Developing, Implementing, and Evaluating an Opioid-Sparing Thyroid/Parathyroid Anesthesia Protocol:
A Quality Improvement Initiative

by

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Abstract

The recent scrutiny around opioid use and abuse in the United States has been alarming. As anesthesia providers, we are tasked with managing both acute and chronic pain in a variety of settings. A balanced, opioid-sparing technique has been demonstrated to be effective for a variety of different surgical procedures in the literature. In this paper, we discuss opioid-sparing anesthetics for patients undergoing thyroid and parathyroid surgery.

This project was completed by doing a retrospective chart review before and after the implementation of an opioid-sparing protocol. The protocol was developed from an evidence-based literature review on the subject. Primary outcomes were evaluating the protocol's effect on postoperative nausea and vomiting (PONV), overall pain scores at multiple stages throughout the stay in PACU, respiratory depression, and total opioid dose in morphine-milligram equivalents (MME). Secondary outcomes were time spent in PACU and protocol compliance.

A total of 30 patients meeting inclusion criteria received the protocol from November 2021 through February 2022. When compared to a similar pre-intervention cohort, those that received the protocol had significantly less PONV (10% in protocol group vs. 90% in pre-protocol group). Other outcomes that were analyzed had no statistical significance. Since thyroid/parathyroid surgeries are not associated with significant perioperative pain, an opioid-sparing anesthesia for these surgeries may decrease negative outcomes associated with opioid administration.

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Background and Significance

The opioid epidemic in America has been growing exponentially over the past two decades. From 1999-2017, there were 399,230 (56.8%) deaths from overdose as a result of opioid abuse (Scholl, Seth, Kariisa, Wilson, & Baldwin, 2019, p. 1425). Opioid dependence occurs across all age groups, from newborn babies that experience withdrawal symptoms from maternal opioid abuse to older adults (The National Institute on Drug Abuse Blog Team, 2018). Opioid use is also linked to several negative perioperative outcomes such as postoperative nausea and vomiting and respiratory depression, both of which can decrease the quality of recovery in postsurgical patients and increase hospital length of stay.

Certified registered nurse anesthetists (CRNAs) are on the forefront of the opioid epidemic. Traditional methods of delivering anesthesia involve the use of opioids and narcotics intraoperatively and in the immediate postoperative period. However, considering the opioid epidemic, CRNAs are forced to find methods to limit narcotics and use adjuvant therapies instead (Hah et al, 2017). While this is not always possible, thyroidectomies and parathyroidectomies are stimulating surgeries that are not associated with significant pain perioperatively. This provides an opportunity for anesthetists to limit narcotic use to improve the patient's perioperative experience.

Problem Statement

With the opioid crisis sweeping through the United States and the addiction rates increasing, Certified Registered Nurse Anesthetists can decrease the amount of opioids administered in the perioperative setting by using a multimodal anesthetic technique that does

not require much opioid use. This is especially true in procedures that are not very painful, such as thyroid/parathyroid surgeries. The purpose of this project is to develop and implement an opioid-sparing thyroid/parathyroid surgery anesthesia protocol with a goal of reducing the incidence of postoperative nausea and vomiting, respiratory depression, hospital/post anesthesia care unit length of stay, and overall pain scores.

Literature Review and Framework

A review of the literature has revealed many methods to reduce perioperative opioid use in patients undergoing different surgical procedures, including thyroid/parathyroid surgery. A majority of these are centered around pain theory and the use of many adjuvant medications perioperatively. These medications include acetaminophen (Tylenol), celecoxib (Celebrex), lidocaine, dexmedetomidine (precedex), and ketamine. Due to the large body of evidence-based literature on this subject, the authors of this initiative believe that it is feasible to develop and implement an opioid-sparing protocol for patients undergoing thyroid/parathyroid surgery. References for reviewed articles are listed at the end of this document. The goal of this quality improvement initiative is to use adjunct medications at similar doses used in the literature to tailor an opioid-sparing anesthetic for this patient population.

To better understand the current state of an opioid sparing approach to pain management for thyroid and parathyroid surgery, a literature search was conducted using the electronic databases of CINAHL and PubMed. A keyword search using a combination of the terms “thyroid surgery”, “opioid sparing”, “dexmedetomidine”, “cyclooxygenase inhibitors”, “ketamine”, “lidocaine”, and “NSAIDs” with the Boolean operators AND/OR used. Articles included in the review were those from 2003-2020 that studied adult patients (18 or over), had pain control and/or opioid consumption as primary outcomes, and were of high-level evidence.

Articles were excluded if they included pediatric patients or had a primary focus on other outcomes (monetary incentives, regional anesthetic techniques, poor study design, etc.). The search yielded a total of 323 relevant articles. Of these, 14 were selected for this critical review. All 14 of these articles found that a variety of different anesthetic techniques, namely adjuvant medications mentioned above, are equally as effective as opioids for controlling pain and reducing harmful side effects associated with opioids in patients undergoing thyroid and parathyroid surgery.

Pain Theory

As stated earlier, most of the current literature regarding multimodal analgesia for patients undergoing thyroid/parathyroid surgery is centered around pain theory. To understand the effect of analgesic medications, it is important to know the physiology by which pain occurs. There are four major processes that must occur for a patient to experience pain: transmission, transduction, modulation, and perception. Analgesic medications work to disrupt the pain signals at these four stages.

Transmission occurs in the peripheral nervous system. A noxious stimulus (surgical instrumentation, needle insertion, etc.) activates nociceptors called *first order neurons* in the peripheral nervous system. A series of biochemical events results in the signal being transmitted to the spinal cord. These biochemical events include depolarization of first order neurons to transmit the pain signal towards the spinal cord. Different inflammatory mediators (cytokines, prostaglandins, histamine, bradykinin) that are released from damaged cells also work to enhance the pain signals. Examples of pain medications that work to disrupt transmission include local anesthetics and anti-inflammatory drugs. Local anesthetics prevent cells from depolarizing and

transmitting a signal. Anti-inflammatory drugs decrease the number of inflammatory mediators present at the site of injury which helps to blunt the response (Nagelhout, 2018, p.1167-1182).

Transduction of pain signals occurs in the spinal cord. When a pain signal travels from the periphery to the spinal cord, it enters via the dorsal horn. Depending on the type of nerve fiber that is carrying the pain signal (C-fiber or A-delta fiber), these first order neurons synapse with second order neurons at different points. Pain carried by C-fibers (transmit "slow" or delayed pain) synapse in lamina II of the substantia gelatinosa (a collection of gray matter). Pain carried by A-delta fibers (fast, sharp pain) synapse in lamina I of the substantia gelatinosa. From here, the second order neurons cross to the contralateral side of the spinal cord and ascend to the brain via the Tract of Lissauer. Opioids work to inhibit pain signals in the substantia gelatinosa. Local anesthetics can also work at this level to block transmission of signals. Alpha-2 agonists (like dexmedetomidine) work at the substantia gelatinosa in a similar manner to opioids, but the mechanism is not fully understood (Nagelhout, 2018, p.1167-1182).

Perception is the conscious awareness of pain and is a multidimensional process. After pain signals reach the brain, they are transmitted to various cortical areas such as the limbic system, reticular system, and somatosensory cortex. This is the cause of emotional/behavioral, autonomic/motor, and perception/interpretation of pain, respectively. Medications that work directly on these areas of the brain to inhibit pain signals include opioids and ketamine.

Modulation is a complex phenomenon that occurs along the pain pathway. Modulation can both enhance or inhibit pain signals at the level of the spinal cord. When a pain signal reaches the brain, an endogenous opioid system is activated via many neurotransmitters (glycine, gamma-aminobutyric acid [GABA], enkephalin, serotonin, norepinephrine) that work to inhibit the signal. They body sends the stimulus down the descending dorsolateral pathway from the

brain to the dorsal horn of the spinal cord, and these neurotransmitters work to inhibit the pain signals. Thus, any medication class that increases the number of these neurotransmitters (selective serotonin reuptake inhibitors [SSRI's], alpha-2 adrenergic receptor agonists, etc.) will help to inhibit pain signals (Nagelhout, 2018, p.1167-1182).

Opioids

Opioids are theorized to work on Mu, Kappa, and Delta receptors in the central and peripheral nervous systems. Binding of an opioid molecule to an opioid receptor can work in two ways. In the spinal cord, agonizing an opioid receptor on a presynaptic, first-order neuron from the peripheral nervous system blocks the calcium channels and subsequently halts transmission of pain signals to the central nervous system. Opioids can also bind to postsynaptic second-order neurons to cause potassium influx in the neuron which hyperpolarizes the cell and halts signal transmission. Opioid receptors, specifically Mu-2 receptors of the periphery, also exist in the gastrointestinal tract, lungs, and some autonomic fibers. Blockade of these opioid receptors cause the common negative side effects such as respiratory depression, bradycardia, inhibition of peristalsis with subsequent nausea and vomiting, and physical dependence (Nagelhout & Elisha, 2016).

Acetaminophen

The first non-opioid medication that has shown to be effective for treating perioperative pain in patients undergoing thyroid surgery is acetaminophen, which is an antipyretic and analgesic drug. The mechanism of action by which acetaminophen exerts its effect is not currently known, but it is theorized to work by reducing prostaglandin production, which are inflammation-inducing molecules that cause pain.

Three articles (Arenas et al, 2021; Gehling et al, 2010; Papoian et al, 2020) were reviewed regarding the use of acetaminophen during thyroid surgery. One article (Arenas et al, 2021) randomized two study groups into an opioid and non-opioid group. The opioid group received acetaminophen with codeine every 4-6 hours as needed, and the non-opioid group received acetaminophen every 8 hours and had tramadol (an opioid analgesic) available for breakthrough pain. They found a 57% reduction in opioid usage in the non-opioid group with equivalent pain scores.

The other articles (Gehling et al, 2010; Papoian et al, 2020) used acetaminophen as part of a non-opioid analgesic regimen for thyroid surgery that combined acetaminophen with non-steroidal anti-inflammatory drugs (NSAIDs) for perioperative pain. For both studies, the experimental group that received acetaminophen in combination with NSAIDs had similar pain scores at reduced morphine milligram equivalents (MME).

Nonsteroidal Anti-Inflammatory Drugs

Another class of non-opioid pain medication is nonsteroidal anti-inflammatory drugs, or NSAIDs. These include the cyclooxygenase (COX) inhibitors celebrex, ibuprofen, ketorolac, and parecoxib. Inhibition of COX results in decreased formation of prostaglandins, which work on peripheral pain fibers by sensitizing them to stimulus and making them easily activated. When this happens, a stimulus is more readily transmitted to the central nervous system and elicits a feeling of pain. By inhibiting a step early on in this pathway, the stimulus cannot reach the brain. While these medications do not exhibit the same negative effects that opioids do, there are risks associated with their use including kidney injury, gastrointestinal tract bleeding, and liver injury due to reductions in prostaglandins. It should be noted that prostaglandins have a protective

effect on gastrointestinal tract mucosa and cause renal artery dilation. Inhibition of prostaglandin can therefore cause gastrointestinal bleeding and decreased kidney function.

Two relevant articles (Yang et al, 2005; Karamanlioglu et al, 2005) were reviewed that analyzed the use of NSAIDs in patients undergoing thyroid surgery. Both of these randomized controlled trials (RCT's) compared various drugs in this class against a placebo group. They then compared pain scores to a placebo group postoperatively and analyzed the differences in opioid consumption and visual analog scale (VAS) pain scores. Each article demonstrated a reduction in opioid consumption and other secondary outcomes (postoperative nausea and vomiting, pain at rest, pain when swallowing, etc.) when compared to placebo groups. Medications that were used in these studies included ketorolac, ibuprofen, celecoxib, and parecoxib. One limitation that was mentioned in each study was the fact that not every patient undergoing thyroid surgery is able to take NSAIDs for a variety of reasons. These include bleeding risk, patient comorbidities (renal dysfunction, history of GI bleed, etc.) or intolerance to the medications.

