

IMPACT OF NURSE EDUCATION IN PACU ON OPIOID
MINIMIZATION COMPLIANCE IN BARIATRIC
SURGERY PATIENTS

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Dedication and Acknowledgements

I would like to thank my fiancé, my family, future in-laws, and friends for their continued support throughout this program. Without your love, support, and understanding, I would not have been able to complete these tough three years.

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Abstract

Background: Opioids have significant side effects, especially for bariatric surgery patients, yet are still frequently administered in the Post Anesthesia Care Unit (PACU). Multimodal analgesics effectively relieve pain, minimize opioid consumption, and decrease postoperative complications for this patient population. Purpose: This DNP project aims to educate PACU nurses on the benefits of multimodal analgesia, the harmful impact opioids have on bariatric patients and assess barriers to opioid minimization compliance for this patient population in PACU. Methods: Thirty-four PACU nurses from a 439-bed private hospital in North Carolina were recruited to participate in an education session discussing the adverse effects of opioids and opioid alternatives. A pre- and post-survey adapted from the Clinical Pain Knowledge Test by Dr. Bernhofer were sent to participants. Barriers to opioid minimization were assessed in the post-survey through qualitative data responses. SPSS and StataSE statistical packages were used to analyze quantitative data. Results: Twenty-four nurses participated in the education session. Seventeen participants responded to the presurvey, and nine responded to the post-survey. Fisher's exact test was used to analyze individual survey questions for knowledge improvement. Data analysis showed no statistical significance. However, all showed improvement in the percentage of correct answers from pre- to post-survey. Recommendations and conclusion: Continued education on opioid alternatives and the harmful effects opioids have on bariatric patients would be helpful to promote and sustain practice change. Development of pre-op and post-op analgesic medication guidelines would improve consistency in limiting opioid administration. Barriers identified by PACU nurses provide a basis for future quality improvement projects.

Keywords

Enhanced Recovery, ERAS, Opioid sparing analgesia, multimodal analgesia, bariatrics, pain management, PACU, education, nurse education, compliance, and barriers.

Background and Significance

Optimal pain control is a primary consideration in patient care postoperatively. Opioids are still "go to" drugs for pain relief in PACU despite their well-documented adverse side effects and high abuse potential (Joshi & Kehlet, 2019). Research has shown that the bariatric patient population is at increased risk of opioid abuse compared to non-bariatric patients (Adis Medical Writers, 2020; Hoehn et al., 2019; Ma et al., 2020). Considering the significant respiratory and other comorbidities morbidly obese patients experience, the adverse side effects of opioids are much more of a concern for this population (Adis Medical Writers, 2020; Hoehn et al., 2019; Kayhan et al., 2018). Adverse side effects from opioids consist of a dose-dependent decrease in ventilation; cough suppression; sedation; spasm of biliary smooth muscle resulting in biliary colic; constipation; delayed gastric emptying; nausea and vomiting; urinary retention; placental transfer; histamine release with morphine; and potential for tolerance and dependence (Flood et al., 2015).

The opioid epidemic is a rising concern. More than 232,000 people died from prescription opioid overdoses in the U.S. from 1999 to 2018 (Centers for Disease Control and Prevention, 2020). With the ongoing opioid epidemic, Enhanced Recovery After Surgery (ERAS) protocols have become more widely adopted (Wick et al., 2017). Many attributes of ERAS protocols promote faster patient recovery. Opioid sparing analgesia within ERAS protocols for bariatric surgery patients is the focus of this DNP project. Multimodal analgesia

combines non-opioid medications for the goal of synergistic pain control, minimizing the number of opioids needed and reducing opioid-related side effects (Joshi & Kehlet, 2019).

Multimodal analgesia protocols are used throughout many preoperative, intraoperative, and postoperative settings. Despite overwhelming evidence of the benefits of multimodal analgesia, opioids are still frequently administered in PACU (Joshi & Kehlet, 2019). Many studies have evaluated the effectiveness of multimodal analgesia in providing optimal pain control, reducing opioids postoperatively, and reducing the adverse side effects of opioid administration (Gridley et al., 2020; Hartford et al., 2020; Hoehn et al., 2019; Kayhan et al., 2018; Ma et al., 2020; Magrum et al., 2020; Scott et al., 2017; Soffin et al., 2019; Townsend et al., 2020; Uhlmann et al., 2019; Wick et al., 2017). Evidence based education for PACU nurses could play a role in reducing opioid administration for bariatric patients postoperatively.

Purpose

The purpose of this DNP project is to educate PACU nurses regarding the benefits of multimodal analgesia, the harmful impact opioids have on bariatric patients and to identify barriers to reduced opioid administration to bariatric patients in the PACU. The project goals are a) to assess PACU nurses' baseline knowledge of pain management through a pre-survey; b) to provide an educational in-service on pain management, opioids, and opioid alternatives for bariatric surgery patients; c) to conduct a post-educational survey to reassess pain knowledge and examine barriers with guidance to minimize opioid administration for bariatric surgery patients in the PACU.

Review of Current Evidence

The purpose of this review was to identify multimodal analgesics useful for pain relief and decreasing bariatric patients' opioid consumption postoperatively. A second goal is to

identify barriers to compliance to opioid minimization protocols for bariatric patients in the PACU. Databases used for the literature search were CINAHL, Scopus, PubMed, and Google Scholar. The key terms used were Enhanced Recovery, ERAS, Opioid sparing analgesia, multimodal analgesia, bariatrics, pain management, PACU, education, compliance, and barriers. The inclusion criteria were articles written in English within the past ten years, and primarily consisted of meta-analyses, research trials, or systematic reviews. Exclusion criteria were articles not relevant to post-op pain management.

Despite the availability of alternative medications for pain control, opioids continue to be first-line treatments in the Post Anesthesia Care Unit (Joshi & Kehlet, 2019; Sherman et al., 2020). Bariatric patients tend to have significant pain postoperatively (Kayhan et al., 2018). However, bariatric patients are at an increased risk of complications with opioid use, particularly respiratory compromise (Adis Medical Writers, 2020; Kayhan et al., 2018; Ma et al., 2020). This review discusses the effectiveness of ERAS protocols, multimodal analgesics, and barriers and enablers to opioid minimization compliance.

Effectiveness of ERAS Protocols and Multimodal Analgesics

According to recent research, opioid minimization protocols decrease opioid consumption postoperatively without affecting pain scores (Gridley et al., 2020; Helander et al., 2017; Hoehn et al., 2019; Ma et al., 2020; Magrum et al., 2020; Monte et al., 2021; Naqib et al., 2018; Persico et al., 2019; Scott et al., 2017; Sherman et al., 2020; Soffin et al., 2019; Townsend et al., 2020; Vu et al., 2020; Warren et al., 2017). In addition, multimodal analgesia provides superior pain relief by combining various analgesics acting on a variety of different receptors within the central nervous system (Song et al., 2014). Their actions work synergistically to provide optimal pain control, cutting down on opioid uses.

Many opioid reduction protocols use combinations of acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), and gabapentinoids (Abou Zeid et al., 2019; Gridley et al., 2020; Hoehn et al., 2019; Kayhan et al., 2018; Ma et al., 2020; Naqib et al., 2018; Scott et al., 2017; Soffin et al., 2019; Song et al., 2014; Townsend et al., 2020; Uhlmann et al., 2019; Vu et al., 2020; Warren et al., 2017). Whether used individually or in combination, these medications have been proven effective in reducing opioid consumption intraoperatively and postoperatively. According to the Colorectal ERAS Guidelines, these preoperative medications help to produce analgesia while minimizing opioid usage and the adverse side effects from opioids (Gustafsson et al., 2019). In a systematic review of ten articles on their pain management protocols, eight of them used combinations of acetaminophen, NSAIDs, and gabapentin (Uhlmann et al., 2019). Out of the eight studies, pain was either decreased or unchanged. One of the ten studies in the review showed increased pain scores despite using only opioids for analgesic control.

Acetaminophen is a recognized analgesic and antipyretic available by mouth (PO), intravenously (IV), and per rectum (PR). For bariatric surgery patients, IV acetaminophen (Ofirmev) has been shown to be a better option postoperatively due to decreased gastric motility and absorption (Song et al., 2014). In addition, one study reviewed found Ofirmev to be more effective than PO acetaminophen in the immediate postoperative period due to its more rapid onset of action (Politi et al., 2017).

NSAIDs are not only anti-inflammatory agents but are effective analgesics as well. They are shown to be effective at relieving pain, decreasing post-op opioid requirements, and decreasing PACU length of stay (Abou Zeid et al., 2019; Helander et al., 2017; Kayhan et al., 2018; Monte et al., 2021). Cox 2 selective inhibitors, such as Celecoxib, are often preferred in

bariatric surgery due to their decreased risk for bleeding and damage to gastric mucosa (Abou Zeid et al., 2019; Helander et al., 2017).

