dosages, initiated fluid management, and used NSAIDs and acetaminophen for pain control and found that there was a reduction in PONV and unplanned admissions. The rate of extended stay due to PONV before TIVA implementation was 6.1% and decreased to 0.9% after implementation (adjusted difference 4.7%, 95% CI 3.0%, 6.2%, $p < 0.001$). This translates to one fewer extended stay due to PONV for every 21 patients treated with the new protocol (2021).

Bartlett et al conducted an ERAS protocol for cosmetic surgery; breast and facial surgeries, which included preoperative counseling and optimization of nutrition (2017). The night before surgery patients were preloaded on celecoxib (200mg to 400mg), gabapentin (300mg to 600mg), and ondansetron (8mg); after induction of fentanyl and propofol, they were given intravenous dexamethasone and a promethazine suppository (2017). A local block was used intraoperatively, and IV acetaminophen was given at the end of the case (2017). Once in post-anesthesia care unit (PACU) patients received gabapentin, they were discharged home with celecoxib, gabapentin, methylprednisolone (4mg to 48mg), and encouraged use of acetaminophen (500mg) for breakthrough pain (2017). This protocol decreased PONV by 50% and eliminated PDNV altogether (Bartlett et al., 2017), although this sample size consisted of twenty-two patients.

Chui et al reviewed charts of patients who underwent total skin sparing mastectomy to evaluate the efficacy of an ERAS protocol used (2018). The protocol included preoperative counseling, oral acetaminophen (1000mg) and gabapentin (600mg), clear liquids encouraged for up to two hours before surgery, and patients who were less than sixty years old with a history of PONV had a scopolamine patch applied (Chui et al., 2018). Intraoperatively, a pectoral block one and two or a paravertebral block was utilized. TIVA was then used which included propofol, fentanyl, hydromorphone, dexamethasone (8mg), and ondansetron (4mg) (Chui et al., 2018). Fluids were limited to less than two liters and warming measures were implemented (2018). Postoperatively patients were given ibuprofen for mild pain, acetaminophen with hydrocodone or oxycodone for moderate pain, and IV hydromorphone for severe pain (2018). It was found that PONV decreased by 23 percent in the ninety-six charts included. However, use of antiemetics in the PACU remained unchanged (Chui et al., 2018).

PONV was found to be reduced in these studies through the decreased use of opioids, decreased NPO time, antiemetic use, and increased IV fluids throughout the surgeries.

Purpose Statement

The purpose of this DNP project was to identify potential anesthetic causes of PONV and PDNV by doing a retrospective chart review at the New Millennium Surgery Center. Following that review, and in combination with the literature review findings, recommendations to aid in decreasing the incidence of PONV and PDNV at the surgical center were developed.

The primary objective was to make recommendations to help anesthesia providers at the New Millennium Surgery Center to decrease PONV. The secondary objective was to educate the staff on our findings to help decrease the incidence of PONV and PDNV in this patient population.

Conceptual Framework

The best-practice framework of Quality Improvement (QI) developed by Nelson et al. (2007) a model that targets process improvement in four domains: leadership, staff, information and information technology (IT), and performance and improvement will be utilized. Each domain is structured with individual QI interventions designed to activate stakeholder participation in the adoption of Evidence Based Practices (EBPs), such as hospital leadership, clinicians, and patients. The organizational theory that fits best with this project is Lewin's change theory. This theory concentrates on how one of the problems encountered in doing a quality improvement project is resistance to change by staff. This theory operates on a three-step process that 1) “unfreezes” current practice by introducing the new evidence-based practice on prevention of PONV in this patient population, 2) changes the current practice by implementing

the new prevention strategies, and 3) “refreezes” after the new practice is implemented that allows increased patient comfort and satisfaction (Lewin, 1951).

Project Methodology

Design

Upon IRB approval (Appendix C) and designation as a Quality Improvement Project, this project consisted of three phases. In the first phase, a retrospective chart review was conducted on patients that underwent endoscopic brow lift and herniated orbital fat removal by Dr. Black at the New Millennium Surgery Center in Southfield, Michigan from May 2021 until 100 charts were reviewed. The focus was on all medications given perioperatively (pre-, intra-, and postoperative), and the incidence of PONV and PDNV. Phase two involved analyzing data retrieved and development of recommendations for reducing PONV/PDNV outcomes based on current literature. Phase three involved educating the CRNA staff on new, suggested PONV prevention guidelines for the New Millennium Surgery Center.

The key personnel for this project included Mary Margaret Gulowski, CRNA, MS, and Lisa Saunders, Office Manager, MSN. Sara Cupp RN, BSN and Maxie Mitchell RN, BSN were the doctoral students conducting the project. Dr. Laura Rodgers CRNA, DNAP, CHSE was the faculty of record for this project. The target patient population included patients undergoing endoscopic brow lift and herniated orbital fat removal procedures by Dr. Evan Black MD, FACS, FAACS.

Data Collection

Collection of the data came from paper chart reviews. Data included patients of Dr. Evan Black MD, FACS, FAACS that have undergone endoscopic brow lift and herniated orbital fat removal at New Millennium Surgery Center in Southfield, Michigan. A data collection tool was

utilized. (Appendix D). Chart reviews were conducted at the New Millennium Surgery Center. Patients were deidentified and labeled one through one hundred; one hundred being the maximum data collected for a specific end date. The number of charts used in the statistical research revolved around inclusion criteria; patients having endoscopic brow lift or herniated orbital fat removal by Dr. Evan Black MD, FACS, FAACS, with incidence of PONV or PDNV. After charts were reviewed and data collected, the deidentified data was inputted into a spreadsheet for data analysis.