Ketamine

Ketamine is another adjunct medication that has been shown to effectively control pain perioperatively. It's mechanism of action is via antagonism of excitatory N-methyl-D-aspartate (NMDA) receptors in the central nervous system. By inhibiting these receptors, pain signals cannot be propagated through the brain. There is also some degree of inhibition of signals in the spinal cord (Nagelhout & Elisha, 2016). Side effects are due to its action in the central nervous system and include seizures (controversial), emergence delirium, and a dissociative state of anesthesia that may be unpleasant to the patient; this can often be negated with administration of a benzodiazepine, such as midazolam.

Two of the included studies (Lee et al, 2017; Kim et al, 2016) evaluated the effects of ketamine on perioperative pain management for patients undergoing thyroid surgery. More specifically, a ketamine infusion was initiated following the induction of anesthesia in both studies and pain scores were compared to control groups at varying intervals postoperatively. Both studies demonstrated lower pain scores and less opioid consumption in the ketamine group. However, one of these studies (Kim et al, 2016) demonstrated a statistically significant increase in the incidence of PONV in the group receiving ketamine. The other study (Lee et al, 2017) demonstrated similar rates of PONV between the two groups.

Dexmedetomidine

Dexmedetomidine is a selective alpha-2 receptor agonist. Binding of a dexmedetomidine molecule to an alpha-2 receptor causes an inhibitory effect by decreasing calcium influx and hyperpolarizing the cell. This renders the cell inactive and is theorized to be the method for inhibition of pain signals. By inhibiting excitatory cells, dexmedetomidine has the ability to cause bradycardia and hypotension in a dose-dependent manner (Nagelhout & Elisha, 2016).

Two studies compared the effects of using Dexmedetomidine versus a placebo group in thyroidectomies (Ma et al, 2017; Kim et al, 2020). The first study conducted by Ma et al (2017), included 100 participants that were separated into groups comparing the use of Dexmedetomidine and saline. Extubation and recovery times were significantly shorter for the group receiving 0.5 mcg/kg of Dexmedetomidine 30 minutes before the end of surgery. The second study by Kim et al, 2020 evaluated the effects of intraoperative Dexmedetomidine infusion and the incidence of postoperative sore throat. The study showed that an infusion reduced the incidence of sore throat, hoarseness, and the need for opioids for the first 24 hours after thyroidectomies.

Lidocaine

Finally, lidocaine is a local anesthetic that works by blockade of voltage-gated sodium channels, which subsequently inhibits propagation of an impulse along a nerve fiber. Systemic administration of lidocaine intravenously works on peripheral pain pathways. Side effects are consistent with toxicity and can range from circumoral numbness and tingling to cardiac and respiratory arrest.

Three articles reviewed the effects of intravenous Lidocaine infusions during thyroid surgeries and its analgesic and anti-inflammatory effects (Choi et al, 2017; Kim et al, 2017; Choi et al, 2016). The first study by Choi et al (2017) concluded that the group receiving 2 mg/kg of lidocaine followed by a continuous infusion of 3 mg/kg/hr had a lower incidence of chronic postsurgical pain as well as a reduction in sensory impairment when compared to the saline control group. The second study by Kim et al (2017) reviewed the effects of Lidocaine infusion versus magnesium infusions for thyroid surgeries. Of the 135 females that participated in the study, 3 groups were formed that divided the females into a lidocaine group, magnesium group, and a saline (control) group. The lidocaine group received lidocaine 2 mg/kg for 15 minutes followed by a continuous infusion of 2 mg/kg/hr which resulted in a better quality of postoperative recovery when compared to the other two groups. The last group reviewing the effects of lidocaine (Choi et al, 2017) studied the effects of lidocaine versus a control (saline) group. The results concluded that intravenous lidocaine effectively reduced postoperative pain and nausea as well as improved the quality of recovery following thyroidectomy surgery.

Thus, there are many medications currently available to anesthetists that can effectively control pain without activation of opioid receptors. These medications are not benign and should be used selectively for appropriate patients, but a multimodal approach that combines some of

these medications can be of great benefits to patients undergoing thyroid and parathyroid surgery.

Antiemetics

While decreasing opioids in the perioperative setting is crucial to avoid PONV, antiemetics can also be given. Medications given in the preoperative and intraoperative setting can help with any nausea and vomiting that may occur after surgery. Diphenhydramine (Dramamine) is an antihistamine often prescribed in the preoperative setting and works by blocking histamine-1 receptors that are associated with causing nausea and vomiting (Nagelhout, 2018, p.196-197). Decadron is a glucocorticoid given intravenously that also is given for prevention of PONV. Although it's mechanism of action is unclear, it is theorized to work through central inhibition of the nucleus tractus solitarii (Nagelhout, 2018, p.195). Lastly, ondansetron is a 5-HT3 receptor antagonist and is the most widely used antiemetic. It is considered the gold standard for preventing PONV. A standard dose of 4 mg administered at the end of the procedure has a great anti-vomiting effect via antagonism of serotonin receptors (Nagelhout, 2018, p.196).

Project Methodology and Design

Methods and Design

The project design is the Plan-Do-Study-Act model (PDSA). Stage I of the PDSA model was the "plan" step, which included an extensive literature review into medical databases that included journal articles comparing opioid-sparing adjuvants to decrease the need for opioids in the perioperative setting. Step II of the PDSA model was the "do" step, which included educating stakeholders. First, we presented the findings to the main endocrine surgeon at Bronson Methodist hospital to show that opioid-sparing anesthesia for these surgeries can

improve multiple outcomes. Next, an educational information session took place that included the certified registered nurse anesthetists and anesthesiologists as well as the post-anesthesia care unit (PACU) nurses at Bronson Methodist Hospital. Education took place to discuss the findings of the literature review and the plan for implementing an evidence-based opioid-sparing protocol into practice. The protocol (see Appendix J) was laminated on a card that CRNAs brought into the surgical cases. Cards included preoperative, intraoperative, and postoperative medications the patient could receive.

Stage III was the "study" phase, which was an assessment of the findings after implementation of the protocol to determine if the opioid-sparing adjuvants decreased postoperative nausea and vomiting, pain, respiratory depression, time spent in PACU, pain scores upon entering and leaving PACU, and total dose of opioids received. In this phase, 30 patients who received standard anesthesia care before protocol implementation and 30 patients who received the opioid-sparing protocol were compared. The final stage, Stage IV, was the "act" phase. If the protocol was successful, the goal will be to standardize this protocol at Bronson Methodist Hospital for thyroid/parathyroid surgical cases. If any issues arise, changes within the protocol will be based on feedback from the surgeon, CRNAs, anesthesiologists, and PACU nurses.

The purpose of this study was to implement an opioid-sparing anesthetic technique using multimodal adjuvants to decrease side effects of opioids, such as respiratory depression, nausea and vomiting and time spent in the PACU. Thyroidectomy/ parathyroidectomy surgeries are considered high risk for postoperative nausea and vomiting (PONV) with disastrous outcomes at the operative site. With the use of opioids, the chances of PONV increases exponentially. Retching has the potential to cause a hematoma and compress the airway because of the

increased pressure. Respiratory depression is a well-known side effect of opioid use that can increase PACU length of stay and become costly to patients. Potential benefits and outcomes by developing and implementing an opioid-sparing protocol include a decrease in PONV, decreased respiratory depression, and a quicker return to baseline after surgery (Oyler et al., 2020).

After a literature review and gathering data on the best opioid-sparing techniques possible for thyroid/parathyroidectomies, a protocol was proposed. The protocol limited narcotic use, yet still alleviated pain in this patient population. The use of Acetaminophen, NSAIDs, Ketamine, Dexmedetomidine, and Lidocaine are multimodal analgesic agents that are utilized instead of opioids with a decrease in side effects. Appendix J provides a table of the medications used in the protocol. Before surgery when the patient is in the preoperative unit, Acetaminophen 1000 mg by mouth (PO), Celebrex 200 mg PO, and Dramamine 50 mg PO are given. Acetaminophen and Celebrex will work on pain receptors while Dramamine will decrease the risk of PONV. Intraoperatively, the patient receives a 2 mg/kg IV bolus of Lidocaine while infusing a 2 mg/kg/hr continuous infusion. Dexmedetomidine 0.5 mcg/kg IV bolus, a Ketamine IV bolus of 0.5 mg/kg and 10 mg/hr bolus every 1 hour will decrease pain. Decadron 8 mg IV after intubation and 4 mg of Ondansetron before extubation decreases PONV. Lastly, a patient can receive Fentanyl 25-50 mcg IV for breakthrough pain and Oxycodone 5 mg PO in PACU.

Key Personnel/Stakeholders

Certified registered nurse anesthetists, anesthesiologists, PACU nurses and the surgeon were key personnel in this study to appropriately implement the protocol. Their cooperation and feedback was important to maintain a protocol that was effective in opioid-sparing anesthesia for thyroid/parathyroid surgeries. Potential barriers that may have affected this study included

noncompliance among anesthesia staff when implementing this protocol and instead using a "traditional" anesthesia technique that includes opioids.

Measurement Instruments and Data Collection

Assessing compliance and gathering data regarding patients involved in this initiative, a spreadsheet was used to collect data. In addition to non-specific patient data to identify patients, outcomes to be measured include:

1. Compliance with the protocol
2. Length of surgery
3. Incidence of PONV in PACU
4. Incidence of respiratory depression in PACU
5. Length of PACU stay
6. Pain scores post-operatively
7. Pain scores when leaving PACU to phase II recovery
8. Total opioid use (in morphine milligram equivalents [MME]) if required

This tool was used for both pre- and post-intervention groups, so the results were compared to make a definitive conclusion regarding the efficacy of the protocol. Appendix K is an example of the data collection tool.

Ethical Considerations

The Oakland University Internal Review Board (IRB) approval was obtained prior to initiating this doctoral of nursing practice project (Appendix M). Ambiguity of data was ensured by extracting only demographic data to isolate patients. Doing so ensured that Health Insurance Portability and Accountability Act of 1996 (HIPAA) rules were appropriately followed.

Risks of receiving the protocol in this project were no different than receiving traditional anesthetic care for these procedures. As with any intervention in anesthesia, patients were informed of possible side effects from medications that were administered perioperatively prior to surgery.

Timeline and Inclusion Criteria

A review of 30 randomized patients who underwent thyroid/parathyroid surgery from January 1, 2019 - December 31, 2019, were analyzed and included in the "pre-protocol group". After implementation of the protocol, 30 patients were included in the "post-protocol group" and data was compared between the two groups. The data analyzed included opioid use, incidence of postoperative nausea and vomiting and pain scores in the post anesthesia care unit (PACU), as well as length of stay in the PACU. Patients included in the initiative were between the ages of 18 to 65 years old, ASA class I-III, and were not taking prescription opioids for chronic conditions at the time of surgery.

Cost Analysis

One of the great benefits about the protocol is that it uses many medications that are already used regularly in anesthetic practice. All medications used in the protocol (ketamine, dexmedetomidine, lidocaine, Tylenol, and Celebrex) are routinely given for a variety of surgical procedures at Bronson Methodist Hospital. These medications are relatively inexpensive and readily available to anesthesia providers. A summary of medication costs is listed in Appendix I.

Evaluation Plan

The four main objectives for evaluation included analysis of the incidence of PONV, respiratory depression in the postoperative setting, overall time patients returned to baseline functional status, and overall pain scores perioperatively. The goal of this study was to decrease

each of these parameters through the protocol. By comparing results from a standard anesthetic plan in thyroidectomy/parathyroidectomy surgical patients to those enrolled with the proposed protocol, an evaluation was made in the evidence of how well the protocol worked.

Out of the 30 patients that met the pre-protocol inclusion criteria, we determined what percentage of these patients had PONV, respiratory depression, and a delay in baseline of functional status. This data was compared to 30 patients' post-protocol information that met the inclusion criteria. Statistical analysis of the pre- and post-intervention groups was made with Statistical Package for the Social Sciences (SPSS) software using Mann-Whitney-U tests. This test allowed for dependent variables (PONV incidence pre/post intervention, pain scores pre/post intervention, respiratory depression pre/post intervention, and pain scores pre/post intervention) to be directly compared in two different study groups. Outcomes were then presented to anesthesia providers and the surgeon on the effectiveness of the protocol in this surgical population.