Ketorolac is an NSAID given IV, shown to be effective in pain relief not only at surgical closure but throughout the postoperative period on either a scheduled or as-needed basis (Gridley et al., 2020; Hariri et al., 2019; Hartford et al., 2020; Hoehn et al., 2019; Ma et al., 2020; Naqib et al., 2018; Persico et al., 2019; Soffin et al., 2019; Townsend et al., 2020; Warren et al., 2017). Continuing ketorolac as a scheduled medication postoperatively along with acetaminophen and gabapentin reduces pain postoperatively and decreases opioid consumption (Hariri et al., 2019; Hoehn et al., 2019; Ma et al., 2020; Naqib et al., 2018; Townsend et al., 2020; Warren et al., 2017). Like other NSAIDs, ketorolac has the potential to increase bleeding risk due to its inhibition of Cox-1. Although studies have shown ketorolac is not associated with an increase in bleeding, many surgeons still avoid its use due to the risk potential (Gobble et al., 2014; Hariri et al., 2019).

Other studies have used multimodal analgesics intraoperatively and postoperatively rather than preoperatively (Hartford et al., 2020; Helander et al., 2017; Kayhan et al., 2018; Persico et al., 2019; Sherman et al., 2020). These studies used ketamine, magnesium, lidocaine, dexmedetomidine, dexamethasone, tramadol and regional anesthetics.

Ketamine is an N-methyl-D-aspartate (NMDA) antagonist and is very useful in providing analgesia through the block of pain transmission at this receptor. (Helander et al., 2017; Wick et al., 2017). Glutamate binds to the NMDA receptor during tissue injury, leading to an upregulation of pro-inflammatory cytokines. These cytokines can lead to central sensitization, opioid-induced hyperalgesia, and opioid tolerance (Helander et al., 2017). Since ketamine is an antagonist at the NMDA receptor, it has been shown to decrease pain and opioid requirements

due to opioid-induced hyperalgesia as well as for opioid-tolerant patients (Helander et al., 2017). Ketamine, combined with magnesium, synergistically antagonizes NMDA receptors. Ketamine is useful in morbidly obese patients due to the preservation of pharyngeal reflexes.

Lidocaine, a local anesthetic, when administered systemically, can provide excellent pain relief (Wick et al., 2017). Sherman et al. (2020) administered lidocaine infusions to post-renal transplant patients. Postoperative opioid requirements were reduced by 36.5% through the first 72 hours. Systemic lidocaine has been shown to improve the quality of recovery in morbidly obese patients after bariatric surgery and decrease opioid requirements in PACU (De Oliveira et al., 2014). In additional studies, lidocaine infusions demonstrated evidence of reduced opioid consumption postoperatively (Scott et al., 2017; Sherman et al., 2020; Soffin et al., 2019; Townsend et al., 2020; Warren et al., 2017).

Dexmedetomidine is a highly selective alpha 2 agonist that has sedative and anxiolytic effects as well as analgesic properties (Helander et al., 2017; Monte et al., 2021). Infusions of dexmedetomidine have been proven to decrease opioid requirements. Dexmedetomidine, like ketamine, does not cause respiratory depression or depression of pharyngeal reflexes, making it a useful alternative to opioids in obese patients (Monte et al., 2021). Salama & Abdallah (2016) combined preoperative pregabalin with intraoperative dexmedetomidine infusions. This combination showed a significant decrease in pain scores, heart rate and blood pressure, as well as opioid consumption (Salama & Abdallah, 2016).

Dexamethasone is a glucocorticoid shown to decrease pain through its anti-inflammatory properties (Helander et al., 2017). Studies have shown dexamethasone to decrease opioid consumption and decrease PACU length of stay through its analgesic properties (Helander et al., 2017; Waldron et al., 2013)

Regional anesthesia, including the use of neuraxial anesthesia, as well as transverse abdominis plane (TAP), quadratus lumborum (QL), and erector spinae plane (ESP) blocks have shown promising results in decreasing opioid requirements postoperatively (Jones & Aldwinckle, 2020; Sherman et al., 2020). QL and ESP blocks have been shown to provide greater somatic and visceral analgesia than TAP blocks due to closer proximity to the paravertebral space (Jones & Aldwinckle, 2020). TAP blocks have been shown to provide pain relief and are considered superior to wound infiltration with local anesthetic. However, Exparel[®] injected at port sites in laparoscopic bariatric surgery was helpful as part of an ERAS protocol to decrease post-op opioid consumption (Ma et al., 2020). Sherman et al (2020) determined a TAP continuous catheter block used as an adjunct to PCA in post-renal transplant patients significantly reduced opioid consumption. Opioid use was decreased by 34.4% cumulatively over 72 hours postoperatively (Sherman et al., 2020). Additional studies included TAP blocks as part of their protocol to reduce postoperative opioid consumption (Persico et al., 2019; Scott et al., 2017; Townsend et al., 2020; Warren et al., 2017). TAP blocks in these studies were used in combination with other multimodal analgesics and not studied alone.

Tramadol is "a weak opioid agonist and a weak noradrenaline and serotonin reuptake inhibitor" (Vu et al., 2020). Tramadol is useful for pain control postoperatively, decreasing opioid consumption (Gridley et al., 2020; Hartford et al., 2020; Hoehn et al., 2019; Persico et al., 2019; Scott et al., 2017; Soffin et al., 2019; Vu et al., 2020). Vu et al. (2020) administered tramadol preoperatively along with acetaminophen and celecoxib in their multimodal protocol in head and neck surgery patients. Their study demonstrated a decrease in postoperative opioid requirements. Only preoperative adjuncts were used in a study by Vu et al. (2020). These results provide clear

evidence of multimodal adjuncts, when given preoperatively, are effective in decreasing postoperative opioid use.

Multimodal analgesics given as a supplement to opioids decrease opioid consumption postoperatively (Adis Medical Writers, 2020; Gridley et al., 2020; Hartford et al., 2020; Hoehn et al., 2019; Kayhan et al., 2018; Ma et al., 2020; Magrum et al., 2020; Naqib et al., 2018; Persico et al., 2019; Scott et al., 2017; Soffin et al., 2019; Townsend et al., 2020; Uhlmann et al., 2019; Vu et al., 2020; Warren et al., 2017). Numerous studies have shown the benefits of combining two or more drugs rather than evaluating their effects individually. Further research needs to be conducted to evaluate various multimodal combinations to determine the most effective ones.

Barriers and Enablers to Compliance of Multimodal Analgesia Protocols

Education for patients, families, health care providers, and staffs has effectively increased compliance with multimodal analgesia protocols. According to a recent study by Forster et al. (2020), high compliance with ERAS for video-assisted thoracic surgery (VATS) leads to better patient outcomes. Cessation of opioids on post-op day three had the lowest compliance in their ERAS protocol. Patients in this study had more post-op complications and increased length of hospital stays with continued opioid use. Increasing compliance with the cessation of opioids on postoperative day three would contribute to improved patient outcomes. Recent studies by Naqib et al. (2018) and Persico et al. (2019) strongly suggest educational programs for PACU nurses can lead to increased compliance rates. PACU nurses stated the educational programs were helpful and made them more comfortable managing their patient's pain. Adherence to ERAS protocols by the nursing staff is vital to the protocols success, and education plays a significant

role in the sustainability of the programs (Gramlich et al., 2020; Gustafsson et al., 2019; Montgomery & McNamara, 2016; Naqib et al., 2018; Persico et al., 2019).

Postoperative compliance scores within ERAS programs are lower than preoperative and intraoperative scores (Joshi & Kehlet, 2019; Montgomery & McNamara, 2016). Joshi & Kehlet (2019) evaluated procedure-specific postoperative pain management guidelines (PROSPECT), and their evidence suggests specific guidelines tailored to individual procedures improve overall ERAS compliance. Montgomery & McNamara (2016) determined nursing plays a role in shifting away from traditional pain management towards multimodal analgesics.

A recent study on the influence of compliance with ERAS on nursing workload determined workload decreased when ERAS compliance increased (Hübner et al., 2015). This finding is isolated to a single study and suggests the need for further research. Excessive nursing workload is believed to be a barrier to the acceptance of new tasks and protocols. Additional evidence demonstrating a decrease in nursing workload with high compliance with ERAS protocols, could be an incentive to comply with ERAS protocols. A qualitative study by Gramlich et al. (2020) identified barriers to ERAS implementation and factors to support the adoption and sustainability of ERAS programs across healthcare systems. They found supportive environments with leadership roles and education for healthcare staff and patients were essential in establishing ERAS (Gramlich et al., 2020). Compliance increased as long as there were clear expectations and support from leadership (Gramlich et al., 2020). Further research to identify compliance barriers could increase ERAS protocols' adherence.

Summary of Evidence

Many studies have shown the effectiveness of multimodal analgesics in decreasing pain, although the agents which are most effective have yet to be determined. There is a lack of

compliance with multimodal pain management protocols in the postoperative period. Educational in-services for nursing staff and leadership support have proven effective in increasing compliance scores and decreasing nursing workload. Positive feedback from nursing staff after education shows promise for the sustainability of ERAS protocols. Further research on the benefits for nursing staff on ERAS compliance is needed to support the sustainability of these programs.