Barriers

Barriers that could have potentially skewed the results of this project included the knowledge that there are more HOF procedures performed in comparison to endoscopic brow lift surgeries at the surgery center. The results of the study could have potentially favored the patients that underwent the HOF procedure. Another perceived barrier was educating all the CRNAs on the proposed antiemetic guidelines as there are two different groups that perform anesthesia at this center.

Ethics

Following approval from the IRB at Oakland University and designation as a quality improvement project, all chart reviews were de-identified and reviewed in a confidential manner.

Potential Benefits and Outcomes

After an extensive literature review it was discovered that using a multimodal drug approach, which works on different CTZ receptors and sends signals to the vomiting center, is the best way to decrease PONV/PDNV. Many anesthetics were reviewed in our search. Literature supported decreasing the use/dosage of opioids, ketamine, and avoiding general anesthesia.

Increasing the use of IV fluids and TIVA was supported. The goal outcome for this project was to determine best practice in reducing PONV/PDNV in this patient population.

Budget and Timetable

There were no financial needs or prospective costs involved in the implementation process. An anticipated timetable is shown in Appendix E.

Results

Data Analysis

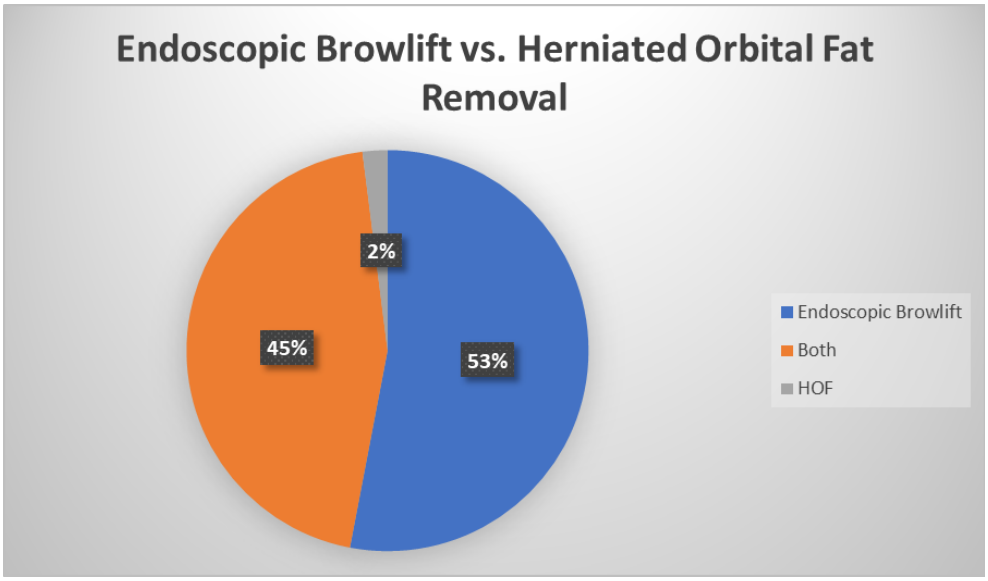
Data analysis was performed with SPSS. The Wilcoxon ranked sum was utilized due to its ability to handle unequal samples. Data also violated the assumptions of distributional normality. After the analysis of the chart reviews, recommendations were formulated and discussed with the NMSC staff.

Patient Demographics

One hundred charts were reviewed of patients undergoing HOF and endoscopic brow lift procedures at the New Millennium Surgery Center. The age range for patients was forty-one to seventy-eight. Ninety-one patients were female (eleven between the age thirty and fifty and eighty greater than 50 years) and nine were male (all greater than 50 years). Fifty three out of hundred patients had an endoscopic brow lift, forty-five had both HOF and endoscopic brow lift, and two had HOF surgery (Figure 2).

Figure 2

Incidence of Endoscopic Browlift and Herniated Orbital Fat Removal Procedures



Ninety-six patients were non-smokers and four were current smokers. Out of the one hundred patients, there were a total of twenty-four that had a history of having PONV.

Descriptive Statistics

Descriptive statistics were utilized to compute the total amount of Propofol, Ketamine, and Fentanyl administered. Propofol doses ranged from 100mg to 1650mg, Fentanyl twenty-five micrograms to one hundred micrograms, and Ketamine's doses ranged from zero to 170mg. Other data that was reviewed pertained to what type and amount in mg of antiemetics that were given. Decadron given ranged from zero to ten milligrams and Zofran ranged from zero to eight milligrams. Scopolamine patches were applied to twenty-three patients with or without a history of PONV and out of those twenty-three, two had PONV. The amount of IV fluid was documented as total fluid given or fluid given prior to incision. Total fluid ranges from 0-1100ml and IV fluid given prior to incision ranges from 0-500ml.