Data Analysis

To analyze the first objective of the incidence of PONV, a chart review of the medication administration record (MAR) was conducted to evaluate if a rescue antiemetic was administered in PACU or if the PACU registered nurse charted if the patient vomited. The second objective of respiratory depression was analyzed by reviewing the respiratory rate under the patient's vital signs assessment in the PACU within the first hour after surgery to evaluate if the respiratory rate dropped below 10 breaths per minute. The third objective, a delay in return to baseline functional status, was evaluated by an increased time between the patient arriving to phase 1 of PACU and leaving the PACU setting. An average range of minutes between the patient arriving in the postoperative setting and going home was determined, and any length of stay exceeding this

average time was considered a delay in functional status. This also was assessed by reading the anesthesiologists post-operative assessment note, to determine if any delay was indicated. Finally, the fourth objective, overall pain scores, was recorded preoperatively and postoperatively in both the control and study groups to determine if a difference exists.

Results

Group Descriptive Statistics

The pre-intervention group was primarily female (86.7%); the youngest patient in this group was 25 years old with the oldest being 64 years old. The post-intervention group was also primarily female (70.0%) with a larger age range; the youngest being 25 years old and the oldest being 88 years old. The maximum weight was 147 kg for the pre-intervention group and 121 kg for the post. No patient had an ASA score above 3 in either group. The longest surgery was 300 minutes (5 hours) for the pre-group and 232 minutes (approximately 4 hours) for the post-group. The longest stay in the PACU was 247 minutes (just over four hours) for the pre-group and 325 (five hours) for the post. See Table 1. All results were computed using SPSS v. 28.

Pain Scores

Pain scores were measured on a scale of 0 to 10 with 10 representing the greatest amount of pain. Pain scores after surgery for the pre-intervention group had a mean of 1.3 (*SD*=2.3) with outlying scores of 7 and 10. The post-intervention group mean was 1.4 (*SD*=1.5). See Figure 1.

The mean difference in pain scores between the two groups was not statistically significant as determined by an independent samples *t*-test, $t\ (58) = -.135$, $p=.893$, two-tailed. As the pain score means are relatively comparable, any reductions in variables such as PONV, respiratory depression or opioid use in the post-intervention group will be more meaningful.

Pain scores upon leaving the PACU had a mean of 2.1 (*SD*=2.9) with scores reaching a maximum of 8 out of 10 in the pre-intervention group. Pain scores for each of the post-group participants was zero. While equal variances could not be assumed, the difference was significant, t (29) = 29.00, p<.001, two-tailed. See Figure 2.

Post-Operative Nausea and Vomiting/Respiratory Depression

Ninety percent of the pre-intervention patients experienced postoperative nausea and vomiting (PONV); 3.3% of the post-operative group experienced PONV. This was a significant difference using Pearson's chi-square, X^2 (1) = 45.268, p < .001, two-tailed. Two of the pre-intervention group experienced respiratory depression (6.7%); no patient in the post-intervention group did. Fisher's exact test was used to determine a significant difference between the pre- and post-intervention groups; this difference was not significant, p < .492, two-tailed.

Perioperative Opioid Use

Total perioperative opioid use was measured in morphine milligram equivalents (MME). The mean for the pre-operative group was 36.1 (*SD*=19.1) with a maximum dosage of 83.5 and a minimum dosage of 15. The mean for the post-operative group was 66.8 (*SD*=92.8) with a maximum dosage of 360 and a minimum dosage of 0. This difference was not statistically significant, t (32) = -1.778, p =.085, two-tailed. See Figure 3.

Discussion

The main objectives for evaluation between the pre-intervention and post-intervention groups included incidence of PONV, respiratory depression in the postoperative setting, and pain scores upon arriving to PACU and upon leaving PACU. A reduction of PONV due to opioid-sparing technique can lead to improved patient outcomes and surgical experience. It was proposed that by decreasing opioid use in thyroid/parathyroidectomies, patients can decrease their length of PACU stay and return to baseline quicker. Since this surgery at baseline has low pain scores, a multimodal analgesic approach can be beneficial to help limit opioid use.

The first objective was to decrease the incidence of PONV. The occurrence of PONV in the pre-intervention group was 27 (90%) patients. After protocol implementation, the post-intervention group had 3 (10%) patients report PONV. A statistically significant difference was found between the groups. A reduction in opioids and the use of the multimodal protocol was shown to be successful in this patient population. In the literature review, one study found that lidocaine reduced the incidence of PONV on this surgical population with an infusion of 2 mg/kg/hr (Choi et al, 2017). Dexmedetomidine provided equivalent analgesia and similar rates of PONV (Ma et al, 2017; Kim et al, 2020). Interestingly, Ketamine infusion during these procedures significantly increased the risk of PONV in one study (Kim et al, 2016). By combining multiple non-opioid medications in the current protocol, pain was effectively treated while significantly reducing PONV.

The second objective was to decrease the incidence of respiratory depression in the postoperative setting. The pre-intervention group had 2 (6.7%) patients with a respiratory rate under 8 breaths per minute, while the post-intervention group had 0 patients. The difference between the two groups is not significant, $p<4.92$. Although the results were shown not to be

statistically significant, there was a reduction in the incidence of respiratory depression, which can ultimately lead to a decrease in overall PACU stay. No articles that were included in either literature review discussed the incidence of respiratory depression.

The last objective was to assess the pain scores perioperatively. This was measured on a 0-10 verbal pain scale upon arriving to PACU and upon leaving PACU. Upon arriving to the PACU in the pre-intervention group, a mean pain scale of 1.3 was noted. The post-intervention group had a mean of 1.4. This pain scores between the 2 groups were similar and were not statistically significant, although the total perioperative opioid use (MME) was 36.1 for the pre-intervention group and 66.8 in the post-intervention group. The use of opioids between the two groups was not statistically significant, p=0.85.

Upon leaving the PACU, the pre-intervention group had a mean pain score of 2.1 while the post-intervention group had a pain score of 0. The difference between the two groups was statistically significant, p<.001. Multiple studies in the literature review showed that non-opioid medications reduced MME. Acetaminophen and NSAIDs such as Celebrex, ibuprofen, ketorolac, and parecoxib significantly reduced MME in this surgical population (Arenas et al, 2021; Gehling et al, 2010; Papoian et al, 2020; Oltman et al, 2017; Karamanligoglu et al, 2005). Ketamine also significantly reduced MME in multiple studies (Lee et al, 2017; Kim et al, 2016). Thus, it can be inferred that an opioid-sparing protocol using non-opioid analgesic medications can provide comparable pain relief to a standard anesthetic with the use of opioids.

Secondary outcomes that were analyzed in this project included time spent in the PACU following surgery and the time to discharge. The mean time spent in PACU for the pre-intervention group was 131.9 minutes. For the post-intervention group, the mean time was 117.7 minutes. While these values were not statistically significant at a P value of 0.05, they may be

clinically significant. Any reduction in time spent in PACU indicates that a patient returned to their baseline status more quickly. This also has a cost saving effect for the patient and the hospital. If an opioid-sparing approach results in a decreased time spent in PACU, there may be a benefit. One study in the literature review demonstrated a reduced PACU time when dexmedetomidine at a dose of 0.5 mcg/kg was given 30 minutes prior to extubation (Ma et al, 2017).

The use of the multimodal analgesic protocol was successful in that it decreased the incidence of PONV, decreased the occurrence of respiratory depression, and decreased pain scores upon leaving PACU. There are multiple recommendations and limitations to the study, that would enhance the patient outcomes in the future.

Recommendations and Limitations

Recommendations

Based on data obtained from the protocol and anecdotal feedback from CRNAs at Bronson Methodist Hospital, a number of recommendations for the future can be made. The first recommendation surrounds Lidocaine. Because Lidocaine infusions are only supplied in a 500 milliliter (mL) bag there is commonly a great deal of waste during thyroid/parathyroid surgery, as only about 75 milliliters are infused for this procedure. Although Bronson Hospital's pharmacy department charges $7.30 per 500 mL bag, this was a concern for CRNAs since most of the medication was being wasted. A recommendation by CRNAs to combat waste was to give IV boluses of Lidocaine throughout the case instead of a continuous infusion. However, no literature was found comparing bolus vs. infusion of lidocaine for an opioid-sparing approach.

Next, this protocol was implemented in patients who do not have chronic pain and are not prescribed opioids, although using this multimodal analgesia pain regime may be beneficial for

patients who take chronic opioids. Further studies are warranted for patients who could benefit from receiving an opioid-sparing technique as opposed to more narcotics intraoperatively.

The timing of ketamine and dexmedetomidine should be considered when using the opioid-sparing technique. When patients were given both medications at the beginning of surgery, patients would become hypotensive and a phenylephrine infusion was implemented. To combat this, most providers cited ketamine towards the beginning of surgery and dexmedetomidine at the end of surgery was the best strategy. Only one article from the literature review discussed the timing of medication administration. When dexmedetomidine was given within 30 minutes of the end of surgery, it facilitated extubation and decreased the time spent in PACU (Ma et al, 2017). No other literature regarding timing of administration of these medications was found. However, it is important to consider the context and mechanism of action of both ketamine and dexmedetomidine when administering them, as both have the potential to cause hypotension when administered together.

Finally, the results showed that pain scores were equivalent when patients first arrived in PACU, yet narcotic use in MME was increased in the post-protocol group. While it is difficult to draw conclusions from this, the impact of the COVID-19 pandemic on PACU staffing cannot be ignored. Staff turnover and lack of formal education regarding the protocol could have precipitated these results. A recommendation moving forward with this protocol is to educate PACU nurses about the opioid-sparing approach and the benefits of it. This is crucial to ensure an understanding of the importance of decreasing narcotic use and using other remedies when possible.

Limitations

This study had multiple limitations. First, patients included were an ASA I-III because patients with a poor preoperative status (ASA IV and over) have worse intraoperative outcomes in comparison to ASA class I-III. Second, the study included patients ages 18 to 65 years old. This limited the ability to assess the protocol in patients over 65 years old. Third, this study assessed 30 patients' pre-protocol and 30 patients' post-protocol. A larger sample size may lead to a more valuable assessment of how well the multimodal analgesia pain protocol can work. Next, the impact of the COVID-19 pandemic resulted in lower than normal surgical volumes and thus a longer time to recruit patients for the study. Lastly, the study was conducted at one facility- Bronson Methodist Hospital. At this facility, most anesthesia providers implement anesthesia in the same fashion. However, a majority CRNAs were willing to carry out the protocol when assigned to these cases. Rolling out the protocol amongst additional hospitals may lead to different results.

Implications for Practice and Career Development

The impact of this project has furthered the understanding of how an evidence-based project evolves. It takes time, patience, and multiple stakeholders to implement a project and gather sufficient data to assess the quality of the project. As students, we have read many journal articles throughout the graduate program but never fully understood all of the work and data collection that proceeds these articles.

By completing this project, we were able to fully exercise our abilities as doctorate prepared nurses as outlined in the essential content for DNP candidates. We created a project that focused on two main scientific underpinnings relevant to the field of nurse anesthesia: pain and pharmacology. Through implementing an evidence-based protocol in collaboration with

anesthesiologists, surgeons, and nurses, we effectively completed all competencies to become doctorally prepared nurses. On a personal note, this quality improvement project served as a reminder that knowledge of pharmacology and adapting an anesthetic plan to meet the specific needs of each patient is the best way that we can individualize care in the future.

The purpose of the DNP project was to research the best opioid-sparing technique we could for thyroid/parathyroids to have a successful outcome. We succeeded in developing a framework to guide the project, gathering key personnel and a data analysis plan, implementing the project at an institution, and viewing the results of the evidence-based project. This project has forced us to grow in not only writing a scientific research article, but also developing interprofessional skills that we can use throughout the anesthesia careers.

Conclusion

Thyroid/parathyroid surgeries are not associated with significant perioperative pain. Traditional anesthetic technique with opioids increases the risks of PONV, respiratory depression, and longer length of PACU stay. There is a sufficient body of evidence that demonstrates opioid-sparing anesthesia for these surgeries decreases the incidence of these negative outcomes. This provides an opportunity at Bronson Methodist Hospital to adopt the opioid-sparing protocol for this surgical population to improve overall outcomes for patients. Ultimately, limiting the use of narcotics in the perioperative setting can lead to a decreased rate of opioid addiction and can assist in reducing the opioid crisis.