Conceptual Framework/Theoretical Model

The theoretical framework guiding this DNP project is Kurt Lewin's theory of change. Lewin's change theory involves a three-step model: unfreezing, moving, refreezing (Burnes, 2004). In the unfreezing stage, the norm needs to be disrupted to eliminate old behaviors and adopt new behaviors (Burnes, 2004). For this DNP project, old pain management behaviors will be disrupted by educating PACU nurses on the harmful effects opioids have on bariatric patients. Providing evidence-based research on multimodal analgesia's effectiveness in decreasing pain and minimizing nursing workload will motivate change. Once pain management knowledge improves among the nurses, the next step in the change theory model can occur. In the moving stage, new behavior can begin with reinforcement along the way (Burnes, 2004). PACU nurses' new knowledge from the educational intervention will lead to new practices in managing bariatric surgery patients' pain. Overall opioid administration should decrease as a result of education. The third step, refreezing, seeks to maintain the newfound behaviors (Burnes, 2004). Lewin found successful change among groups rather than individuals, described in his developed concept, Group Dynamics (Burnes, 2004). The change will not be sustainable unless the entire group is involved in the new behaviors (Burnes, 2004). Educating all PACU nurses instead of

one individual on opioid alternatives and the importance of decreasing opioids in the bariatric patient population will promote sustainable change.

Methods

The literature review determined there is a lack of compliance with opioid reduction in the postoperative period and education is beneficial in improving protocol compliance. The purpose of this DNP project is to educate PACU nurses regarding the benefits of multimodal analgesia, the harmful impact opioids have on bariatric patients and to identify barriers to reduced opioid administration to bariatric patients in the PACU.

Design

The quality improvement project included pre-and post-surveys examining PACU nurses' knowledge of pain management and alternatives to opioids. Barriers to ERAS compliance were assessed by adding open-ended questions to the original survey. Historical ERAS data was used for reference and included in education for PACU nurses. An educational in-service was presented to PACU nurses on pain management, opioid's harmful effects in bariatric patients, and multimodal analgesic alternatives. The Director of Quality, Practice, and Research at the project site provided permission for this project.

Translational Framework

The EBP framework guiding this DNP project is the Iowa model. This model identifies opportunities for change, forms a team, conducts research, and puts into practice a change plan based on evidence (*The Iowa Model Revised*, 2016). It then evaluates those results to determine whether they are worthy of sustainability in practice (*The Iowa Model Revised*, 2016). The Iowa model guides healthcare professionals to use their evidence-based research to improve patient care (Titler et al., 2001). For this project, the Iowa model will guide the project to improve

PACU nurses' knowledge on multimodal analgesics for bariatric surgery patients. The project team consists of the project leader, PACU nurses, PACU nurse manager, ERAS coordinator, and the Director of Practice, Quality, and Research. Research on multimodal analgesia benefits will guide the PACU nurses on implementing new pain management strategies into practice for bariatric patients.

Population

The population for this project consists of PACU nurses with experience caring for bariatric surgery patients. Exclusion criteria are PACU nurses with no experience caring for post-op bariatric surgery patients. Convenience sampling was used to gather volunteer nurse participants working in PACU, specifically the section taking care of bariatric patients. Flyers were placed in the post-op unit to recruit participants for the education sessions. Thirty-four nurses were employed on this unit at the time of the DNP project, and a recruitment email was sent to the staff listserv. The educational session was provided via Web-ex at the PACU nurse staff meeting, and 24 nurses were in attendance. There were 17 responses for the pre-survey and nine responses for the post-survey.

Setting

The project took place in the PACU of a 439-bed private, not-for-profit hospital in North Carolina. The facility provides a variety of surgical services ranging from cardiothoracic to pediatrics to weight loss surgery. The bariatric surgery patient population in the PACU is the focus of this project. This hospital has four surgeons specializing in bariatric surgery, performing many surgeries each week, making this a large PACU patient population.

Project Implementation

An educational in-service addressing the adverse effects of opioids for bariatric patients and non-opioid alternatives was provided to PACU RNs at the PACU nursing staff meeting via Web-ex. The DNP project leader provided the education using PowerPoint and time was allotted for questions at the end of the session. Multimodal analgesics discussed included NSAIDs, Acetaminophen, Ketamine, Dexmedetomidine, Lidocaine, Magnesium, Gabapentinoids, and Dexamethasone, as well as TAP, QL, and ESP blocks. Non-pharmacologic alternatives discussed included music, distraction, aromatherapy, heating pads, and ambulation. The session lasted approximately 30-45 minutes.

Actions taken and support/resources

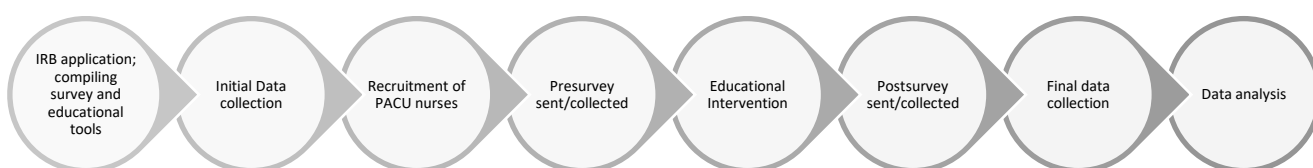
Historical ERAS data provided by the ERAS coordinator was used to supplement the educational experience and provide actual compliance numbers. The PACU nurse manager provided support for the project by determining what educational needs her staff would benefit from.

Instruments

The Clinical Pain Knowledge Test, a survey developed by Dr. Bernhofer, was used for this project. This survey's reliability and validity have already been established (Bernhofer et al., 2017). Content validity indicated 95.1% agreement for relevance and 98.2% agreement for importance. A split-half reliability score of 0.66 indicated moderate reliability. Decision consistency reliability showed high reliability with a mean score of 73% and a cut-score set at 75%. The Clinical Pain Knowledge Test for nurses consists of 23 items assessing nurses' knowledge on pain management to determine education gaps and reevaluate knowledge post-education (Bernhofer et al., 2017). Questions are multiple-choice with one correct answer. This

survey was adapted slightly for relevance. The survey was transferred into UNCG Qualtrics to be sent to PACU RNs anonymously (Appendix A).

Timeline and critical milestones



IRB approval

All information obtained in this study is strictly confidential unless disclosure is required by law. Surveys remained anonymous through UNCG Qualtrics, with no identifying information asked. The survey information was entered into StataSE and SPSS statistical packages with no identifiers and was stored on the PI's password-protected and firewalled personal laptop which is under her control at all times. The PI managed electronic data files within the cloud and did not sync to a hard drive. In addition, the PI did not use the drive in any unsecured areas, such as coffee shops, where data could be viewed by unauthorized personnel. Data analysis was conducted on the student's personal password protected and firewalled computer or secure computers on the UNCG campus depending on where the student and faculty were working on the analysis and interpretation. All electronic files for the study will be deleted after 5 years using an Eraser program. Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access.

Steps implemented

Stakeholders include PACU nurses, PACU nurse manager, ERAS coordinator, and the Director of Practice, Quality, and Research. First, IRB approval was obtained before going

forward with the project intervention. Meetings with the PACU nurse manager and ERAS coordinator established a plan for what would be discussed during the educational session and when it would take place. Implementation of education took place via Web-ex.

Data collection

Historical data on ERAS compliance were collected from the ERAS coordinator before the intervention. Patient identifiers were removed prior to the data being collected from the ERAS coordinator. Collected data included multimodal analgesics and opioids given to patients pre-op, intra-op, and post-op. Data also included regional blocks given. This data was used for reference and provided examples during the nursing educational in-service. Data collected was stored on a secure computer with password protection.

Surveys were sent out one week before the educational in-service to all eligible PACU RNs through an anonymous link. The presurvey assessed pain knowledge preceding the educational experience. One week after the educational session, follow-up surveys were sent to all eligible PACU RNs through the anonymous link. The follow-up survey reassessed post-intervention knowledge and included two open-ended questions to identify barriers to reduced opioid compliance. Surveys were archived anonymously through UNCG Qualtrics to maintain the privacy of participants. Informed consent was assumed as participation is voluntary.

Data Analysis

Surveys sent to PACU RNs were compared pre-and post-education to determine whether pain management knowledge increased. In addition, the open-ended questions in the post-survey were analyzed to identify continuing barriers to reducing opioid administration in bariatric patients. These qualitative results will help establish future areas of research and education in this setting. SPSS and StataSE statistical packages and a faculty statistician helped guide the

quantitative data analysis. Due to the small sample size, Fisher's exact test was used to analyze associations between individual questions in the pre- and post-education surveys. A p-value of <0.05 was considered significant.

Results

Twenty-four PACU nurses participated in the education session. Seventeen participants responded to the presurvey, and nine responded to the post-survey. No demographic data was collected. Fisher's exact test was used on five individual survey questions to determine any significant increase in pain knowledge between the pre-and post-education survey. A summary of the results is described below, and details can be viewed in Table 1. Percentage of correct answers in pre-survey vs. post-survey was also collected to show comparison.