Wilcoxon Analysis

The Wilcoxon ranked sum was used to test three different drugs for significance in relation to PONV and PDNV. Opioids were not included related to the insignificant findings for PONV and PDNV. Findings suggest Propofol (Mean rank 48.91, n= 87) did not influence observations of post-operative nausea and vomiting (Mean rank=44.50, n=9). A Wilcoxon signed rank test indicated no statistical significance in differences (W = 400.50, p = .65). Findings suggest Ketamine (Mean rank=47.78, n= 89) did influence observations of post-operative nausea and vomiting (Mean rank= 66.5, n=9). A Wilcoxon signed rank test indicated statistical significance in differences (W = 4252.50, p = .05). Findings suggest IV fluid (Mean rank=49.8, n= 89) did not influence observations of post-operative nausea and vomiting (Mean rank=46.50, n=9). A Wilcoxon signed rank test indicated no statistical significance in differences (W = 418.50, p = .73). (Appendix F).

Discussion

In 1914 the first journal devoted to anesthesia featured an article highlighting prophylaxis of PONV, yet over 100 years later PONV is still problematic for patients (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Patients continuously rank PONV as one of the worst aspects of surgery and would rather avoid it more than post-op pain (Finch et al., 2019). The objective of this retrospective chart review was to identify potential anesthetic causes of PONV and PDNV at the New Millennium Surgery Center. Our findings from the retrospective chart review, data analysis and evaluation of that analysis were used to develop recommendations for anesthesia providers and staff at the NMSC to decrease PONV/PDNV in endobrow and herniated orbital fat removal surgical patients at the center, while also educating the staff on PONV/PDNV prevention.

PONV

The incidence of PONV/PDNV from 100 patient charts was evaluated, from which recommendations for modifications were developed. PONV was defined as nausea and vomiting that developed in recovery, until discharge. This was documented by PACU nurses in the postoperative checklist. PDNV was defined as the incidence of nausea and vomiting after discharge, up to 24 hours. This was documented on follow-up calls to patients. There was no significant correlation between PONV/PDNV and the use of opioids intraoperatively. The nine occurrences of PONV/PDNV did not receive opioids intraoperatively. This is not congruent with the literature that states that opioids increase the incidence of PONV (Cao et al., 2017; Stjernberg et al., 2018; Masiongale et al., 2018; Manahan et al., 2018; Hyman et al., 2020). This could have been due to the small dosage of Fentanyl given throughout the surgeries.

Intraoperative medications

As causes of PONV/PDNV can be multifactorial, individual components that contribute to PONV/PDNV were examined. Data was collected on the dosage of opioids given to patients, anesthetic agents administered, and the dose of these agents (Tables 1, 2, 3). IV fluids and antiemetics, type and dose, given perioperatively were examined and totaled. Although propofol was given to all patients it showed no significance in postoperative complications. It is well documented that propofol reduces PONV but does not reduce the incidence of PDNV related to its short half-life (Hyman et al., 2020).

Table 1

Anesthetic Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Fentanyl	16	25.00	100.00	85.9375	25.76941
Propofol	98	100.00	1650.00	817.1429	364.94598
Other	100	0	8	2.38	1.813
Ketamine	100	0	170	38.85	39.208
Valid N (listwise)	16				

Table 2

Antiemetic Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Scopolamine Patch	100	1	2	1.25	.435
Decadron	100	0	10	9.22	2.023
Zofran	100	0	8	4.00	1.137

Valid N (listwise)	10 0

Ketamine use was given to seventy-four patients and had a significant impact on PONV/PDNV, in relation to dosing. It is recommended that 0.2mg/kg to 0.5mg/kg be given intraoperatively for pain management (Stoelting's et al., 2022). Ketamine is rapid acting with an onset of less than one minute and a duration of action 80 to 180 minutes (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). The United States Consensus Guidelines recommend that subanesthetic doses of ketamine should be considered for patients undergoing painful surgeries and bolus doses should not exceed 0.35mg/kg (Schwenk et al., 2018). Patients at NMSC who suffered from PONV/PDNV were given doses that exceeded induction doses, which are 1 to 2 mg/kg. It is also noted that there is an increase in systolic and diastolic blood pressure when larger doses of Ketamine are administered (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). Clinicians should avoid Ketamine use in patients who have a high risk of PONV (Manahan et al., 2018). There is no evidence in current literature that suggests what dose increases the risk of PONV. This is an area that deserves further research and discussion.

The use of adequate IV fluid hydration perioperatively is an effective strategy for decreasing the risk for PONV (Cao et al., 2017). IV fluid administration was calculated for the perioperative and pre-incision period. A mean preoperative total of 274.51ml and perioperative total of 627.65ml was administered (Table 3).

Table 3

IV Fluid Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
IV Fluid Periop	98	0	1100	627.55	247.370
IV Fluid Before Incision	100	0	500	274.51	242.502
Valid N (listwise)	98				

Based on a 70 kg patient the amount of fluid that should be given in the first hour is 620ml. This total is based on the 4-2-1 calculation, 8hr NPO status, and surgical loss of 1ml/kg (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). There was no significant correlation between IV fluid given and PONV/PDNV with the exception of one outlier, a patient who had been NPO over 24 hours. This patient received a total of 350ml of IV fluid and experienced PONV. The need to adequately assess NPO time and implement the recommended fluid volume for each patient is recommended.