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Appendix A: DNP PROJECT AREA OF INTEREST AND DNP PROJECT TEAM APPROVAL FORM

Date: 3/15/2021

Student name: Cody Brainard and Kayla Roggentine

Describe your area of interest:

For our project, we are interested in developing and implementing an opioid-sparing quality improvement initiative for patients undergoing thyroid surgeries (partial thyroidectomy, radical thyroidectomy, parathyroidectomy). Generally, these procedures do not cause significant amounts of perioperative pain, thus it provides the perfect opportunity to reduce opioids in the perioperative period. Currently, there is no standard of anesthetic care for this surgical population in place at Bronson Methodist Hospital in Kalamazoo, Michigan.

Describe the problem to be addressed and specify the question to be answered:

The opioid epidemic in America has been growing exponentially over the past two decades. From 1999-2017, 399,230 (56.8%) deaths from overdose were the result of opioid abuse (Scholl, Seth, Kariisa, Wilson, & Baldwin, 2019, p. 1425). Opioid dependence occurs across all age groups, from newborn babies that experience withdrawal symptoms from maternal opioid abuse to older adults (The National Institute on Drug Abuse Blog Team, 2018). Opioid use is also linked to several negative perioperative outcomes such as postoperative nausea and vomiting and respiratory depression, both of which can decrease the quality of recovery in postsurgical patients and increase hospital length of stay.

Certified registered nurse anesthetists (CRNAs) are on the forefront of the opioid epidemic. Traditional methods of delivering anesthesia involve the use of opioids and narcotics intraoperatively and in the immediate postoperative period. However, considering the opioid

epidemic, CRNA's are being called upon to find methods to limit narcotics and use adjuvant therapies instead (Hah, Bateman, Ratliff, Curtin, & Sun, 2017, p. 1735). Thyroidectomies and parathyroidectomies are stimulating surgeries that are not associated with significant pain perioperatively. This provides an opportunity for anesthetists to limit narcotic use to improve the patient's perioperative experience.

The purpose of this quality improvement project is to answer the following question: Does the implementation of an opioid-sparing thyroid/parathyroid anesthesia protocol at Bronson Methodist Hospital in Kalamazoo, Michigan reduce the incidence of postoperative nausea and vomiting, respiratory depression, hospital/PACU length of stay, and overall pain scores while minimizing the use of perioperative opioids in patients undergoing thyroid or parathyroid surgery.

Explain the importance of the question or problem to the area of specialty nursing:

The objective of emerging a patient who just had thyroid or parathyroid surgery requires a smooth emergence and extubation. Postoperative nausea and vomiting (PONV), coughing, and retching can all increase the risk of hemorrhage following these surgeries. When initiating opioid-sparing techniques during surgical procedures, a decrease in narcotic use will lessen the incidence of PONV, reduce time in recovery and a quicker release from the hospital, and a decrease in occurrence of respiratory depression, thus, these factors lead to a shorter hospital stay for the patient. An easy-to-follow protocol similar to what is currently in use at Beaumont Hospital in Royal Oak, Michigan will help to lessen the occurrence of these negative outcomes.

Describe the DNP Project method proposed to answer the problem:

The goal of this quality improvement initiative is to develop and implement an opioid-sparing thyroid/parathyroid anesthesia protocol at Bronson Methodist Hospital in Kalamazoo,

Michigan. Prior to implementation of the protocol, consent from the Western Michigan University IRB will be obtained to review the records of 30 patients who underwent thyroid/parathyroid surgery from January 1, 2019- December 31, 2019. Data regarding opioid use, incidence of postoperative nausea and vomiting and pain scores in the post anesthesia care unit (PACU) will be gathered to establish a baseline. Patients included in our initiative must be between the ages of 18 to 65, ASA class I-III, and not taking prescription opioids for chronic conditions at the time of surgery. We will then move to educating the staff about the proposed and approved protocol. Once the proposed protocol is accepted by the staff, following the initial data analysis, we will then move to application of the protocol. Finally we will review 30 patient charts post-intervention and compare the results with the pre-intervention results.

The project design involves a Plan-Do-Study-Act model (PDSA). Stage I of the PDSA model is the "plan" step, which includes an extensive literature review into medical databases that include journal articles comparing opioid-sparing adjuvants to decrease the need for opioids in the perioperative setting. A retrospective chart review will be performed using the aforementioned inclusion criteria to analyze the incidence of postoperative nausea and vomiting, respiratory depression, and hospital/PACU length of stay in regard to opioid use perioperatively. Step II of the PDSA model is the "do" step, which includes educating stakeholders. Firstly, we will present our findings to the surgeon at Bronson Methodist hospital to show that opioid-sparing anesthesia for thyroid/parathyroid surgeries can improve multiple outcomes. With the assistance of the stakeholders, a protocol will be developed and presented to the surgeon regarding the opioid-sparing technique that will be conducted in hopes to decrease postoperative nausea and vomiting. Secondly, an educational information session that includes the certified registered nurse anesthetists and anesthesiologists at Bronson Methodist Hospital will take place

to discuss the findings of our literature review and our plan for implementing an evidence-based opioid-sparing protocol into practice. The protocol will be on a laminated card that CRNA's can bring into the surgical cases. Cards will include preoperative, intraoperative, and postoperative medications the patient should receive. Stage III is the "study" phase, which is an assessment of the findings after implementation of the protocol and if the opioid-sparing adjuvants decreased postoperative nausea and vomiting, along with pain. In this phase, we will be comparing 30 patients who received standard anesthesia care before protocol implementation and 30 patients who received the opioid-sparing protocol. The final stage, Stage IV, is the "act" phase. If the protocol was successful, the goal will be to standardize this protocol at Bronson Methodist Hospital for thyroid/parathyroid surgical cases. If any issues arise, changes within the protocol will be based on feedback from the surgeon, CRNA's, and anesthesiologists.

Thyroidectomy/parathyroidectomy surgeries are considered high risk for postoperative nausea and vomiting (PONV) with disastrous outcomes at the operative site. Retching has the potential to cause a hematoma and compress the airway because of the increased pressure. In addition, respiratory depression is a well-known side effect of opioid use that can increase PACU length of stay and become costly to patients. Potential benefits and outcomes by developing and implementing an opioid-sparing protocol include a decrease in PONV, decreased respiratory depression, and a quicker return to baseline after surgery.

Certified registered nurse anesthetists, anesthesiologists, and the surgeon are key personnel in this study to appropriately implement the protocol. Their cooperation and feedback will be important to maintain a protocol that will be effective in opioid-sparing anesthesia for thyroid/parathyroid surgeries. Potential barriers that may affect this study include noncompliance

among anesthesia staff when implementing this protocol and instead using a "traditional" anesthesia technique that includes opioids.

To assess compliance and gather data regarding patients involved in this initiative, a spreadsheet will be used to collect data. This sheet will contain nonspecific patient demographic information (gender, age, weight, ASA classification, surgical time) for each encounter. It will also serve as a place to record opioid usage, negative perioperative outcomes (PONV, respiratory depression, increased length of PACU stay), and overall experience (pain scores before and after surgery, pain score when leaving PACU). This tool will be used for both pre and post-intervention groups so the results can be compared to make a definitive conclusion regarding the efficacy of the protocol.

Literature Review and Framework

A preliminary review of the literature has demonstrated many methods to reduce perioperative opioid use in patients undergoing thyroid/parathyroid surgery. A majority of these are centered around pain theory and the use of many adjuvant medications perioperatively. These medications include acetaminophen (tylenol), celecoxib (celebrex), gabapentin (neurontin), lidocaine, dexmedetomidine (precedex), and ketamine. Due to the large body of evidence-based literature on this subject, the authors of this initiative believe that it is feasible to develop and implement an opioid-sparing protocol for patients undergoing thyroid/parathyroid surgery. References for reviewed articles are listed at the end of this document. The goal of this quality improvement initiative is to use adjunct medications at similar doses used in the literature to tailor an opioid-sparing anesthetic for this patient population.

To better understand the current state of an opioid sparing approach to pain management for thyroid, a literature search was conducted using the electronic databases of CINAHL and

PubMed. A keyword search using a combination of the terms “thyroid surgery”, “opioid sparing”, “dexmedetomidine”, “cyclooxygenase inhibitors”, “ketamine”, “lidocaine”, “NSAIDs”, and “gabapentin” with the Boolean operators AND/OR used. Articles included in the review were those from 2003-2020 that studied adult patients (18 or over), had pain control and/or opioid consumption as primary outcomes, and were of high-level evidence. Articles were excluded if they included pediatric patients or had a primary focus on other outcomes (monetary incentives, regional anesthetic techniques, poor study design, etc.). The search yielded a total of 323 relevant articles. Of these, 14 were selected for this critical review. All 14 of these articles found that a variety of different anesthetic techniques, namely adjuvant medications mentioned above, are equally as effective as opioids for controlling pain and reducing harmful side effects associated with opioids in patients undergoing thyroid and parathyroid surgery.

A majority of the current literature regarding multimodal analgesia for patients undergoing thyroid/parathyroid surgery is centered around pain theory. In short, medications that are given perioperatively exhibit their effect on different receptors in the body to decrease pain. In addition to the targeted effect of a drug, patients may exhibit side effects that are not intended due to activation/deactivation of a given receptor in the body. Pain from surgery is a symphony of many different mechanisms. This includes tissue damage from surgical dissection and manipulation, inflammation from a release of many different mediators due to stress response, and exacerbation of chronic pain. Medications to be used in our project include acetaminophen, celecoxib, gabapentin, ketamine, dexmedetomidine, and lidocaine.

Opioids

Opioids are theorized to work on Mu, Kappa, and Delta receptors in the central and peripheral nervous systems. Binding of an opioid molecule to an opioid receptor causes

suppression of calcium influx and a subsequent decrease in neuronal activity in pain pathways. Inhibition of these pathways also causes many negative side effects such as respiratory depression, bradycardia, inhibition of peristalsis with subsequent nausea and vomiting, and physical dependence (Nagelhout & Elisha, 2016).

Acetaminophen

The first non-opioid medications that has shown to be effective for treating perioperative pain in patients undergoing thyroid surgery is acetaminophen. Acetaminophen is an antipyretic and analgesic drug. The mechanism of action by which acetaminophen exerts its effect is not currently known, but it is theorized to work by reducing prostaglandin production, which are inflammation-inducing molecules that cause pain.

Three articles (Arenas et al, 2021; Gehling et al, 2010; Papoian et al, 2020) were reviewed regarding the use of acetaminophen during thyroid surgery. One article (Arenas et al, 2021) randomized two study groups into an opioid and non-opioid group. The opioid group received acetaminophen/codeine every 4-6 hours as needed, and the non-opioid group received acetaminophen every 8 hours and had tramadol (an opioid analgesic) available for breakthrough pain. They found a 57% reduction in opioid usage in the non-opioid group with equivalent pain scores.

The other articles (Gehling et al, 2010; Papoian et al, 2020) used acetaminophen as part of a non-opioid analgesic regimen for thyroid surgery that combined acetaminophen with NSAIDs for perioperative pain. For both studies, the experimental group that received acetaminophen in combination with NSAIDs had similar pain scores at a reduced morphine milligram equivalents (MME). Side effects (sedation, nausea, vomiting, etc.) were similar in both opioid and non-opioid groups

Nonsteroidal Anti-Inflammatory Drugs

Another class of non-opioid pain medication is nonsteroidal anti-inflammatory drugs, or NSAIDs. These include the cyclooxygenase (COX) inhibitors celebrex, ibuprofen, ketorolac, and parecoxib. Inhibition of COX results in decreased formation of prostaglandins. While these medications do not exhibit the same negative effects that opioids do, there are risks associated with their use including kidney injury, gastrointestinal tract bleeding, and liver injury due to reductions in prostaglandins. Prostaglandin has a protective effect on gastrointestinal tract mucosa and causes renal artery dilation. Inhibition of prostaglandin can therefore cause gastrointestinal bleeding and decreased kidney function.