Question 1 in the survey asked what is a consistently reliable objective indicator of high-intensity pain? The correct answer was that there is no consistently reliable objective indicator of pain intensity. In the presurvey, there were seven correct answers and ten incorrect answers. In the post-survey, there were five correct answers and four incorrect answers. Fisher's exact test determined a p-value of 0.68, which was not considered significant. Question 1 had 41.2% correct answers in the pre-survey and improved to 55.5% correct answers in the post-survey.

Question 2 asked what is an example of multimodal analgesia? The correct answer was non-steroidal anti-inflammatory agents (NSAIDs) and oxycodone used together. In the pre-survey, there were 12 correct answers and five incorrect answers. In the post-survey, there were eight correct answers and one incorrect answer. Fisher's exact test determined a p-value of 0.38, which was not considered significant. Question 2 had 70.66% correct answers in the pre-survey and improved to 88.9% correct answers in the post-survey.

Question 4 asked deciding how much analgesic medication a patient needs is based on what? The correct answer was the individual patient's subjective response to analgesic dosing. There were 11 correct answers and six incorrect answers in the pre-survey, and in the post-survey, there were seven correct answers and two incorrect answers. Fisher's exact test determined the p-value to be 0.667, which was not considered significant. Question 4 had 64.7% correct answers in the presurvey and improved to 77.8% correct answers in the post-survey.

Question 15 asked: A patient is admitted and placed on a very high dose and frequency schedule of IV hydromorphone for pain related to a medical disorder. The patient calls the nurse frequently to report that she is still in terrible pain and needs more medication or something different. The nurse investigates and finds that the patients has been readmitted several times for the same condition and remains on high doses of opioids with little reported relief. The risk for substance misuse is unknown. The patient is most likely experiencing what? The correct answer was opioid-induced hyperalgesia. In the pre-survey, there were six correct answers and 11 incorrect answers. In the post-survey, there were four correct answers and five incorrect answers. Fisher's exact test determined the p-value to be 0.692, which was not considered significant. Question 15 had 35.3% correct answers in the presurvey and improved to 44.4% correct answers in the post-survey.

Question 17 asked which one of the following therapies, shown to be most effective, could the clinical nurse use to calm the anxious patient with acute pain? The correct answer was music. In the pre-survey, there were three correct answers and 14 incorrect answers. In the post-survey, there were four correct answers and five incorrect answers. Fisher's exact test determined the p-value to be 0.188, which was not considered significant. Question 17 had 17.6% correct answers in the presurvey and improved to 44.4% correct answers in the post-survey.

Questions 11 and 12 had all correct answers in pre-and post-survey, indicating good knowledge of these topics. Question 11 stated unresolved pain results in the body's stress response and the release of stress hormone and asked which one of the following conditions may occur when pain is relieved? The correct answer was increased myocardial consumption. Question 12 asked which statement best describes the development of opioid tolerance in a patient? The correct answer was the patient requires increasingly larger doses of opioids to control the pain.

Table 1

Q1	choice		Total
	correct	incorrect	
pre	7	10	17
	7.8	9.2	17.0
post	5	4	9
	4.2	4.8	9.0
Total	12	14	26
	12.0	14.0	26.0

Pearson chi2(1) = 0.4896 Pr = 0.484
 Fisher's exact = 0.683
 1-sided Fisher's exact = 0.387

Q2	choice		Total
	correct	incorrect	
pre	12	5	17
	13.1	3.9	17.0
post	8	1	9
	6.9	2.1	9.0
Total	20	6	26
	20.0	6.0	26.0

Pearson chi2(1) = 1.1102 Pr = 0.292
 Fisher's exact = 0.380
 1-sided Fisher's exact = 0.296

Q4	choice		Total
	correct	incorrect	
pre	11	6	17
	11.8	5.2	17.0
post	7	2	9
	6.2	2.8	9.0
Total	18	8	26
	18.0	8.0	26.0

Pearson chi2(1) = 0.4720 Pr = 0.492
 Fisher's exact = 0.667
 1-sided Fisher's exact = 0.413

Q15	choice		Total
	correct	incorrect	
pre	6	11	17
	6.5	10.5	17.0
post	4	5	9
	3.5	5.5	9.0
Total	10	16	26
	10.0	16.0	26.0

Pearson chi2(1) = 0.2082 Pr = 0.648
 Fisher's exact = 0.692
 1-sided Fisher's exact = 0.483

Q17	choice		Total
	correct	incorrect	
pre	3	14	17
	4.6	12.4	17.0
post	4	5	9
	2.4	6.6	9.0
Total	7	19	26
	7.0	19.0	26.0

Pearson chi2(1) = 2.1478 Pr = 0.143
 Fisher's exact = 0.188
 1-sided Fisher's exact = 0.159

In addition to the quantitative data described above, qualitative data was gathered from the post-survey. A thematic content analysis was performed, identifying themes within the

responses to determine what barriers existed for the PACU nurses to reduce opioids administered to bariatric surgery patients, and requested suggestions to improve practice. Five nurses responded to the open-ended questions in the post-surveys. PACU nurses identified barriers to reducing opioids administration including pre-op meds not being given or ordered and a lack of education for patients on pain management expectations. To quote a response, "realistic expectations beforehand always help with the recovery." In addition, there were recommendations for post-op order-sets to include alternatives such as Tylenol® or Toradol® in order to limit opioids postoperatively. Another barrier mentioned by one PACU nurse was related to difficulty ambulating patients postoperatively. The nurse indicated that ambulation is essential for recovery and helps with gas pain.

Barriers to success and strengths to overcome barriers

During the implementation of this project, the educational material was presented during a required staff meeting for the PACU nurses, enabling a respectable number of participants to attend. Unfortunately, with the COVID-19 pandemic, the meeting was held virtually via Web-ex. Using Web-ex, many of the nurses attended the meeting using their telephones and could not see the PowerPoint until after the presentation. As a result, there was a lack of engagement from these participants. This likely led to decreased responses on the post-education survey and contributed to the lack of statistical significance in the data collected. Only five nurses responded to the open-ended questions in the post-survey, making it difficult to identify themes within the responses. In the future, an in-person presentation would optimize participant engagement. In addition, giving the follow-up survey on paper after the presentation would increase the number of responses.

Finally, the survey data collected pre- and post-education was not matched to each respondent. In the future, connecting each participant's pre- and post-education data will allow a paired t-test to be conducted, showing each individual's knowledge improvement.

Discussion

Despite many analgesics available, opioids continue to be first-line treatments for pain control in PACU (Joshi & Kehlet, 2019). Bariatric patients experience significant pain postoperatively but are at increased risk for complications with opioid use (Adis Medical Writers, 2020; Hoehn et al., 2019; Kayhan et al., 2018). Studies of alternative analgesics have demonstrated their benefit in post-operative pain control in this patient population. This project provided education to PACU nurses to emphasize the benefits of multimodal analgesics and the harmful effects of opioids, seeking to improve their knowledge of pain control for bariatric patients. The follow-up survey intended to identify barriers to reducing opioid administration in the PACU through qualitative data collection.

This DNP project's data analysis did not show a statistical significance for increasing knowledge between pre-and post-educational surveys. The lack of statistical significance is likely attributed to the small sample size. With only nine post-survey responses and 17 presurvey responses, an increase in knowledge is difficult to demonstrate statistically. Although improvement in knowledge was not considered statistically significant, the percentage of correct answers did improve from pre- to post-survey in all questions analyzed. This encouraging finding supports the need for further education for PACU nurses to improve pain knowledge and the use of multimodal analgesics for bariatric surgery patients. Previous research has shown that education improves compliance with opioid minimization protocols (Naqib et al., 2018; Persico et al., 2019). In these two studies, PACU nurses provided feedback on the education provided,

indicating the programs improved their knowledge and confidence in addressing their patient's pain. For this DNP Project, the PACU nurses attending the education session gave positive feedback and stated it helped broaden their knowledge of opioid alternatives. With Kurt Lewin's theory of change guiding this project, the initial education and reinforcement of knowledge through the unfreezing and moving stage will help sustain the practice in the future and move into the refreezing stage. Previous studies have shown the importance of nursing education and its role in sustaining new practice changes (Gramlich et al., 2020; Gustafsson et al., 2019; Montgomery & McNamara, 2016; Naqib et al., 2018; Persico et al., 2019). Improving nurses' knowledge on pain management improves patient care postoperatively (Montgomery & McNamara, 2016).

The qualitative data collected identified barriers to opioid use reduction and provided suggestions for improvement in these practices. As anticipated, some responses identified the lack of consistency with pre-op and post-op pain medications given. The historical ERAS data provided the nurses' real compliance numbers over three months to verify the lack of consistency. For example, Toradol[®] is part of the bariatric surgery ERAS protocol to be given postoperatively for pain control but was only given 529 out of 594 times. Four patients out of this group were given Celebrex[®] preoperatively, preventing Toradol[®] administration post-op. This makes it difficult for nurses to provide consistent care to these patients in PACU because not all patients are prescribed the same medications.