Recommendations and Limitations

Recommendations

Recommendations for the New Millennium Surgery Center included reducing Ketamine dosing to the recommended 0.2mg/kg to 0.5mg/kg. Although there is no dose found in literature to cause PONV, it is a likely attribute to the cause of PONV within our research. There was

statistical significance for PONV with Ketamine and doses ranged from 60 mg to 170 mg. These procedures are short (45 min 1.5hrs) and that dose exceeds the 0.5mg/kg recommendation. There was a total of six patients who received doses greater than 0.5 mg/kg. It is important to tailor the anesthetic according to recommendations and guidelines within the literature to prevent future complications. Literature states that Ketamine should be avoided in patients who have a history of PONV (Manahan et al., 2018). Three of the nine patients who received Ketamine experienced PONV and had a history of PONV. Therefore, by avoiding the use of Ketamine with patients who have a history of PONV the possibility of decreasing PONV and PDNV may have improved.

Another recommendation included adding Dexmedetomidine into the anesthetic technique for those patients that fit the administration criteria.

In HOF and endobrow surgery the airway is away from the anesthetist leaving the patient at risk for airway complications. Using Dexmedetomidine may decrease the incidence of bronchospasm, laryngospasm, and coughing throughout the procedure and maintain patient safety. Dexmedetomidine decreases airway reactivity for patients with chronic obstructive pulmonary disease (COPD) and asthma while also possessing anti-inflammatory effects (Naaz & Ozair, 2014). Dexmedetomidine is seven to ten times more selective for alpha 2 with a shorter duration of action than Clonidine which is also an alpha 2 adrenoreceptor agonist (Naaz & Ozair, 2014). This amplifies the recommendation of using Dexmedetomidine over Clonidine. There are three subtypes of alpha 2 receptors and it is important to understand the clinical significance of each when administering. The clinical significance includes hypertension, hypotension, analgesia, antishivering along with other key functions (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). The specificity for Dexmedetomidine for alpha 2 to alpha 1 is 1600:1 (Nagelhout

CRNA PhD FAAN, John J. et al., n.d.). It is a central sympatholytic that exerts its sedative analgesic effect by decreasing norepinephrine by up to seventy two percent (Naaz & Ozair, 2014).

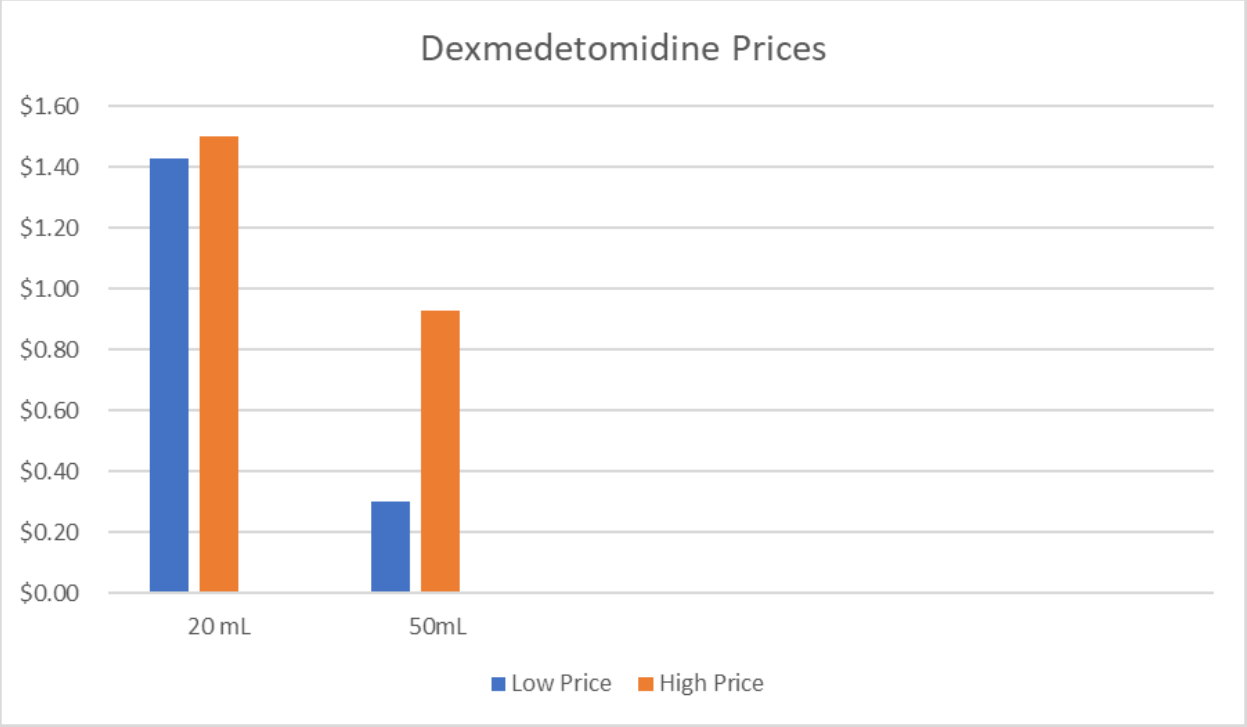
Patients who should not receive Dexmedetomidine include those that have second or third-degree heart block, bradycardia, severe ventricular dysfunction, hypovolemia. Doses should be reduced for patients with a history of renal or liver disease (Naaz & Ozair, 2014).

Patients can experience transient hypertension with rapid administration if 0.5mcg/kg in total is administered at one time.