Two relevant articles (Oltman et al, 2017; Karamanlioglu et al, 2005) were reviewed that analyzed the use of NSAIDs in patients undergoing thyroid surgery. Both of these randomized controlled trials (RCT's) compared various drugs in this class against a placebo group. They then compared pain scores to a placebo group postoperatively and analyzed the differences in opioid consumption and visual analog scale (VAS) pain scores. Each article demonstrated a reduction in opioid consumption and other secondary outcomes (PONV, pain at rest, pain when swallowing, etc.) when compared to placebo groups. Medications that were used in these studies included ketorolac, ibuprofen, celecoxib, and parecoxib. One limitation that was mentioned in each study was the fact that not every patient undergoing thyroid surgery is able to take NSAIDs for a variety of reasons. These include bleeding risk, patient comorbidities (renal dysfunction, history of GI bleed, etc.), intolerance to the medications.

Gabapentin

Gabapentin is anticonvulsant that has gained popularity in treatment of neuropathic pain such as diabetic neuropathy. It's mechanism of action is theorized to be blockade of alpha 2 delta

receptors in the central nervous system which blocks excitatory neurotransmitter release. Recent research has shown that preoperative administration of gabapentin reduces perioperative opioid use, and that it's mechanism of action can potentiate the effects of opioids. In other words, there is a synergistic effect that can help to decrease the need for opioids. Side effects include dizziness, somnolence, and edema.

Two of the articles relating to opioid-sparing techniques for parathyroidectomies / thyroidectomies researched the effects of 600 mg of Gabapentin administered one hour before anesthesia (Lee et al, 2013; Shal et al, 2017). Shal indicated that the group of 22 patients receiving Gabapentin in the preoperative setting had a significantly lower postoperative nausea and vomiting rate compared to the control group. The second study (Lee et al, 2013) researching the effects of Gabapentin on thyroid surgeries had a total of 71 participants, 36 receiving Gabapentin one hour before anesthesia, and 35 participants in the placebo group. The study concluded that Gabapentin reduced the intensity and incidence of a sore throat during the postoperative resting state during the first 24 hours after surgery.

Ketamine

Ketamine is another adjunct medication that has been shown to effectively control pain perioperatively. It's mechanism of actions is via antagonism of excitatory N-methyl-D-aspartate (NMDA) receptors in the central nervous system. By inhibiting these receptors, pain signals cannot be propagated through the brain. There is also some degree of inhibition of signals in the spinal cord (Nagelhout & Elisha, 2016). Side effects are due to its action in the central nervous system and include seizures (controversial), emergence delirium, and a dissociative state of anesthesia that may be unpleasant to the patient. This can often be negated with administration of a benzodiazepine, such as midazolam.

Two of the included studies (Lee et al, 2017; Kim et al, 2016) evaluated the effects of ketamine on perioperative pain management for patients undergoing thyroid surgery. More specifically, a ketamine infusion was initiated following the induction of anesthesia in both studies and pain scores were compared to control groups at varying intervals postoperatively. Both studies demonstrated lower pain scores in the ketamine group and less opioid consumption. However, one of these studies (Kim et al, 2016) demonstrated a statistically significant increase in the incidence of PONV in the group receiving ketamine. The other study (Lee et al, 2017) demonstrated similar rates of PONV between the two groups.

Dexmedetomidine

Dexmedetomidine is a selective alpha-2 receptor agonist. Binding of a dexmedetomidine molecule to an alpha-2 receptor causes an inhibitory effect by decreasing calcium influx and hyperpolarizing the cell. This renders the cell inactive and is theorized to be the method for inhibition of pain signals. By inhibiting excitatory cells, dexmedetomidine has the ability to cause bradycardia and hypotension in a dose-dependent manner (Nagelhout & Elisha, 2016).

Two studies compared the effects of using Dexmedetomidine versus a placebo group in thyroidectomies (Ma et al, 2017; Kim et al, 2020). The first study conducted by Ma et al, included 100 participants that were separated into groups comparing the use of Dexmedetomidine and saline. Extubation and recovery times were significantly shorter for the group receiving 0.5 mcg/kg of Dexmedetomidine 30 minutes before the end of surgery. The second study by Kim et al, evaluated the effects of intraoperative Dexmedetomidine infusion and the incidence of postoperative sore throat. The study showed that an infusion reduced the incidence of a sore throat, hoarseness, and the need for opioids for the first 24 hours after thyroidectomies.

Lidocaine

Finally, lidocaine is a local anesthetic that works by blockade of voltage-gated sodium channels and subsequently inhibits propagation of an impulse along a nerve fiber. Systemic administration of lidocaine intravenously works on peripheral pain pathways. Side effects are consistent with toxicity and can range from circumoral numbness and tingling to cardiac and respiratory arrest.

Conclusion

Thus, there are many medications currently available to anesthetists that can effectively control pain without activation of opioid receptors. These medications are not benign and should be used selectively for appropriate patients, but a multimodal approach that combines some of these medications can be of great benefits to patients undergoing thyroid and parathyroid surgery.

Describe your plans for dissemination of DNP Project results:

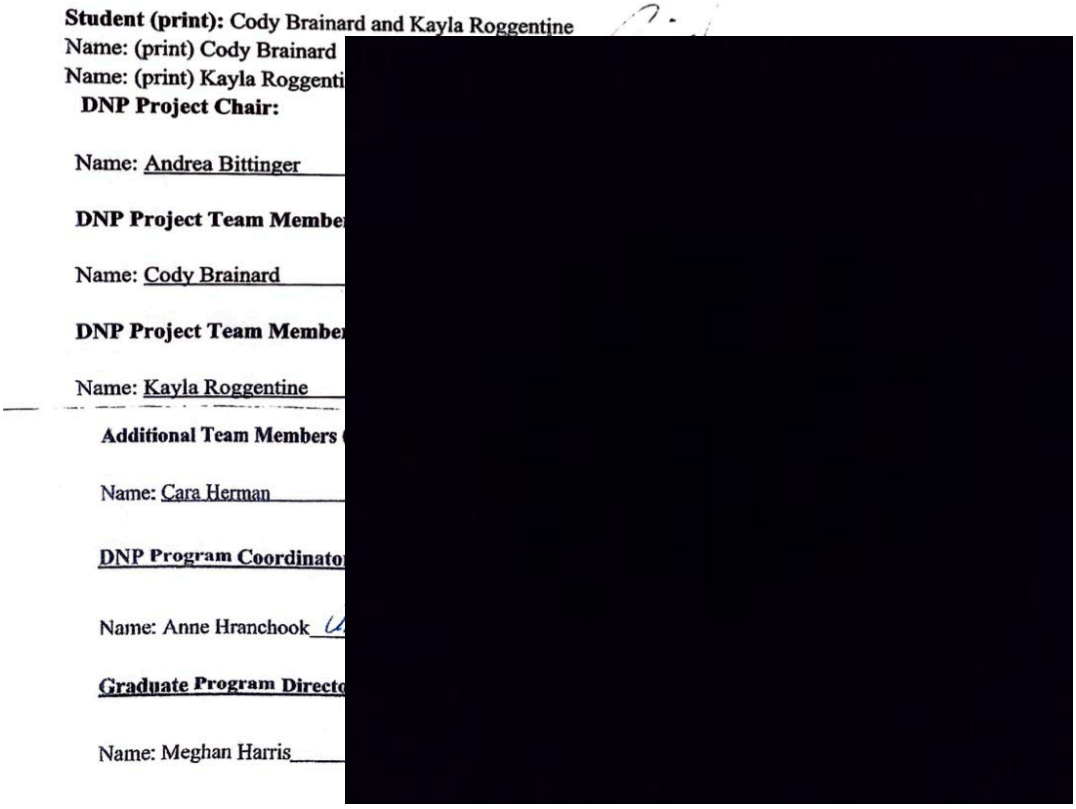
Our four main objectives for evaluation include analysis of the incidence of PONV, respiratory depression in the postoperative setting, overall time for patient's return to baseline functional status, and overall pain scores perioperatively. The goal of this study is to decrease each of these parameters through our protocol with the ultimate ability to limit the use of opioids for this patient population. By comparing results from a standard anesthetic plan in thyroidectomy/parathyroidectomy patients dating January 1, 2019- December 31, 2019 and after protocol implementation, a critique can be made in the evidence of how well the protocol worked.

Out of 30 patients' pre-protocol that meet the inclusion criteria, we will determine what percentage of these patients had PONV, respiratory depression, and a delay in baseline of

functional status. This data will be compared to 30 patients' post-protocol that met the inclusion criteria. Statistical analysis of the pre and post-intervention groups will be made with SPSS software using Mann-Whitney-U tests. This test allows for dependent variables (PONV incidence pre/post intervention, pain scores pre/post intervention, respiratory depression pre/post intervention, and pain scores pre/post intervention) to be directly compared in two different study groups. Outcomes can then be presented to anesthesia providers and the surgeon on the effectiveness of the protocol in this surgical population.

Following implementation of our project, the results will be disseminated to Kalamazoo Anesthesiology in Kalamazoo, Michigan during one of their monthly staff meetings. The data that we present will hopefully influence some of the current anesthesia staff's practice to better care for patients undergoing thyroid or parathyroid surgery. In addition, we hope to present this information in a poster format to allow for our results to be presented, which may help other institutions to consider implementing an opioid-sparing protocol.

The signature of the DNP Project Team indicates approval of the DNP Final Project idea/concept and agreement to serve on the team.



Appendix B: DNP Proposal Rubric

Score each area using the following: 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

		Score
Background and Significance	Describes the phenomena, its importance to healthcare and affected stakeholders.	5
Purpose Statement	Clearly and concisely states the goal of the project.	5
Review of the Literature	Provides an organized, integrated summary of the state of the science (with level of evidence provided).	5
Theoretical Framework	Provides appropriate theoretical framework to guide the project.	5
Methods and Procedures	Clearly and concisely summarizes (where applicable): • Evidence-based practice model or research design • Participants/population • Sample/setting • Recruitment • Instruments • Procedures • Key personnel • Stakeholders • Barriers to implementation and sustainability • Data collection plan • Data analysis plan • Ethical considerations	5
Resources	Identifies all anticipated resources and potential costs.	5
Approvals for Implementation	Identifies required approvals needed for implementation (cooperating agencies, IRB, etc)	5
Evaluation Plan	Clearly and concisely summarizes evaluation plan (where applicable): • Objectives or research questions. • Plan for monitoring objective accomplishment. • Plan if problems encountered during implementation.	5
References	Current references	5
Clarity of Writing and Writing Technique	Writing is clear and succinct. The writer incorporates the active voice when appropriate. Appropriate grammar	5
APA	Follows current APA format guidelines	5

DNP Project Chair [redacted]

DNP Team member [redacted]

DNP Team member/[redacted]

Appendix C: FORMAT FOR TITLE PAGE

Developing, Implementing, and Evaluating an Opioid-Sparing Thyroid/Parathyroid Anesthesia Protocol:
A Quality Improvement Initiative

by

CODY BRAINARD AND KAYLA ROGGENTINE

A research report submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF NURSING PRACTICE

2022

Oakland University
Rochester, Michigan

APPROVED BY:

Appendix D: FINAL PROJECT RUBRIC/APPROVAL FORM

Score each area using the following Likert scale:

1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

		Score
Background & Significance	Describes the phenomena, its importance to healthcare and affected stakeholders	
Purpose Statement	Clearly and concisely states the goal of the project.	
Review of the Literature	Provides an organized, integrated summary of the state of the science (with level of evidence provided).	
Theoretical Framework	Provides appropriate theoretical framework to guide project.	
Methods and Procedures	Clearly and concisely summarizes (where applicable): • Evidence-based Practice model or Research design • Participants/population • Sample/setting • Recruitment • Instruments • Procedures • Key personnel • Stakeholders • Barriers to implementation and sustainability • Data collection plan • Data analysis plan • Ethical considerations	
Resources	Identifies all required resources and costs	
Approvals for Implementation	Provides all required letters of support from cooperating agencies (as appendices).	
Results	Clearly and concisely summarizes (if appropriate): • How each goal/research question was objectively evaluated. • Statistical analyses for each goal/question.	
Discussion	Addresses each objective: • Provides facilitators and barriers encountered. • Identifies unintended consequences (both positive and negative, if appropriate) and how handled. • Thorough analysis of findings with comparison to literature.	
Recommendations and Limitations	Provides future recommendations for project/research and possible application of this project in other settings. Identifies all limitations of project	
Implications for practice and career development	Discusses impact of project and residency on personal growth and development.	
References	Current state of the science references (with matrix).	
Clarity of Writing and Writing Technique	Writing is clear and succinct. The writer incorporates the active voice when appropriate. Grammar appropriate	
APA	Follows APA.	