Lack of patient education regarding pain expectations was a barrier identified in the post-survey that was unanticipated. For bariatric surgery, patients go through extensive preoperative preparation to make sure they understand what to expect from the surgery and to ensure they are

appropriate surgical candidates (Benotti, 2014). Nursing responses suggest pain management should be part of their preparation. This is an area that can be focused on in future studies.

Conclusion

Barriers and suggestions identified in the qualitative data provide a basis for developing future quality improvement projects. PACU nurses identified the lack of pain management patient education to be a significant barrier to reducing post-operative opioid administration. Future projects could provide preoperative pain management patient education and evaluate opioid consumption changes after education. As discussed by Montgomery & McNamara (2016), nurses are responsible for providing patient pain management education throughout the perioperative period. This is an opportunity to address this barrier to reduce opioid administration.

An additional barrier identified was the absence of alternatives to opioid medications ordered pre- and postoperatively. This finding suggests a need to analyze current medication orders and to provide further education regarding the importance of alternative pain medications in the bariatric population. Due to a lack of qualitative data responses, identifying themes within the responses was difficult. With the barriers identified, however, the Iowa model can guide the development of future change opportunities. In a previous study by Gramlich et al. (2020), barriers to compliance included the lack of consistency with protocol implementation and the difficulty of adapting to multiple changes at once. When only some patients were considered part of the ERAS pathways, it was difficult for the pathways to become best practices (Gramlich et al., 2020). This barrier is consistent with the DNP project's identified barrier of lack of consistency in opioid alternative medication orders.

Relevance and Recommendations for Practice

Research has shown the bariatric surgery patient population performs significantly better postoperatively when opioid administration is limited. Despite ERAS protocols and multimodal analgesics, opioids continue to be given to bariatric patients in the PACU. In this DNP project, the lack of statistical significance in knowledge improvement does not suggest the educational experience was not valuable. Instead, it shows the need for continued education to further improve knowledge. To sustain practice change, continued education, emphasizing the harmful effects of opioids and the benefits of limiting postoperative opioids, is needed. The PACU nurses taking care of bariatric patients should be exposed to regular educational sessions to improve their understanding of pain management while minimizing opioid administration.

The lack of consistency of ERAS protocols among patients was listed as a barrier not only in this DNP project but also in previous studies. Therefore, the pre-op and post-op multimodal analgesics for bariatric patients should be verified for each patient to ensure consistency.

Project results will be disseminated through poster presentation to the DNP faculty and classmates, as well as back to the stakeholders at the facility, including the PACU nurses, ERAS coordinator, PACU nurse manager, and director of practice, quality, and research.

References

- Abou Zeid, H., Kallab, R., Najm, M. A., Jabbour, H., Noun, R., Sleilati, F., Chucri, S., Dagher, C., Sleilaty, G., & Naccache, N. (2019). Safety and efficacy of non-steroidal anti-inflammatory drugs (NSAIDs) used for analgesia after bariatric surgery: A retrospective case-control study. *Obesity Surgery*, *29*(3), 911–916. <https://doi.org/10.1007/s11695-018-3608-y>
- Adis Medical Writers. (2020). Manage perioperative pain in morbidly obese patients by taking an all-round multimodal approach. *Drugs & Therapy Perspectives*, *36*(4), 139–145. <https://doi.org/10.1007/s40267-020-00705-1>
- Benotti, P. N. (2014). *Patient Preparation for Bariatric Surgery*. Springer New York. <https://doi.org/10.1007/978-1-4939-0906-3>
- Bernhofer, E. I., St. Marie, B., & Bena, J. F. (2017). A new clinical pain knowledge test for nurses: Development and psychometric evaluation. *Pain Management Nursing : Official Journal of the American Society of Pain Management Nurses*, *18*(4), 224–233. <https://doi.org/10.1016/j.pmn.2017.04.009>
- Burnes, B. (2004). Kurt Lewin and the planned approach to change: A re-appraisal. *Journal of Management Studies*, *41*(6), 977–1002. <https://doi.org/10.1111/j.1467-6486.2004.00463.x>
- Centers for Disease Control and Prevention. (2020, March 19). *Opioid Overdose Overview*. Centers for Disease Control and Prevention. <https://www.cdc.gov/drugoverdose/data/prescribing/overview.html>
- De Oliveira, G. S., Duncan, K., Fitzgerald, P., Nader, A., Gould, R. W., & McCarthy, R. J. (2014). Systemic lidocaine to improve quality of recovery after laparoscopic bariatric

- surgery: A randomized double-blinded placebo-controlled trial. *Obesity Surgery*, 24(2), 212–218. <https://doi.org/10.1007/s11695-013-1077-x>
- Flood, P., Rathmell, J. P., & Shaffer, S. S. (2015). *Stoelting's Pharmacology and Physiology in Anesthetic Practice* (5th ed.). Wolters Kluwer.
- Gobble, R. M., Hoang, H. L. T., Kachniarz, B., & Orgill, D. P. (2014). Ketorolac does not increase perioperative bleeding: A meta-analysis of randomized controlled trials. *Plastic and Reconstructive Surgery*, 133(3), 741–755. <https://doi.org/10.1097/01.prs.0000438459.60474.b5>
- Gramlich, L., Nelson, G., Nelson, A., Lagendyk, L., Gilmour, L. E., & Wasylak, T. (2020). Moving enhanced recovery after surgery from implementation to sustainability across a health system: A qualitative assessment of leadership perspectives. *BMC Health Services Research*, 20. <https://doi.org/10.1186/s12913-020-05227-0>
- Gridley, C., Robles, J., Calvert, J., Kavoussi, N., Winkler, T., Jayaram, J., Fosnot, M., Liberman, J., Allen, B., McEvoy, M., Herrell, D., Hsi, R., & Miller, N. L. (2020). Enhanced recovery after surgery protocol for patients undergoing ureteroscopy: Prospective Evaluation of an Opioid-Free Protocol. *Journal of Endourology*, 34(6), 647–653. <https://doi.org/10.1089/end.2019.0552>
- Gustafsson, U. O., Scott, M. J., Hubner, M., Nygren, J., Demartines, N., Francis, N., Rockall, T. A., Young-Fadok, T. M., Hill, A. G., Soop, M., de Boer, H. D., Urman, R. D., Chang, G. J., Fichera, A., Kessler, H., Grass, F., Whang, E. E., Fawcett, W. J., Carli, F., ... Ljungqvist, O. (2019). Guidelines for perioperative care in elective colorectal surgery: Enhanced recovery after surgery (ERAS®) society recommendations: 2018. *World Journal of Surgery*, 43(3), 659–695. <https://doi.org/10.1007/s00268-018-4844-y>

- Hariri, K., Hechenbleikner, E., Dong, M., Kini, S. U., Fernandez-Ranvier, G., & Herron, D. M. (2019). Ketorolac use shortens hospital length of stay after bariatric surgery: A single-center 5-year experience. *Obesity Surgery, 29*(8), 2360–2366.
<https://doi.org/10.1007/s11695-018-03636-z>
- Hartford, L. B., Murphy, P. B., Gray, D. K., Maciver, A., Clarke, C. F. M., Allen, L. J., Garcia-Ochoa, C., Leslie, K. A., & Van Koughnett, J. A. M. (2020). The Standardization of Outpatient Procedure (STOP) Narcotics after anorectal surgery: A prospective non-inferiority study to reduce opioid use. *Techniques in Coloproctology, 24*(6), 563–571. Scopus. <https://doi.org/10.1007/s10151-020-02190-0>
- Helander, E. M., Menard, B. L., Harmon, C. M., Homra, B. K., Allain, A. V., Bordelon, G. J., Wyche, M. Q., Padnos, I. W., Lavrova, A., & Kaye, A. D. (2017). Multimodal analgesia, current concepts, and acute pain considerations. *Current Pain and Headache Reports, 21*(1), 3. <https://doi.org/10.1007/s11916-017-0607-y>
- Hoehn, R. S., Seitz, A. P., Singer, K. E., Thompson, J. R., & Watkins, B. M. (2019). Enhanced recovery protocol for laparoscopic sleeve gastrectomy: Are narcotics necessary? *Journal of Gastrointestinal Surgery, 23*(8), 1541–1546. <http://dx.doi.org/10.1007/s11605-018-04091-y>
- Jones, J. H., & Aldwinckle, R. (2020). Interfascial plane blocks and laparoscopic abdominal surgery: A narrative review. *Local and Regional Anesthesia, 13*, 159–169.
<https://doi.org/10.2147/LRA.S272694>
- Joshi, G. P., & Kehlet, H. (2019). Postoperative pain management in the era of ERAS: An overview. *Best Practice & Research Clinical Anaesthesiology, 33*(3), 259–267.
<https://doi.org/10.1016/j.bpa.2019.07.016>