Dexmedetomidine can be administered a couple of different ways to provide sedation for these procedures. It can be given as a single dose of 0.5 mcg/kg (per ideal body weight) broken up (4-8 mcg at a time) throughout the procedure in conjunction with a propofol infusion, or as an initial bolus dose of 0.5 mcg/kg (may not be given if concern of bradycardia and hypotension) followed by an infusion rate of 0.2-0.8 mcg/kg/hr with or without the use of propofol (Naaz & Ozair, 2014). It can be prepared by adding 2ml of Dexmedetomidine 100mcg/ml concentration into 48ml of 0.9% sodium chloride injection for a total of 50ml and a final concentration of 4mcg/ml (Nagelhout CRNA PhD FAAN, John J. et al., n.d.). The onset is less than five minutes. The cost of Dexmedetomidine is based on the formulation bought; 10 vials of 20ml solution can be purchased at $1.43 to $1.50 per unit or 10 vials of 50 ml solution purchased at 0.30 to 0.93 cents per unit according to Drugs.com, 2023 (Figure 3).

Figure 3

Comparison of Dexmedetomidine Prices



It is recommended that a future study assess the effectiveness of the recommendations this project has provided. It would be beneficial to do another chart review to determine if rates of PONV have been reduced and if it has or has not, were the recommendations followed by the anesthesia staff.

Limitations

One limitation of this project was sample size. While we did one hundred chart reviews, only nine patients experienced PONV/PDNV. This did not allow for all statistical tests that were initially desired. The nine patients that did experience PONV/PDNV had significance for Ketamine only ($p=0.05$).

Another limitation included the lack of medications being charted. We found that some charts had no pre-operative or perioperative fluids, propofol dose, or antiemetics documented.

Finally, there were multiple patients that could not be reached on follow-up phone call sheets. Most indicated that a message had been left or had no answer to the phone call. There was no documentation as to if patients called back or if second attempts were made to reach them. A post-op summary would allow the surgeon to document findings in a postoperative visit. This would allow the surgeon to document PONV/PDNV reported to him. There was no post-op visit summary to review.

Implications for Nursing Practice

One of the fundamental goals in nursing practice is to improve the patients' overall experience while receiving healthcare. Decreasing rates of PONV/PDNV would improve the patient's overall experience because PONV causes a decrease in patient satisfaction (from suture rupture, bleeding, electrolyte imbalance, prolonged recovery, fatigue, unanticipated admission to hospital, and increased hospital costs) (Finch et al., 2019).

The nursing profession has a responsibility to provide nursing interventions that are safe, evidence-based, and improve patient outcomes. For example, PONV/PDNV may lead to multiple harmful outcomes to the patient, as nurse anesthesia practitioners' interventions that can prevent these outcomes should be instituted. Evidence found in this Doctor of Nursing Practice (DNP) project recommends a maximum dose of 0.5mg/kg of ketamine, accurately assessing NPO status and responding to this assessment with appropriate fluid administration, and the addition of Dexmedetomidine as an adjunct to other anesthetics to help decrease PONV/PDNV. The recommendations could increase patient satisfaction and decrease health care spending by

decreasing the number of patients that need emergency care related to hydration and anti-nausea treatments.

Contribution of Doctor of Nursing Practice Essentials

The Doctor of Nursing Practice (DNP) essentials were developed by the American Association of Colleges of Nurses (AACN). The DNP essentials consist of eight components that require fulfillment in order for graduate students to become doctorate prepared nurses. Throughout the development of this DNP project, we were able to satisfy many of the DNP essentials. This retrospective chart review specifically satisfied DNP essentials I, II, III, IV, VI, and VIII.

Essential I: Scientific Underpinnings for practice was fulfilled by examining the scientific literature of PONV/PDNV and its prevention and incorporating nursing theory into this DNP project. Lewin's change theory was utilized for this project by using evidence-based articles to "unfreeze" current practice and suggest changes to current practice by implementing new strategies.

Essential II: Organizational and systems leadership for quality improvement and systems thinking was met by formulating recommendations, based on the literature, to decrease PONV/PDNV in HOF and endoscopic brow lift procedures and presenting this information to the anesthesia staff at New Millennium Surgery Center.

Essential III: Clinical scholarship and analytical methods for EBP was met by appraising the literature and using that information to develop practice recommendations for the anesthesia staff to improve outcomes in relationship to PONV.

Essential IV: Information systems/technology and patient care technology for the improvement and transformation of health care was met by data extraction from patient charts

during the retrospective chart review portion of this project. This data extraction allowed us to compile the data and run statistical tests to discern which medications were given/not given and which were significant in causing PONV/PDNV.

Essential VI: Interprofessional collaboration for improving patient and population health outcomes was fulfilled by discussing the concerns of patients experiencing PONV and PDNV after endoscopic browlift and herniated orbital fat removal procedures with the surgeon, anesthesia providers, nursing staff, and administrative staff. We continued this interprofessional collaboration throughout our project by coordinating times for data collection with administrative staff. The culmination of this project was a presentation, proposing different anesthesia care practices to the anesthetic team while also recommending other changes to the nursing staff, such as giving adequate fluid administration before the surgery to decrease the incidence of PONV/PDNV for these patients.