Appendix E: DNP FINAL PROJECT COMPLETION APPROVAL FORM

This is to certify that _____, a DNP student in the School of Nursing, has successfully presented and received approval for completion of his/her DNP Project entitled

_____ and it has been approved as meeting the requirement for the Degree of Doctor of Nursing Practice.

Oral presentation approved Date: _____

Manuscript approved Date: _____

_____

DNP Project Chair Date

_____

FacultyTeam Member Date

_____

Clinical Expert Mentor Date

_____

Graduate Program Director Date

Appendix F: DNP PROJECT TIME LOGS

Kayla Roggentine

Date	Hours	DNP Project Task Completed	AACN Essential Met	Mentor Signature
1-12-21	12	Appendix A	II. VI. VIII.	
1-14-21	12	Appendix A	II. VI. VIII.	
1-26-21	12	Appendix A	II. VI. VIII.	
1-30-21	12	Appendix A	II. VI. VIII.	
2-15-21	12	Appendix A	II. VI. VIII.	
2-16-21	12	Appendix A	II. VI. VIII.	
4-10-21	10	Proposal	II. VI. VIII.	
4-11-21	10	Proposal	II. VI. VIII.	
5-7-21	10	Proposal	II. VI. VIII.	
5-8-21	10	Proposal	II. VI. VIII.	
5-14-21	4	Meeting	I. III.	
5-14-21	12	Proposal Write-Up	II. VI. VIII.	
5-16-21	12	Proposal Write-Up	II. VI. VIII.	
5-18-21	12	Proposal Write-Up	II. VI. VIII.	
5-21-21	12	Proposal	II. VI. VIII.	
5-22-21	12	Proposal	II. VI. VIII.	
6-1-21	4	Meeting with anesthesiologist	I. III.	
6-6-21	12	Proposal Updates	II. VI. VIII.	
6-8-21	12	Proposal Updates	II. VI. VIII.	
6-15-21	3	Meeting with Anesthesiologists	I. III.	
6-23-21	4	Meeting with professors	I. III.	
6-23-21	3	Meeting with Andrea	I. III.	
7-8-21	3	Meeting with Andrea	I. III.	
7-16-21	12	Proposal Updates	I. III.	
7-22-21	12	Proposal Updates	I. III.	
7-24-22	12	Proposal Updates	II. III.	
8-2-21	6	Meeting with Andrea and email with Bronson IRB	I. III.	
9-10-21	6	Meeting with Bronson IRB	I. III.	

10-16-21	12	Data collection	II. VI. VIII.	
10-16-21	3	Powerpoint Presentation	II. VI. VIII.	
10-17-21	12	Data Collection	III. VI. VIII.	
10-18-21	4	Meeting with Andrea	I. III.	
10-26-21	4	Meeting with Andrea	I. III.	
11-4-21	3	Presentation	II. VI. VIII.	
11-5-21	4	Meeting	I. III.	
12-9-21	12	Data collection	II. VI. VIII.	
1-8-22	12	Data collection	II. VI. VIII.	
1-9-22	12	Data collection	II. VI. VIII.	
1-10-22	4	Meeting with Andrea	I. III.	
1-16-22	12	Recommendations & Limitations	II. VI. VIII.	
1-17-22	12	Recommendations & Limitations	II. VI. VIII.	
1-20-22	12	Recommendations & Limitations	II. VI. VIII.	
1-23-22	12	Implications for practice and career development	II. VI. VIII.	
1-25-21	12	Implications for practice and career development	II. VI. VIII.	
2-14-22	6	Proposal edits & meeting with Andrea	II. VI. VIII.	
2-20-22	10	Proposal edits	II. VI. VIII.	
2-21-22	4	Meeting with Andrea	I. III.	
2-25-22	12	Paper Updates	II. VI. VIII.	
2-26-22	12	Paper Updates	II. VI. VIII.	
3-15-22	5	Meeting with Andrea.	III.	
3-22-22	12	Discussion & Results Write- Up	VI. VIII.	
3-24-22	12	Discussion & Results Write-Up	VI. VIII.	
4-19-22	12	Paper edits.	I.	
4-27-22	12	Editing powerpoint	II.	
5-4-22	12	Editing powerpoint	II. VI. VIII	
5-5-22	4	Presentation to KA	III. VI. VIII.	
5-27-22	12	DNP Paper completion	IV.	

Cody Brainard

Date	Hours	DNP Project Task Completed	AACN Essential Met	Mentor Signature
1-12-21	12	Appendix A	II. VI. VIII.	
1-14-21	12	Appendix A	II. VI. VIII.	
1-26-21	12	Appendix A	II. VI. VIII.	
1-30-21	12	Appendix A	II. VI. VIII.	
2-15-21	12	Appendix A	II. VI. VIII.	
2-16-21	12	Appendix A	II. VI. VIII.	
4-10-21	10	Proposal	II. VI. VIII.	
4-11-21	10	Proposal	II. VI. VIII.	
5-7-21	10	Proposal	II. VI. VIII.	
5-8-21	10	Proposal	II. VI. VIII.	
5-14-21	4	Meeting	I. III.	
5-14-21	12	Proposal Write-Up	II. VI. VIII.	
5-16-21	12	Proposal Write-Up	II. VI. VIII.	
5-18-21	12	Proposal Write-Up	II. VI. VIII.	
5-21-21	12	Proposal	II. VI. VIII.	
5-22-21	12	Proposal	II. VI. VIII.	
6-5-21	4	Meeting with anesthesiologist	I. III.	
6-6-21	12	Proposal Updates	II. VI. VIII.	
6-8-21	12	Proposal Updates	II. VI. VIII.	
6-15-21	3	Meeting with Anesthesiologists	I. III.	
6-23-21	4	Meeting with professors	I. III.	
6-23-21	3	Meeting with Andrea	I. III.	
7-8-21	3	Meeting with Andrea	I. III.	
7-18-21	10	Proposal Updates	II. III.	
7-22-21	12	Proposal Updates	IV. III.	
7-24-22	12	Proposal Updates	V. III.	
8-2-21	6	Meeting with Andrea and email with Bronson IRB	I. III.	
9-10-21	6	Meeting with Bronson IRB	I. III.	
10-16-21	12	Data collection	II. VI. VIII.	
10-7-21	5	Powerpoint Presentation	II. VI. VIII.	

10-17-21	12	Data Collection	VI. VI. VIII.	
10-18-21	4	Meeting with Andrea	I. III.	
10-26-21	4	Meeting with Andrea	I. III.	
11-4-21	3	Presentation	II. VI. VIII.	
11-5-21	4	Meeting	II. III.	
12-9-21	12	Data collection	II. VI. VIII.	
1-8-22	12	Data collection	II. VI. VIII.	
1-9-22	12	Data collection	II. VI. VIII.	
1-10-22	4	Meeting with Andrea	I. III.	
1-15-22	10	Recommendations & Limitations	II. VI. VIII.	
1-17-22	12	Recommendations & Limitations	II. VI. VIII.	
1-20-22	12	Recommendations & Limitations	II. VI. VIII.	
1-23-22	12	Implications for practice and career development	II. VI. VIII.	
1-25-21	12	Implications for practice and career development	II. VI. VIII.	
2-14-22	6	Proposal edits & meeting with Andrea	II. VI. VIII.	
2-20-22	10	Proposal edits	II. VI. VIII.	
2-21-22	4	Meeting with Andrea	I. III.	
2-25-22	12	Paper Updates	II. VI. VIII.	
2-26-22	12	Paper Updates	II. VI. VIII.	
3-15-22	5	Meeting with Andrea.	III.	
3-22-22	12	Discussion & Results Write- Up	VI. VIII.	
3-24-22	12	Discussion & Results Write-Up	VI. VIII.	
4-19-22	12	Paper edits.	V.	
4-27-22	12	Editing powerpoint	VI.	
5-4-22	12	Editing powerpoint	II. VI. VIII	
5-5-22	4	Presentation to KA	VII. VI. VIII.	
5-27-22	12	DNP Paper completion	VIII.	

Appendix G: GROUP DNP PROJECT PLANNING FORM

Students who are completing a Group DNP Project are required to submit this form to the DNP Project Chair for approval at the beginning of the DNP Planning Process. As outlined in the DNP Project Requirements, only 2 students may work together, students must be individually evaluated, and the Project must comply with the AACN (2015) requirements.

Requirements	Student A Cody Brainard	Student B Kayla Roggentine
Describe the contributions to overall DNP Project Planning.	Asissted in DNP proposal, data collection, and presnetaions throughout project.	Asissted in DNP proposal, data collection, and presnetaions throughout project.
Describe the Aim/Objectives of which student is taking a leadership role.	Met with KA administration to get project approval; ensured that project was carried out as stated in proposal	Coordinated meetings and kept track of DNP hours, assisted in development of all aspects of DNP project.
Describe contributions to: - Writing DNP Project Proposal - Proposal Presentation - IRB submission - Developing plan for Experience Hours	Assisted in development of DNP proposal; submitted proposal to Cayuse IRB	Assisted in development of DNP proposal; created study and hours plan to track progress of DNP project
Describe the contributions to: - Project Planning - Project Implementation - Project Analysis/Synthesis - Project Dissemination-	Assist in DNP project proposal, printed out laminated sheets of protocol to put in OR; checked with CRNA's to ensure protocol compliance;	Coordinated meetings with KA for project approval; assist in DNP project proposal; assist in presentation and final paper
Describe the contributions to: -DNP Project Final Report -Mechanism for dissemination	Formulated and presented PowerPoint presentation to Kalamazoo Anesthesiology	Formulated and presented PowerPoint presentation to Kalamazoo Anesthesiology
Other project related contributions:		
Student Signatures:	[redacted]	

Approved by DNP Project Chair:

Name **Date**

Appendix H: Authorship Agreement

AUTHORSHIP AGREEMENT

The student(s) and the DNP Project Team agree to the following in regards to authorship of any published material, posters, and or presentations based on this project. (Check one only).

[X] The team does not wish to be included in the authorship of any published material, posters or presentations.

___The team must be included in the authorship of the first published article only.

___The team must be included in the authorship of ALL published materials, posters, and presentations based on this project.

Student signature _____ [redacted] _____ Date 5/27/2022

Student signature _____ [redacted] _____ Date 5/27/2022

DNP Project Chair signature_____Date_____

Team member signature _____Date_____

Team member signature _____Date_____

Appendix I: PREOPERATIVE MEDICATION COSTS

Medication	Wholesale Cost (USD)
100 mg Celecoxib (per tablet) 200 mg Celecoxib (per tablet)	$0.14 $0.30
325 mg Tylenol (per tablet) 500 mg Tylenol (per tablet)	$0.48 $0.23
50 mg Ketamine syringe (5 mL)	$5.00
1 % Lidocaine (5 mL) Lidocaine (2g/500 mL bag)	$2.07 $7.30
40 mcg Precedex (5 mL) Precedex (100 mcg/mL vial)	$2.07 $7.30

SOURCE: Bronson Methodist Hospital Pharmacy Department
**Prices that are listed are wholesale and do not reflect what the hospital charges the patient for each medication.