- Kayhan, G. E., Sanli, M., Ozgul, U., Kirteke, R., & Yologlu, S. (2018). Comparison of intravenous ibuprofen and acetaminophen for postoperative multimodal pain management in bariatric surgery: A randomized controlled trial. *Journal of Clinical Anesthesia*, *50*, 5–11. <http://dx.doi.org/10.1016/j.jclinane.2018.06.030>
- Ma, P., Lloyd, A., McGrath, M., Moore, R., Jackson, A., Boone, K., & Higa, K. (2020). Reduction of opioid use after implementation of enhanced recovery after bariatric surgery (ERABS). *Surgical Endoscopy*, *34*(5), 2184–2190. <https://doi.org/10.1007/s00464-019-07006-3>
- Magrum, B., Brower, K., Eiferman, D., Horwood, C., Nguyen, M., Buehl, A., McLaughlin, E., & Mostafavifar, L. (2020). Combating the opioid epidemic in acute general surgery: Reframing inpatient acute pain management. *Journal of Surgical Research*, *251*, 6–15. <https://doi.org/10.1016/j.jss.2019.12.050>
- Monte, S. V., Rafi, E., Cantie, S., Wohaibi, E., Sanders, C., & Scovazzo, N. C. (2021). Reduction in opiate use, pain, nausea, and length of stay after implementation of a bariatric enhanced recovery after surgery protocol. *Obesity Surgery*, *31*(7), 2896–2905. <https://doi.org/10.1007/s11695-021-05338-5>
- Montgomery, R., & McNamara, S. A. (2016). Multimodal pain management for enhanced recovery: Reinforcing the shift from traditional pathways through nurse-led interventions. *AORN Journal: The Official Voice of Perioperative Nursing*, *104*(6), S9–S16. <http://dx.doi.org/10.1016/j.aorn.2016.10.012>
- Naqib, D., Purvin, M., Prasad, R., Hanna, I. M., Dimitri, S., Llufrío, A., & Hanna, M. N. (2018). Quality improvement initiative to improve postoperative pain with a clinical pathway and

- nursing education program. *Pain Management Nursing*, 19(5), 447–455.
<https://doi.org/10.1016/j.pmn.2018.06.005>
- Persico, M., Miller, D., Way, C., Williamson, M., O'Keefe, K., Strnatko, D., & Wright, F. (2019). Implementation of enhanced recovery after surgery in a community hospital: An evidence-based approach. *Journal of PeriAnesthesia Nursing*, 34(1), 188–197.
<https://doi.org/10.1016/j.jopan.2018.02.005>
- Politi, J. R., Davis, R. L., & Matrkka, A. K. (2017). Randomized prospective trial comparing the use of intravenous versus oral acetaminophen in total joint arthroplasty. *The Journal of Arthroplasty*, 32(4), 1125–1127. <https://doi.org/10.1016/j.arth.2016.10.018>
- Salama, A. K., & Abdallah, N. M. (2016). Multimodal analgesia with pregabalin and dexmedetomidine in morbidly obese patients undergoing laparoscopic sleeve gastrectomy: A prospective randomized double blind placebo controlled study. *Egyptian Journal of Anaesthesia*, 32(3), 293–298. <https://doi.org/10.1016/j.egja.2016.04.008>
- Scott, M. J., McEvoy, M. D., Gordon, D. B., Grant, S. A., Thacker, J. K. M., Wu, C. L., Gan, T. J., Mythen, M. G., Shaw, A. D., Miller, T. E., Scott, M., McEvoy, M., Gordon, D., Grant, S., Thacker, J., Wu, C., Gan, T., Mythen, M., Shaw, A., ... For the Perioperative Quality Initiative (POQI) I Workgroup. (2017). American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on optimal analgesia within an enhanced recovery pathway for colorectal surgery: Part 2—From PACU to the transition home. *Perioperative Medicine*, 6(1), 7.
<https://doi.org/10.1186/s13741-017-0063-6>
- Sherman, M., Ho, G., Chu, E., Benjenk, I., Gumbert, S., Lin, C., Amdur, R., Podolnick, J., Slocum, J., & Heinz, E. (2020). Reducing opioid consumption in postoperative renal

- transplant patients: A retrospective analysis. *Indian Journal of Transplantation*, 14(3), 235. https://doi.org/10.4103/ijot.ijot_44_20
- Soffin, E. M., Wetmore, D. S., Beckman, J. D., Sheha, E. D., Vaishnav, A. S., Albert, T. J., Gang, C. H., & Qureshi, S. A. (2019). Opioid-free anesthesia within an enhanced recovery after surgery pathway for minimally invasive lumbar spine surgery: A retrospective matched cohort study. *Neurosurgical Focus*, 46(4), E8. <https://doi.org/10.3171/2019.1.FOCUS18645>
- Song, K., Melroy, M. J., & Whipple, O. C. (2014). Optimizing multimodal analgesia with intravenous acetaminophen and opioids in postoperative bariatric patients. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 34(S1), 14S-21S. <https://doi.org/10.1002/phar.1517>
- The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* (2016, July 2). University of Iowa Hospitals & Clinics. <https://uihc.org/iowa-model-revised-evidence-based-practice-promote-excellence-health-care>
- Titler, M. G., Kleiber, C., Steelman, V. J., Rakel, B. A., Budreau, G., Everett, L. Q., Buckwalter, K. C., Tripp-Reimer, T., & Goode, C. J. (2001). The Iowa Model of evidence-based practice to promote quality care. *Critical Care Nursing Clinics of North America*, 13(4), 497–509. [https://doi.org/10.1016/S0899-5885\(18\)30017-0](https://doi.org/10.1016/S0899-5885(18)30017-0)
- Townsend, W. B., Worrilow, W. M., Robinson, M. M., Beano, H., Parker, B., Gaston, K. E., Clark, P. E., & Riggs, S. B. (2020). Implementation of a dedicated enhanced recovery after surgery (ERAS) program for radical cystectomy patients is associated with decreased postoperative inpatient opioid usage and pain scores. *Urology*, 143, 186–193. <https://doi.org/10.1016/j.urology.2020.04.110>

- Uhlmann, R. A., Reinhart, H. A., Postevka, E., Snyder, S. K., & Romero Arenas, M. (2019). A Review of postoperative pain management for thyroid and parathyroid surgery. *Journal of Surgical Research*, *241*, 107–111. <https://doi.org/10.1016/j.jss.2019.03.050>
- Vu, C. N., Lewis, C. M., Bailard, N. S., Kapoor, R., Rubin, M. L., & Zheng, G. (2020). Association between multimodal analgesia administration and perioperative opioid requirements in patients undergoing head and neck surgery with free flap reconstruction. *JAMA Otolaryngology–Head & Neck Surgery*, *146*(8), 708. <https://doi.org/10.1001/jamaoto.2020.1170>
- Waldron, N. H., Jones, C. A., Gan, T. J., Allen, T. K., & Habib, A. S. (2013). Impact of perioperative dexamethasone on postoperative analgesia and side-effects: Systematic review and meta-analysis. *British Journal of Anaesthesia*, *110*(2), 191–200. <https://doi.org/10.1093/bja/aes431>
- Warren, J. A., Stoddard, C., Hunter, A. L., Horton, A. J., Atwood, C., Ewing, J. A., Pusker, S., Cancellaro, V. A., Walker, K. B., Cobb, W. S., Carbonell, A. M., & Morgan, R. R. (2017). Effect of multimodal analgesia on opioid use after open ventral hernia repair. *Journal of Gastrointestinal Surgery*, *21*(10), 1692–1699. <http://dx.doi.org/10.1007/s11605-017-3529-4>
- Wick, E. C., Grant, M. C., & Wu, C. L. (2017). Postoperative multimodal analgesia pain management with nonopioid analgesics and techniques: A review. *JAMA Surgery*, *152*(7), 691. <https://doi.org/10.1001/jamasurg.2017.0898>

Appendix A: Instrument

Appendix

Clinical Pain Knowledge Test (CPKT)

- 1. A consistently reliable objective indicator of high intensity pain is:**
- an increase in vital signs such as heart rate, respirations, and blood pressure
 - distressed facial grimaces
 - requests for more pain medication
 - there is no consistently reliable objective indicator of pain intensity ^
- 2. An example of multimodal analgesia is:**
- IV morphine in Patient Controlled Analgesia (PCA) pump with oxycodone for breakthrough pain
 - IV morphine PCA with basal rate and bolus doses as administered by the patient
 - non-steroidal anti-inflammatory agents (NSAIDS) and oxycodone used together^
 - ibuprofen and naproxen administered together
- 3. Which one of the following statements is true?**
- Opioids should not be used for acute pain relief in patients with a history of substance abuse.
 - NSAIDS are effective analgesics for painful bone metastases for most patients. ^
 - Tramadol is indicated for severe pain.
 - Oxycodone is long-acting, while Oxycotin® is short-acting.
- 4. Deciding how much analgesic medication a patient needs is based on:**
- the provider's approved order set
 - the individual patient's subjective response to analgesic dosing^
 - the 0 to 10 pain scale
 - the level of emotion displayed by the patient
- 5. How is pain assessed in a patient who is sleeping?**
- The patient may or may not be awakened for assessment based their pain history and treatment. ^
 - Since there is no pain when sleeping, the pain score is assessed/documented as zero (0).
 - The institution's non-verbal pain assessment tool is used to assess pain intensity.
 - The patient is woken up and asked how they are doing and what their pain score is.
- 6. When a post-surgical patient has a risk for relapse of previous substance use disorder, the discharge plan for safety while taking opioids for pain at home would include:**
- establishing a safe medication treatment plan that includes opioid monitoring ^
 - telling them to only take the opioids when their pain is severe
 - calling their sponsor from AA or NA to let them know about the opioids for pain
 - not sending the patient home with opioids in this situation; other analgesics should be prescribed
- 7. Which of the following route of administration for analgesics is considered optimal when treating patients with persistent cancer-related pain?**
- intravenous
 - sublingual
 - oral ^
 - intramuscular