Essential VIII: There was a dissemination of findings to the surgeons, nursing staff, administrative staff, and anesthesia providers at the end of this project. This presentation led to the discussion of utilizing Dexmedetomidine in a way that allowed for a quick patient wake up and discharge. This presentation also led to a discussion about how future nurse anesthesia students could continue this project by doing another chart review after the changes to practice were made. This allowed us to use our advanced nursing practice training to guide, mentor, and support nurses at the surgery center as well as other student nurse anesthetists to achieve excellence in nursing practice.

References

Akiyama, K., Nakamura, N., Yamada, M., & Shigeyasu, C. (2015). Surgical repair of orbital fat prolapse by conjunctival fixation to the sclera. *Clinical Ophthalmology*, 1741. https://doi.org/10.2147/opth.s91598

Bartlett, E. L., Zavlin, D., Friedman, J. D., Abdollahi, A., & Rappaport, N. H. (2017). Enhanced recovery after surgery: The plastic surgery paradigm shift. *Aesthetic Surgery Journal*, *38*(6), 676–685. https://doi.org/10.1093/asj/sjx217

Cao, X., White, P. F., & Ma, H. (2017). An update on the management of postoperative nausea and vomiting. *Journal of Anesthesia*, *31*(4), 617–626. https://doi.org/10.1007/s00540-017-2363-x

Chiu, C., Aleshi, P., Esserman, L. J., Inglis-Arkell, C., Yap, E., Whitlock, E. L., & Harbell, M. W. (2018). Improved analgesia and reduced post-operative nausea and vomiting after implementation of an enhanced recovery after surgery (eras) pathway for total mastectomy. *BMC Anesthesiology*, *18*(1). https://doi.org/10.1186/s12871-018-0505-9

Dexmedetomidine prices, Coupons & patient assistance programs. Drugs.com. (n.d.). Retrieved Jan 13, 2023 from https://www.drugs.com/price-guide/dexmedetomidine

NK-1 inhibitor prices, Coupons & patient assistance programs. Drugs.com. (n.d.). Retrieved August 12, 2022, from https://www.drugs.com/price-guide/varubi

Dziadzko, M., & Aubrun, F. (2020). Management of postdischarge nausea and vomiting. *Best Practice & Research Clinical Anaesthesiology*, *34*(4), 771–778. https://doi.org/10.1016/j.bpa.2020.10.008

Elvir-Lazo, O., White, P. F., Yumul, R., & Cruz Eng, H. (2020). Management strategies for the treatment and prevention of postoperative/postdischarge nausea and vomiting: An updated review. *F1000Research*, *9*, 983. https://doi.org/10.12688/f1000research.21832.1

Finch, C., Parkosewich, J. A., Perrone, D., Weidman, K. H., & Furino, L. (2019). Incidence, timing, and factors associated with postoperative nausea and vomiting in the ambulatory surgery setting. *Journal of PeriAnesthesia Nursing*, *34*(6), 1146–1155. https://doi.org/10.1016/j.jopan.2019.04.009

Hofmann, D., Murray, C., Beck, J., & Homann, R. (2017). Acupressure in management of postoperative nausea and vomiting in high-risk ambulatory surgical patients. *Journal of PeriAnesthesia Nursing*, *32*(4), 271–278. https://doi.org/10.1016/j.jopan.2015.09.010

Jewer, J. K., Wong, M. J., Bird, S. J., Habib, A. S., Parker, R., & George, R. B. (2019). Supplemental perioperative intravenous crystalloids for postoperative nausea and vomiting. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.cd012212.pub2

Jones, J., & Aldwinckle, R. (2020). Perioperative dexmedetomidine for outpatient cataract surgery: A systematic review. *BMC Anesthesiology*, *20*(1). https://doi.org/10.1186/s12871-020-00973-4

Joshi, G. P. (2020). Enhanced recovery pathways for ambulatory surgery. *Current Opinion in Anaesthesiology*, *33*(6), 711–717. https://doi.org/10.1097/aco.0000000000000923

Kassel, L., Nelson, M., Shine, J., Jones, L. R., & Kassel, C. (2018). Scopolamine use in the perioperative patient: A systematic review. *AORN Journal*, *108*(3), 287–295. https://doi.org/10.1002/aorn.12336

Le, T. P., & Gan, T. (2010). Update on the management of postoperative nausea and vomiting and postdischarge nausea and vomiting in ambulatory surgery. *Anesthesiology Clinics*, *28*(2), 225–249. https://doi.org/10.1016/j.anclin.2010.02.003

Lewin, & Kurt. (1951). *Field theory in social science selected*.