Appendix J: OPIOID-SPARING THYROID/PARATHYROID PROTOCOL

Project Proposal Opioid-Sparing Thyroid/Parathyroid Protocol		
Pre-op	Intra-Op	PACU
Acetaminophen ● 1000 mg PO Celebrex ● 200 mg PO Dramamine ● 50 mg PO	Lidocaine ● 2 mg/kg IV bolus ● 2 mg/kg/hr continuous IV infusion Dexmedetomidine ● 0.5 mcg/kg IV bolus Ketamine ● 0.5 mg/kg IV bolus ●10 mg IV q1hour Decadron ● 8 mg IV after intubation and before incision Ondansetron ● 4 mg IV before extubation	Fentanyl ● 25-50 mcg IV for breakthrough pain Oxycodone ● 5 mg PO

Appendix K: DATA COLLECTION TOOL

Patient Identification Information (PIN, gender, age, weight, ASA score)	Protocol used (Y/N)	Length of Surgery	PONV (Y/N)	Respiratory Depression (less than 8 breaths/min in PACU; Y/N)	Length of PACU Stay	Pain Score After Surgery (0-10)	Pain Score when Leaving PACU (0-10)	Total Opioid Use (MME)

Appendix L: ARTICLES UTILIZING OPIOID-SPARING PAIN MEDICATIONS

Article	**Acetaminophen Dosages**
Arenas, M., Uhlmann, R., Postevka, E., Wang, X., Reinhart III, H., & Snyder, S. (2021). Multimodal analgesia after thyroid or parathyroid surgery: A randomized controlled trial. *Surgery, 169,* 508-512. doi: 10.1016/j.surg.2020.08.008	• 1,000 mg PO q6h as needed postoperatively o Tramadol 50 mg q6h for breakthrough pain
Gehling, M., Arndt, C., Eberhart, L.H.J, Koch, T., Kruger, T., & Wulf, H. (2010). Postoperative analgesia with parecoxib, acetaminophen, and the combination of both: A randomized, double-blind, placebo-controlled trial in patients undergoing thyroid surgery. *British Journal of Anaesthesia, 104*(6), 761-767. doi: 10.1093/bja/aeq096	• 1,000 mg IV 30 minutes before end of surgery • Scheduled 1,000 mg q6h postoperatively
Papoian, V., Handy, K.G., Villano, A.M., Tolentino, R.A., Hassanein, M.T., Nosanov, L.S., & Felger, E.A. (2020). Randomized control trial of opioid- versus nonopioid-based analgesia after thyroidectomy. *Surgery, 167,*957-961. https://doi.org/10.1016/j.surg.2020.01.011	• 650 mg PO q4h as needed postoperatively combined with 800 mg ibuprofen q4h (alternating to receive pain medication every 2 hours)
Royal Oak Beaumont Thyroidectomy Protocol	• 1,000 mg PO preoperatively
Article	**NSAIDS Dosages**
Karamanhoglu, B., Arar, C., Alagol, A., Colak, A., Gemlik, I., & Sut, N. (2003). Preoperative oral celecoxib versus preoperative oral rofecoxib for pain relief after thyroid surgery.	• 200 mg PO celecoxib preoperatively

European Journal of Anaethesiology, 20, 490-495.	
Oltman J, Militsakh O, D'Agostino M, et al. Multimodal analgesia in outpatient head and neck surgery: A feasibility and safety study. *JAMA Otolaryngology Head Neck Surgery.* 2017;143(12):1207–1212. doi:10.1001/jamaoto.2017.1773	• 200 mg PO celecoxib preoperatively
Article	**Ketamine Dosages**
Lee, J., Park, H.P., Jeong, M.H., Son, J.D., & Kim H.C. (2018). Efficacy of ketamine for postoperative pain following robotic thyroidectomy: A prospective randomized study. *Journal of International Medical Research, 46*(3), 1109-1120. doi: 10.1177/0300060517734679	• 0.15 mg/kg IV bolus intraoperatively • 2 mcg/kg/min continuous IV infusion intraoperatively
Kim, D.H., Choi, J.Y., Kim, B.G., Hwang, J.Y., Park, S.J., Oh, A.Y., Jeon, Y.T., & Ryu, J.H. (2016). Prospective, randomized, and controlled trial on ketamine infusion during bilateral axillo-breast approach (BABA) robotic or endoscopic thyroidectomy: Effects on postoperative pain and recovery profiles. *Medicine, 95*(49). doi: 10.1097/MD.0000000000005485	• 1 mg/kg IV bolus intraoperatively • 60 mcg/kg/hr continuous IV infusion intraoperatively
Article	**Dexmedetomidine Dosages**
Ma, X.D., Li, B.P, Wang, D.L, & Yang, W.S. (2017). Postoperative benefits of dexmedetomidine combined with flurbiprofen axetil after thyroid surgery. *Experimental and Therapeutic Medicine, 14,* 2148-2152. doi: 10.3892/etm.2017.4717	• 0.5 mcg/kg IV bolus intraoperatively

Kim, H., Kwon, H., Jeon, S., & Choi, E.K. (2020). The effect of dexmedetomidine and remifentanil on the postoperative sore throat after thyroidectomy. *Medicine, 99*(29). doi: 10.1097/MD.0000000000021060	● 1 mcg/kg IV bolus ● 0.3-0.6 mcg/kg/hr continuous IV infusion intraoperatively
Article	**Lidocaine Dosages**
Choi, G.J, Kang, H., Ahn, E.J., Oh, J.I., Baek, C.W., Jung, Y.H., & Kim, J.Y. (2016). Clinical efficacy of intravenous lidocaine for thyroidectomy: A prospective, randomized, double-blind, placebo-controlled trial. *World Journal of Surgery, 40*, 2941-2947. doi: 10.1007/s00268-016-3619-6	● 1.5 mg/kg IV bolus ● 2 mg/kg/hr continuous IV infusion intraoperatively
Choi, K.W., Nam, K.Y., Lee, J.R., Chung, W.Y., Kang, S.W., Joe, Y.E., & Lee, J.H. (2017). The effects of intravenous lidocaine infusions on the quality of recovery and chronic pain after robotic thyroidectomy: A randomized, double-blind, controlled study. *World Journal of Surgery, 41*, 1305-1312. doi: 10.1007/s00268-016-3842-1	● 2 mg/kg IV bolus ● 3 mg/kg/hr continuous IV infusion intraoperatively
Kim, M.H., Kim, M.S., Lee, J.H., Kim, S.T., & Lee, J.R. (2017). Intravenously administered lidocaine and magnesium during thyroid surgery in female patients for better quality of recovery after anesthesia. *Anesthetic Clinical Pharmacology, 127*(3), 635-641. doi: 10.1213/ANE.0000000000002797	● 2 mg/kg IV bolus ● 2 mg/kg/hr continuous IV infusion intraoperatively

Appendix M: IRB APPROVAL FORM

NOTICE OF QUALITY IMPROVEMENT PROJECT APPROVAL

July 21, 2021

Cody Brainard & Kayla Roggentine
Kalamazoo Anesthesiology
900 Peeler St, #B
Kalamazoo, MI 49008

TYPE OF REVIEW: QUALITY IMPROVEMENT PROJECT

PROTOCOL TITLE: Developing, Implementing, and Evaluating an Opioid-Sparing Thyroid/Parathyroid Anesthesia; A Quality Improvement Initiative

Dear Cody and Kayla

On July 21, 2021 it was determined the proposed activity does not meet the definition of research as defined by the Common Rule and FDA *[45 CFR 46.102(d)]*. Therefore, review and approval by our local Western Michigan University Homer Stryker School of Medicine Institutional Review Board (IRB) is not required. Please be remindful when presenting or publishing the collected data that it is presented specifically as a Bronson Quality Improvement project and not as research.

This approval only applies to activities described in the proposed protocol submitted for approval and does not apply should any changes be made. If there are changes to the protocol, please re-submit for review and approval prior to implementation. If there are questions about whether these activities constitute research involving human subjects, please submit a new request to our local IRB for a determination utilizing the electronic submission system at https://med.wmich.edu/irbesubmit.

Your project will remain on file within the Research Compliance Office. If you should have any questions please feel free to contact me at 269-341-6662 or by email at ferrisp@bronsonhg.org.

Sincerely,

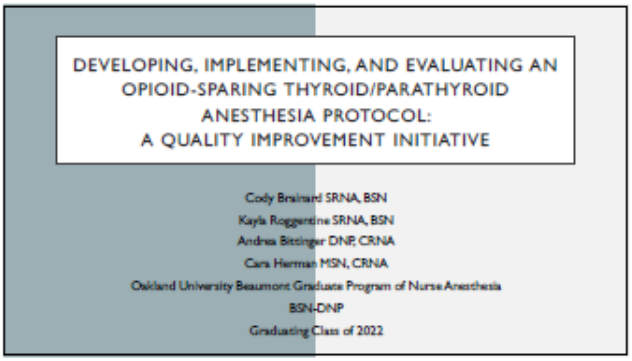
[redacted]

Pamela Ferris, RN, BSN
Research Compliance Specialist
Bronson Methodist Hospital
601 John Street
Kalamazoo, MI 49007

Cc: Andrea Bittinger, Dr. Robert Nicholson, Kate Pratley, Dr. Larson

BRONSON

Appendix N: Dissemination Slides



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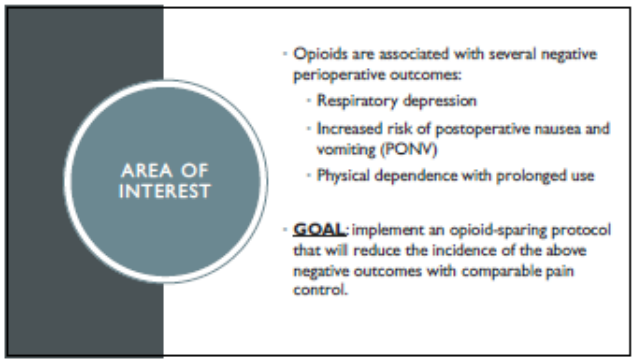

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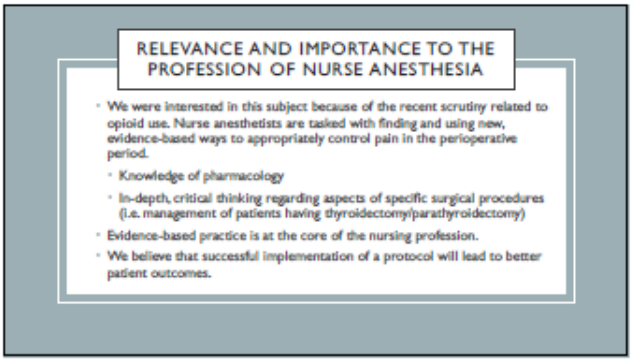

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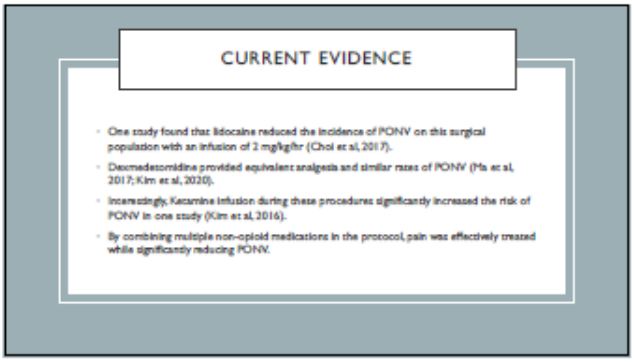

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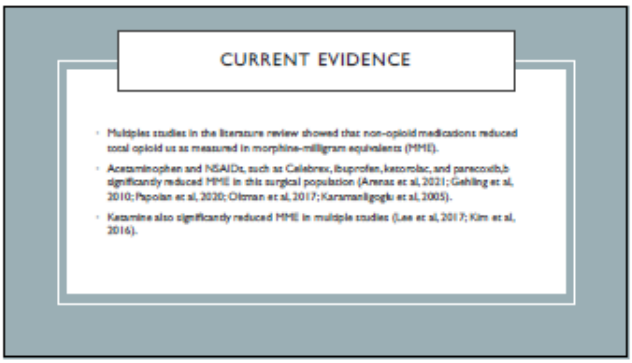

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6

PURPOSE OF OUR DNP PROJECT & OBJECTIVES

- The purpose of our DNP project was to demonstrate the implementation of an opioid-sparing protocol for patients undergoing thyroid/parathyroidectomy and evaluate the successfulness.
- The four objectives for our protocol include:
  1. Incidence of PONV
  2. Respiratory depression in the postoperative setting
  3. Overall time patients returned to baseline functional status
  4. Overall pain scores perioperatively

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Project Proposal Opioid-Sparing Thyroid/Parathyroid Protocol

Pre-op	Intra-Op	PACU
Acetaminophen • 1000 mg PO Celebrex • 200 mg PO Dramamine • 50 mg PO	Lidocaine • 2 mg/kg IV bolus • 2 mg/kg/hr continuous IV infusion Dexmedetomidine • 0.5 mcg/kg IV bolus Ketamine • 0.5 mg/kg IV bolus • 10 mg IV q/hour Decadron • 8 mg IV after intubation and before incision Ondansetron • 4 mg IV before extubation	Fentanyl • 25-50 mcg IV for breakthrough pain Oxycodone • 5 mg PO

OUR PROTOCOL

8

INCLUSION CRITERIA

- Patients included in our study met the following criteria:
  - Ages 18-65
  - Having thyroid/parathyroid surgery
  - ASA I-III
  - Not taking chronic opioids
- All pre-intervention data was randomly selected from a pool of patients meeting inclusion criteria from January 2019 – December 2019.
  - 30 patients were randomly selected from this pool.
- All post-intervention data was gathered from 30 patients meeting criteria that received our protocol.