Appendix

- 14. A 45 year-old male patient reports pain in his foot that moves up along his calf. The patient states, "My right foot feels like it's on fire." The patient further describes that he has no history of injuries or falls, and that his pain started yesterday. Which components of pain assessment has the patient reported?**
- aggravating and alleviating factors
 - exacerbation, and associated signs and symptoms
 - intensity, timing of symptoms, and functional impact
 - location, quality, and onset ^
- 15. A patient is admitted and placed on a very high dose and frequency schedule of IV hydromorphone for pain related to a medical disorder. The patient calls the nurse frequently to report that she is still in terrible pain and needs more medication or something different. The nurse investigates and finds that the patients has been re-admitted several times for the same condition and remains on high doses of opioids with little reported relief. Risk for substance misuse is unknown. The patient is most likely experiencing:**
- addiction
 - opioid-induced hypoalgesia
 - opioid-induced hyperalgesia ^
 - paresthesia
- 16. A 32 year old male patient with acute pancreatitis is in the hospital for further diagnosis and treatment and rates his pain as a 10 on the 0-10 pain rating scale. Thirty minutes after administering the IV pain medication, the patient reports no pain relief. The nurse decides not to call the physician for additional orders for pain medication at this time. The nurse's actions may demonstrate the nurse's:**
- caution
 - biases ^
 - empathy
 - autonomy
- 17. Which one of the following therapies, shown to be most effective, could the clinical nurse use to calm the anxious patient with acute pain?**
- decrease noise stimulation (shutting the door of patient's room, etc.)
 - music ^
 - hypnosis
 - warm water sponge bath
- 18. In order to prevent constipation when taking opioids, the patient must do which one of these?**
- add fiber to the diet
 - use enemas daily
 - rest in bed more
 - take both a bowel stimulant and stool softener ^
- 19. If an opioid is abruptly discontinued, the signs of physical dependence can be seen since the patient:**
- experiences diarrhea, sweating, agitation, and nausea. ^
 - craves the drug, wants to use it despite harm, neglects important aspects of life to get it.
 - needs higher doses to achieve the same effect if the drug is restarted.
 - begins to demand a specific drug for pain.

Appendix

- 8. Which of the following IV doses of morphine is approximately equivalent to 10 mg of oxycodone?**
- morphine 10 mg IV
 - morphine 5 mg IV ^
 - hydromorphone 5 mg IV
 - fentanyl 25 mcg IV
- 9. Prior to hospitalization, a patient with moderate to severe cancer pain has been taking morphine daily for 3 months. When first admitted to the hospital, the patient received morphine 200 mg/hour intravenously. One day later he is ordered morphine 250 mg/hour intravenously to treat increased pain. Which one of the following safety monitoring techniques is most effective to assure the patient does not experience dangerous respiratory depression?**
- A sitter (nurse's aide) should be assigned to stay with the patient in the room continuously.
 - Continuous pulse-ox monitoring should be put in place.
 - Frequent reassessments of pain, level of consciousness and respiratory status. ^
 - Capnography monitoring (to measure buildup of carbon dioxide) should be used on this patient.
- 10. Which one of the following is most true when considering the influence of culture in caring for patients with pain?**
- Generally, cultural considerations do not come into play in caring for individuals with pain due to the homogeneity of the modern hospital environment.
 - Both the caregiver's and the patient's individual cultural traditions can affect how the patient's pain is treated. ^
 - Patients of certain cultures can be expected to react to pain in certain ways.
 - The proper way to react to an individual's pain can often be determined by knowing their ethnicity.
- 11. Unresolved pain results in the body's stress response and the release of stress hormones. Which one of the following conditions may occur when pain is unrelieved?**
- increased myocardial oxygen consumption ^
 - bradycardia and fluid retention
 - coronary vasodilation
 - hypoglycemia
- 12. Which statement best describes the development of opioid tolerance in a patient?**
- The patient becomes anxious about knowing the exact time of the next opioid dose.
 - The patient no longer experiences constipation from the use of opioids.
 - The patient requires increasingly larger doses of opioids to control the pain. ^
 - The patient would experience withdrawal if the opioid were suddenly stopped.
- 13. The nurse observes a patient with complex regional pain syndrome (CRPS) not wearing his right jacket sleeve because when the fabric of the sleeve touches his arm it's very painful. This pain is an example of:**
- hypoalgesia
 - allodynia ^
 - neuritis
 - paresthesia

Appendix

- 20. A patient is on 60 mg bid Oxycotin® for his persistent non-cancer pain. He has breakthrough pain and is asking for additional medication. The most reasonable medication to order for the breakthrough pain is:**
- MS Contin®
 - methadone
 - oxycodone ^
 - a fentanyl patch
- 21. A 35 year-old male patient hospitalized with acute bowel inflammation is joking and playing cards with his roommate. When assessed by the nurse, the patient rates his abdominal pain as a 7 on a pain rating scale of 0 to 10. This may indicate the patient:**
- is confused about how the pain rating scale works
 - is reporting his pain according to how he experiences it ^
 - plans to divert the opioid medication
 - has drug seeking tendencies
- 22. Which one of the following non-pharmacologic interventions for pain may be difficult to use with older, non-verbal adults with dementia?**
- aromatherapy
 - distraction
 - guided imagery ^
 - heat application
- 23. The nurse is educating the patient regarding their take-home analgesics for postoperative pain. Which one of the following is correct information to tell the patient about their prescription for opioid pain medication?**
- Explain that "prn" or "as needed" means to only take the pain medication when it is absolutely necessary.
 - Tell them to lock up their opioids when at home in order to keep secure from others who should not be taking them. ^
 - Explain that if their pain is not adequately relieved, they should NOT call right away but wait a few days and call if it does not get better in a week.
 - Tell them it's ok to have a glass of wine with their medication because it enhances the analgesic effect

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^ indicates correct answer

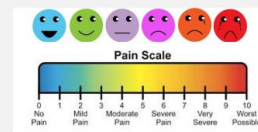
Appendix B: Educational PowerPoint

ALTERNATIVES TO OPIOIDS IN PACU FOR BARIATRIC SURGERY PATIENTS

By: Adrienne Windham, SRNA

HOW DO WE ASSESS PAIN?

- There is no consistently reliable indicator for pain
- What we can assess:
 - Patient description of pain
 - Location, quality, onset
 - Vital signs → ↑ HR, BP/RR → Body's stress response to pain
 - ↑ HR → ↑ myocardial O₂ consumption → ischemia
 - Facial grimacing
 - 0-10 pain scale
 - Try to avoid bias: patients report pain as they experience it
 - History of opioid use → tolerance, potential hyperalgesia
 - If patient is sleeping, use clinical judgment based on their pain history and treatment whether to wake them or not. Sleeping doesn't necessarily mean no pain.
- How much medication to give?
 - Don't just go on an order set
 - Must look at the individual patient
 - Everyone responds differently to medication!



ARE OPIOIDS HARMFUL?

Side effects:

- dose-dependent decrease in ventilation
- cough suppression
- sedation
- spasm of biliary smooth muscle resulting in biliary colic
- constipation
- delayed gastric emptying
- Post op ileus
- Nausea and vomiting
- Urinary retention
- Placental transfer
- Histamine release with morphine
- Potential for tolerance and dependence

For bariatric patients specifically:

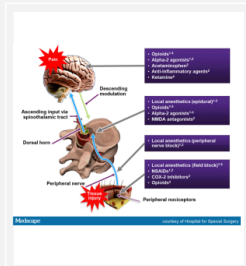
- They have significant associated comorbidities
 - Cardiac disease, respiratory disease, diabetes, etc.
- Increased risk for respiratory compromise
 - Prone to airway collapse
 - Increased pharyngeal tissue
 - Obstructive sleep apnea
- Some studies have shown they are at increased risk for opioid abuse
 - More research is needed on this

OPIOID TOLERANCE AND DEPENDENCE

- Tolerance:** patient requires increasingly larger doses of opioids to control pain
- High doses/high frequency of opioid administration can lead to opioid-induced hyperalgesia
 - Hyperalgesia:** increased sensitivity to pain due to overexposure of opioids
- Dependence:** when opioids abruptly discontinued, patient experiences withdrawal signs –diarrhea, sweating, agitation, nausea

WHAT IS MULTIMODAL ANALGESIA?