Majumdar, J., Vertosick, E., Assel, M., Soeprono, M., Groeger, H., Marte, M. K., Lin, E., & Twersky, R. (2021). Reduction of postoperative nausea and vomiting and unplanned extended stays in

outpatient plastic surgeries with a standardized protocol. *Journal of Clinical Anesthesia*, *74*, 110419. https://doi.org/10.1016/j.jclinane.2021.110419

Malchow, R. J., Gupta, R. K., Shi, Y., Shotwell, M. S., Jaeger, L. M., & Bowens, C. (2017). Comprehensive analysis of 13,897 consecutive regional anesthetics at an ambulatory surgery center. *Pain Medicine*, *19*(2), 368–384. https://doi.org/10.1093/pm/pnx045

Manahan, M. A., Johnson, D. J., Gutowski, K. A., Bonawitz, S. C., Ellsworth, W. A., Zielinski, M., Thomsen, R. W., & Basu, C. (2018). Postoperative nausea and vomiting with plastic surgery. *Plastic and Reconstructive Surgery*, *141*(1), 214–222. https://doi.org/10.1097/prs.0000000000003924

Marcus, J. R., Few, J. W., Chao, J. D., Fine, N. A., & Mustoe, T. A. (2002). The prevention of emesis in plastic surgery: A randomized, prospective study. *Plastic and Reconstructive Surgery*, *109*(7), 2487–2494. https://doi.org/10.1097/00006534-200206000-00049

Masiongale, A. J., Garvin, J. T., Murphy, M. J., Hooper, V. D., Odom-Forren, J., Masiongale, J. I., & Looney, S. W. (2018). Reexamining Metoclopramide's Role in the Prevention of Postoperative Nausea and Vomiting: A Secondary Analysis. *AANA Journal*, *86*(3), 213–219.

Moon, Y. (2014). Postoperative nausea and vomiting. *Korean Journal of Anesthesiology*, *67*(3), 164. https://doi.org/10.4097/kjae.2014.67.3.164

Naaz & Ozair, (2014). Dexmedetomidine in current anesthesia practice- A Review. *Journal of Clinical and Diagnostic Research,* 8(10). jcdr-8-GE01.pdf (oakland.edu)

Nagelhout CRNA PhD FAAN, John J., Elisha EdD CRNA FAAN, Sass, & Elisha EdD CRNA FAAN, Sass. (n.d.). *Nurse anesthesia* (6th ed.). Saunders.

Nelson, E. C., Batalden, P. B., & Godfrey, M. M. (2007). *Quality by design*.

Olanzapine for the prevention of postdischarge nausea and vomiting after ambulatory surgery: A randomized controlled trial: Erratum. (2020). *Anesthesiology*, *133*(3), 693–693. https://doi.org/10.1097/aln.0000000000003438

Putterman, A. M. (1997). Intraoperatively controlled small-incision forehead and brow lift. *Plastic & Reconstructive Surgery*, *100*(1), 262–266. https://doi.org/10.1097/00006534-199707000-00039

Rohrich, R. J., & Cho, M.-J. (2019). Endoscopic temporal brow lift. *Plastic and Reconstructive Surgery*, *144*(6), 1305–1310. https://doi.org/10.1097/prs.0000000000006238

Schwenk, E. S., Viscusi, E. R., Buvanendran, A., Hurley, R. W., Wasan, A. D., Narouze, S., Bhatia, A., Davis, F. N., Hooten, W. M., & Cohen, S. P. (2018). Consensus guidelines on the use of intravenous ketamine infusions for acute pain management from the American Society of Regional Anesthesia and Pain Medicine, the American Academy of Pain Medicine, and the American Society of Anesthesiologists. *Regional Anesthesia and Pain Medicine*, *43*(5), 456–466. https://doi.org/10.1097/aap.0000000000000806

Stallings-Welden, L. M., Doerner, M., Ketchem, E., Benkert, L., Alka, S., & Stallings, J. D. (2018). A comparison of aromatherapy to standard care for relief of ponv and pdnv in ambulatory surgical patients. *Journal of PeriAnesthesia Nursing*, *33*(2), 116–128. https://doi.org/10.1016/j.jopan.2016.09.001

Stjernberg, M., Rustøen, T., & Ræder, J. (2018). Few patients receiving multimodal antiemetic treatment experience postoperative nausea after ambulatory surgery. *Sykepleien Forskning*, (71442), e–71442. https://doi.org/10.4220/sykepleienf.2018.71442en

Stoelting, R., Flood, P., Rathmel, J., & Urman, R. (2022). *Stoelting's Pharmacology & Physiology in Anesthetic Practice* (6th ed.). Wolters Kluwer.

Taghinia, A. H., Shapiro, F. E., & Slavin, S. A. (2008). Dexmedetomidine in aesthetic facial surgery: Improving anesthetic safety and efficacy. *Plastic and Reconstructive Surgery*, *121*(1), 269–276. https://doi.org/10.1097/01.prs.0000293867.05857.90

Theriot, J., Wermuth, H. R., & Ashurst, J. V. (2021, November 25). *Antiemetic Serotonin-5-HT3 Receptor Blockers*. NIH. Retrieved May 14, 2022, from https://www.ncbi.nlm.nih.gov/books/NBK513318

Weibel, S., Schaefer, M. S., Raj, D., Rücker, G., Pace, N. L., Schlesinger, T., Meybohm, P., Kienbaum, P., Eberhart, L. J., & Kranke, P. (2020). Drugs for preventing postoperative nausea and vomiting in adults after general anaesthesia: An abridged cochrane network meta‐analysis. *Anaesthesia*, *76*(7), 962–973. https://doi.org/10.1111/anae.15295

Appendix A

Synthesis Table: Levels and Types of Evidence

	Level I: Systematic Review or Meta-Analysis	**Level II:** Randomized controlled trial	**Level III:** Cohort Study	**Level IV:** Case-control study	**Level V:** Quasi-Experimental Study	**Level VI:** Descriptive study	**Level VII:** Single-case experimental, case series	**Level VIII:** Expert opinion, background information, case report
1								X
2				X				
3	X							
4					X			
5	X							
6	X							
7						X		
8		X						
9	X							
10	X							
11	X							
12	X							
13	X							
14								X
15								X
16						X		