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METHODOLOGY
PLAN-DO-STUDY-ACT (PDSA) MODEL

- Plan- Extensive literature review comparing opioid-sparing adjuvants to decrease perioperative narcotic use.
- Do- Educating the stakeholders. Presented findings to surgeon, anesthesiologist, and CRNA's. Educational session during monthly meeting explaining the protocol.
- Study- Assessment of the findings after implementation of the protocol to determine if the technique met our objectives.
- Act- If the protocol was successful, standardize the protocol at Bronson Hospital.

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RESULTS & DISCUSSION

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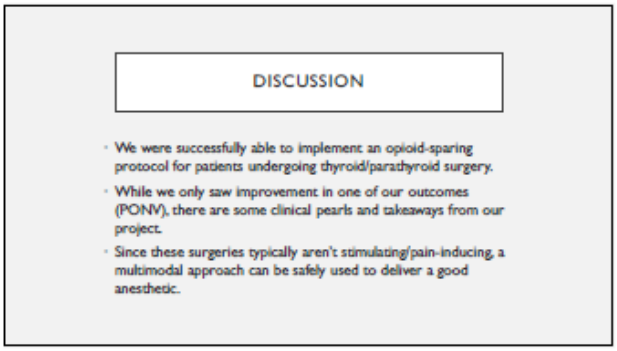
Characteristic	N		%		M		SD	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Age	30	30	100.0	100.0	47.5	41.7	13.4	13.8
Weight (kg)	30	30	100.0	100.0	87.1	87.2	23.3	17.7
Gender								
Female	26	21	86.7	70.0				
Male	4	9	13.3	30.0				
ASA score	30	30	100.0	100.0	2.3	2.5	0.48	0.51
Length of surgery (in minutes)	30	30	100.0	100.0	148.4	116.4	45.6	37.5
Length of PACU stay (in minutes)	30	30	100.0	100.0	111.6	117.9	46.4	58.6
Pain score after surgery (0-10)	30	30	100.0	100.0	1.5	1.4	2.3	1.5
Pain score leaving PACU (0-10)	30	30	100.0	100.0	2.1	0	2.9	0
PONV								
Yes	27	1	90.0	3.3				
No	3	29	10.0	96.7				
Respiratory Depression (>6 min/ml)								
Yes	2	0	6.7	0				
No	28	30	93.3	100.0				
Total perioperative opioid use (MME)	30	30	100.0	100.0	36.1	66.8	19.1	93.8

12



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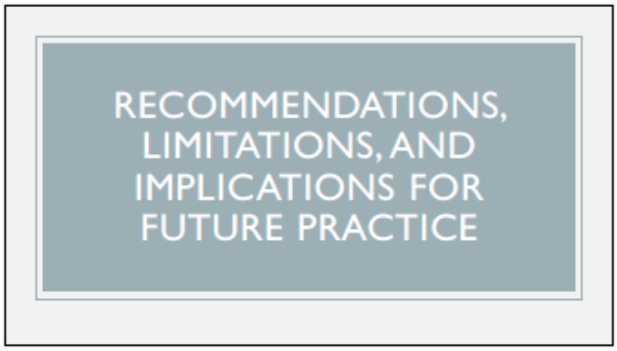

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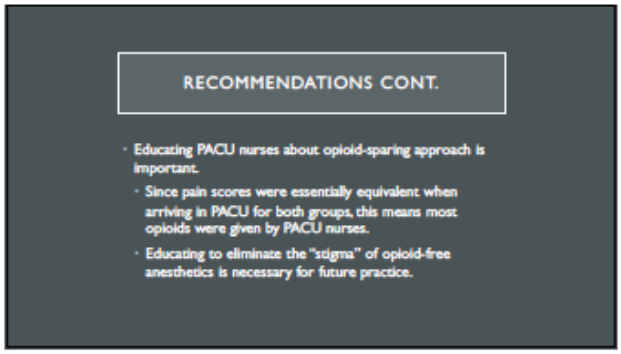

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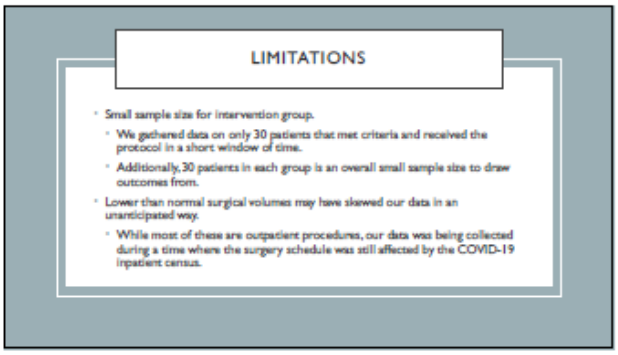

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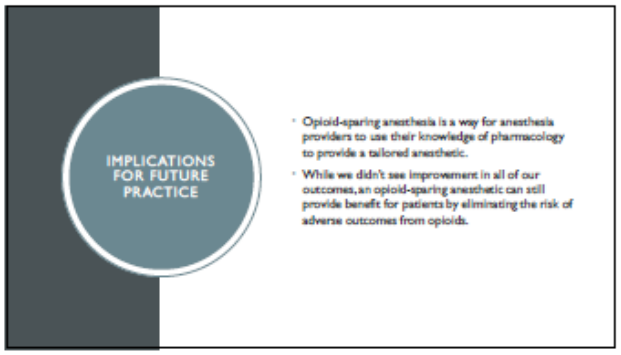

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Table 1: Pre- and Post- Intervention Group Characteristics

Characteristic	N		%		M		SD	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Age	30	30	100.0	100.0	47.5	61.7	12.4	13.8
Weight (kg)	30	30	100.0	100.0	87.1	87.2	23.3	17.7
Gender								
Female	26	21	86.7	70.0				
Male	4	9	13.3	30.0				
ASA score	30	30	100.0	100.0	2.3	2.5	0.48	0.51
Length of surgery (in minutes)	30	30	100.0	100.0	148.4	116.4	45.6	37.5
Length of PACU stay (in minutes)	30	30	100.0	100.0	131.9	117.7	46.4	58.6
Pain score after surgery (0-10)	30	30	100.0	100.0	1.3	1.4	2.3	1.5
Pain score leaving PACU (0-10)	30	30	100.0	100.0	2.1	0	2.9	0
PONV								
Yes	27	1	90.0	3.3				
No	3	29	10.0	96.7				
Respiratory Depression (<8 res/min)								
Yes	2	0	6.7	0				

No	28	30	93.3	100.0				
Total perioperative opioid use (MME)	30	30	100.0	100.0	36.1	66.8	19.1	92.8

Figure 1: Pain Scores After Surgery

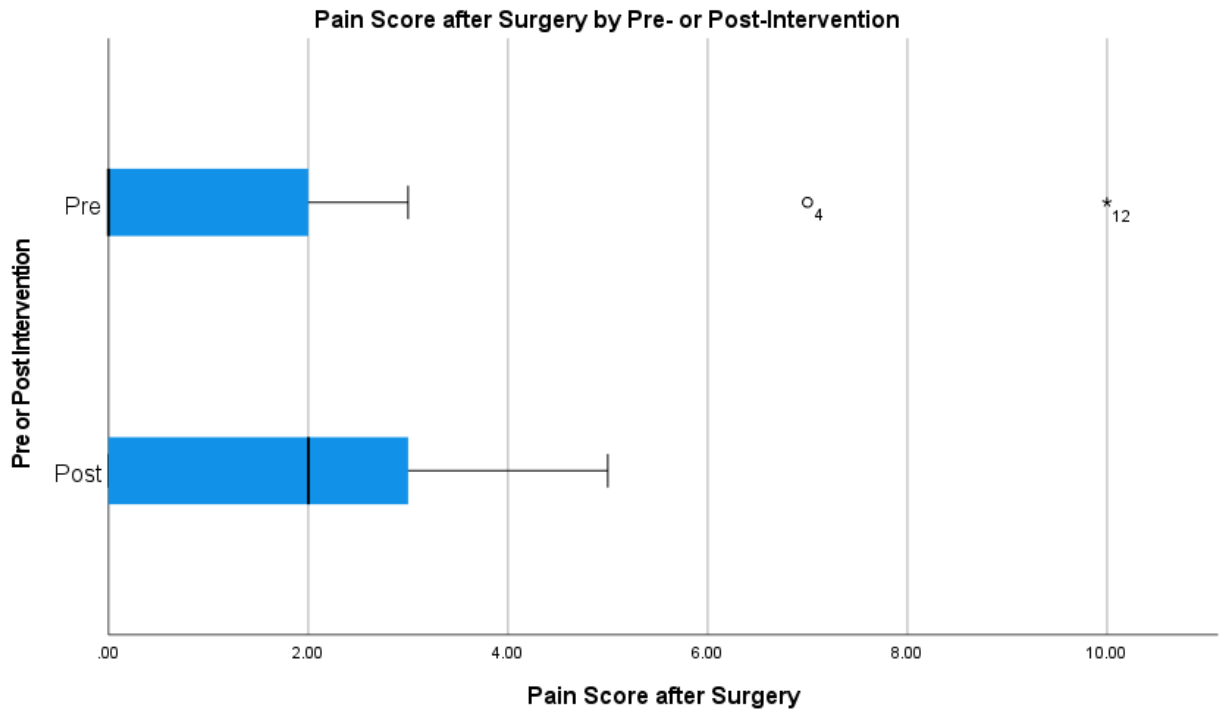

Figure 2: Pain Scores Leaving PACU (Post-Intervention)

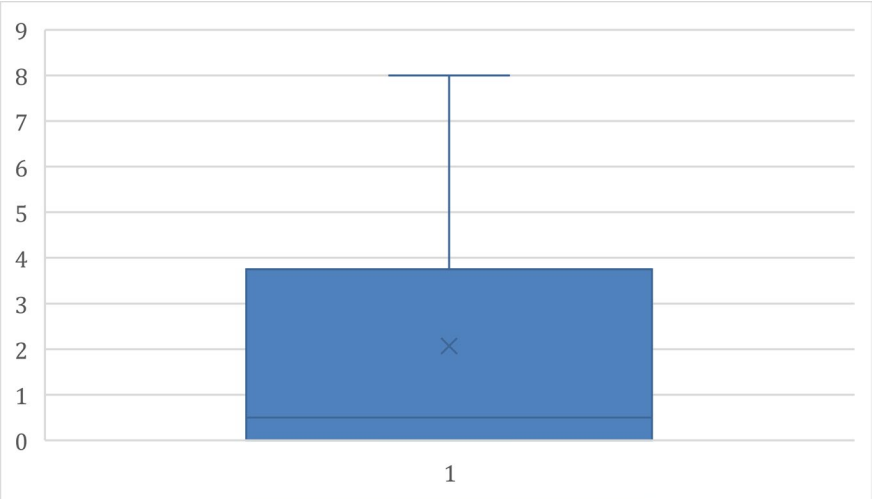

Figure 3: Total Perioperative Opioid Use