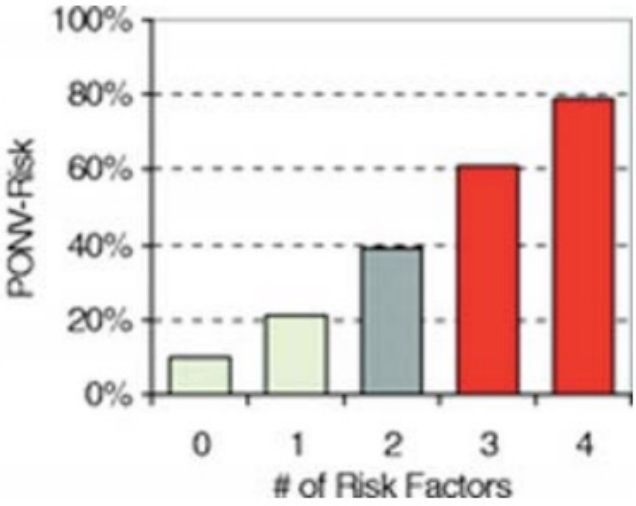
17	X							
18		X						
19			X					
20								X
21								X
22								X
23		X						
24								X
25								X
26		X						
27						X		
28				X				
29	X							

1= Akiyama, K. et al., (2015), 2= Bartlett, E.L. et al., (2017), 3= Cao, X. et al., (2017), 4= Chiu, C. et al., (2018), 5= Dziadzko, M. et al., (2020), 6= Elivir-Lazo, O. et al., (2020), 7= Finch, C. et al., (2019), 8= Hofmann, D. et al., (2017), 9= Jewer, J.K. et al., (2019), 10= Jones, J. et al., (2020), 11= Joshi, G.P. et al., (2020), 12= Kassel, L. et al., (2018), 13= Le, T.P. et al., (2010), 14= Lewin et al., (1951), 15= Majumdar, J. et al., (2021), 16= Malchow, R.J. et al., (2017), 17= Manahan, M.A. et al., (2018), 18= Marcus, J.R. et al., (2002), 19= Masiongale, A.J. et al., (2018), 20= Moon, Y. (2014), 21= Nagelhout, J.J. et al., (2018), 22= Nelson, E.C. et al., (2007), 23= Hyman, J.B. et al., (2020), 24= Putterman, A.M. et al., (1997), 25= Rohrich, R.J. et al., (2019), 26= Stallings-Weldon, L.M. et al., (2018), 27= Stjernberg, M. et al., (2018), 28= Taghinia, A.H. et al., (2008), 29= Weibel, S. et al., (2020)

Appendix B

Simplified Apfel Score

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV	1
Postoperative Opioids	1
Sum =	0 ... 4



[CareTeam App for Anesthesiology - Simplified Apfel Score]

Appendix C

IRB #: IRB-FY2023-30
Title: Perioperative Multimodal Postoperative Nausea and Vomiting Prevention Strategies in the Ambulatory Surgical Setting
Creation Date: 8-12-2022
End Date:
Status: Approved
Principal Investigator: Sara Cupp
Review Board: OU IRB
Sponsor:

Study History

Submission Type Initial	**Review Type** Expedited	**Decision** Approved

Key Study Contacts

Member Laura Rodgers	**Role** Co-Principal Investigator	**Contact** larodgers@oakland.edu
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Appendix D

New Millennium Eye Center Data Collection Tool

Patient gender: Male Female

Patient's age: _____

Current smoker: ___Yes ___No

NPO Time (minutes) _____

Did the patient have a history of PONV or PDNV? Yes No

Drug Administered	Name	Amount Administered (ML)
Narcotic		
Propofol	NA	
Ketamine	NA	
Scopolamine Patch	NA	
Decadron	NA	
Zofran	NA	
Dopamine Antagonist		
NK-1 inhibitor		
Alpha-2 agonist)		
Antihistamine		
Non-opioid Analgesics		
Other		

IV fluid administered perioperatively? _____mL

- When available, IV fluid was given before incision? _____mL

Did the patient experience any PONV or PDNV? Yes No

- If yes, timeframe following surgical procedure? _____

Appendix E

Project Timeline

	March 2022	April 2022	June 2022	July 2022	August 2022	November 2022	January 2023	March 2023	April 2023	May 2023
Literature Review Completed	X									
Proposal Completed		X								
IRB Approval			X							
Data Collection Tool			X							
Data Collection • Retrospective chart review				X	X					
Statistics ran						X				
Protocol Written						X				
Presentation Finished							X			
Educational Meeting								X		
Dissemination									X	
Project Completion										X

Appendix F

	Propofol	**Ketamine**	Fluid
Mann-Whitney U	355.500	247.500	373.500
Wilcoxon W	400.500	4252.500	373.500
Z	-.453	-1.908	-.333
Asymp. Sig. (2-tailed)	.65	**.05**	.74
Exact Sig. (2-tailed)	.658	.056	.746
Exact Sig. (1-tailed)	.329	.029	.373
Point Probability	.002	.000	.002
Mann-Whitney U	355.500	247.500	373.500