- Multimodal analgesia combines non-opioid medications for the goal of synergistic pain control, minimizing the number of opioids needed and therefore cutting down on opioid-related side effects.
- These medications act on different receptors → provide superior pain relief
- Doesn't mean NO opioids
 - Example: NSAIDs along with Oxycodone
- Associated with: decreased hospital length of stay, earlier return of bowel function, and no statistically significant changes in pain scores



OPIOID ALTERNATIVES

- Pharmacological:
- NSAIDs
 - Toradol
 - Acetaminophen
 - Gabapentinoids
 - Ketamine
 - Systemic Lidocaine
 - Precedex
 - Regional: TAP/QL/ESP blocks; Epidural

- Non-pharmacological:
- Music
 - Distraction
 - Aromatherapy
 - Heating pads
 - Ambulation

ACETAMINOPHEN

- Analgesic and antipyretic
- Used as a premed as well as for post op pain control
 - Available as PO (elixir or pill), IV, or rectal
- Has been shown in many studies to reduce postop opioid requirements
- Ofirmev = IV Acetaminophen
 - One study has shown IV to be more effective in the immediate post op period due to faster onset
 - For Bariatric patients, decreased gastric motility and decreased absorption may make IV a better option

NSAIDS

- Non-steroidal anti-inflammatory drugs : analgesic as well as anti-inflammatory
- Have been thought to be contraindicated in bariatric surgery due to potential increased bleeding and anastomosis leak
 - Studies have proven otherwise
- Has been shown to reduce postop opioid requirements, decrease PACU length of stay
- Celecoxib (Celebrex) PO often given as a premed → selective Cox 2 inhibitor (preferred)
 - Previous ERAS data only showed Celebrex given 11 times out of 594 cases reviewed
- IV Ibuprofen (Caldolor) → much more expensive than Toradol, and unsure of availability
 - Shown to decrease pain postoperatively
- Ketorolac (see next slide)

KETOROLAC

- Has been thought to increase risk of bleeding postoperatively (due to inhibition of COX-1)
- Some studies have shown that Ketorolac has NOT been associated with increased risk of bleeding postop. Literature is conflicting around this subject
 - Many surgeons still do not want their patients to have it due to the risk
 - Part of the ERAS protocol for bariatric patients given 529 times out of 594 reviewed cases
- Shown to decrease opioid consumption postoperatively—decreased opioid related complications: PONV, sedation, respiratory depression, constipation, urinary retention
- Narcotic equivalence: 10mg Morphine
- Shown to decrease length of stay
- Multiple studies concluded that continuing ketorolac as a scheduled medication postoperatively along with acetaminophen and gabapentin reduces pain postoperatively and decreases opioids needed
- Avoid in patients with kidney dysfunction and severe asthma

GABAPENTINOIDS

- Bariatric ERAS protocol currently uses Pregabalin (Lyrica) as a premed as well as post op scheduled med
- Pregabalin is more potent than Gabapentin with fewer side effects
- Usually tolerated well on empty stomach
- Helps prevent hyperalgesia, and has anticonvulsant and anxiolytic properties
- Has been shown to decrease intraop and postop opioid consumption
- One study combined use of preop Pregabalin with Dexmedetomidine infusions and showed significant decrease in pain score, better control of HR and BP, and decreased opioid consumption

MULTIMODALS USUALLY GIVEN INTRAOPERATIVELY

KETAMINE

- NMDA receptor antagonist: powerful analgesic and amnesic
- Allows for preserved pharyngeal reflexes: great in the obese population
- Beneficial for opioid induced hyperalgesia and opioid tolerant patients
- Has been shown to decrease opioid requirements and lower pain scores
- Often combined with Magnesium: synergistic effect

DEXMEDETOMIDINE

- Highly selective alpha 2 agonist: sedative, anxiolytic, and analgesic effects
- Has been proven to decrease opioid requirements
- Can cause bradycardia and hypotension
- Does not cause respiratory depression: great drug for obese patients

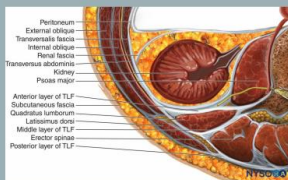
DEXAMETHASONE

- Glucocorticoid: anti-inflammatory properties → decreased pain
- Has been shown to be beneficial in preventing PONV
- Studies have found a decrease in opioid consumption and shorter PACU stays when patients received Dexamethasone
- Use caution in diabetic patients with uncontrolled blood sugars

SYSTEMIC LIDOCAINE

- Local anesthetic – given systemically can block pain conducting nerve fibers
- Has anti-inflammatory properties
- Has been shown to improve quality of recovery in morbidly obese patients after bariatric surgery
- Has been shown to decrease opioid requirements post-operatively
- If patients are receiving regional blocks this limits systemic use of lidocaine
 - Risk of LAST (local anesthetic systemic toxicity)

REGIONAL: TAP, QL, AND ESP BLOCKS



- Block names:** Transversus abdominus plane (TAP); Quadratus Lumborum (QL); Erector Spinae Plane (ESP)
- Done by either surgeon or anesthesiologist
- Provider preference for local anesthetic
- Exparel: Liposomal bupivacaine—slow release of local anesthetic over 92 hours
 - Caution: If non-bupivacaine based local anesthetics (i.e. Lidocaine) are given together with Exparel, can cause rapid release of bupivacaine
- All blocks significantly reduce opioid requirements postoperatively
- QL and ESP blocks have been shown in some studies to provide greater areas of somatic and visceral analgesia in comparison to TAP blocks → closer proximity to paravertebral space
- TAP blocks still shown to be superior to wound infiltration with local anesthetic
- All comes down to provider preference on what block is done

COMPLIANCE

- Compliance with ERAS protocols in reducing opioid consumption postoperatively has shown to improve patient outcomes
- Decreased length of stay
- Decreased post op complications
- Decreased pain scores
- Decreased nursing workload
- Evidence has shown that nursing plays role in shifting towards multimodal analgesics and that education is essential to success of ERAS

CURRENT ERAS PATHWAY

	BARIATRIC ERAS PATHWAY			
PACU	<ul style="list-style-type: none"> Consider ice chips Normothermia maintained with warming blanket Pain: limit opioid use <ul style="list-style-type: none"> Avoid morphine or hydromorphone if extant PRN 			
POD 0	<ul style="list-style-type: none"> Acetaminophen 975mg PO liquid x 2 then Acetaminophen 650mg PO liquid q 6 hrs Pregabalin 50mg PO BID (25 mg if <60yrs) OR gabapentin 200 mg PO BID, can increase dose to 200mg TID as tolerated Ketorolac IV scheduled for 24 hours Oxycodone OR hydromorphone PRN 	<ul style="list-style-type: none"> Advance diet to sips of bariatric clear liquids POD #0 or POD #1 as ordered May have clear liquid protein supplement 	<ul style="list-style-type: none"> ICB to chair or ambulate 	<ul style="list-style-type: none"> IV at KVO if tolerating fluids of clear liquids Start Loxette or S2 heparin regimen POD #1 per surgeon orders Incentive spirometer q4h while awake
POD 1+	<ul style="list-style-type: none"> Acetaminophen 650mg PO liquid q 6 hrs until discharge Pregabalin 50mg PO BID (25 mg if <60yrs) x 1 week OR gabapentin 100 mg PO BID x 1 week, can increase dose to 200mg TID as tolerated After ketorolac complete, celecoxib 200 mg PO BID x 1 week Oxycodone OR hydromorphone PRN 		<ul style="list-style-type: none"> Ambulate at least 3-4x daily 	<ul style="list-style-type: none"> Foley removed, if not already removed at end of case

I WOULD LOVE YOUR FEEDBACK!

- Post-survey will be sent out following this session. They are anonymous!
- At the bottom I have asked for feedback on barriers to decreasing opioids for this patient population.
- What prevents alternatives from being given in PACU?
- What is/is not working for you all and what can help in the future?

REFERENCES

- 1. Abou 2016, H., Kabbaj, R., Najm, M. A., Jabbour, H., Noun, R., Skafati, F., Churri, S., Dagher, C., Sidaty, G., & Nazcahe, N. (2016). Safety and Efficacy of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) Used for Analgesia After Bariatric Surgery: A Retrospective Case-Control Study. *Obesity Surgery*, 29(3), 911–916. <https://doi.org/10.1007/s11895-016-3608-y>
- 2. De Oliveira, C. S., Durand, K., Fagundes, P., Haber, A., Couill, B. W., & McCarthy, R. J. (2018). Systemic Lidocaine to Improve Quality of Recovery after Laparoscopic Bariatric Surgery: A Randomized Double-Blinded Placebo-Controlled Trial. *Obesity Surgery*, 24(2), 212–218. <https://doi.org/10.1007/s11895-017-1077-4>
- 3. Elsharkawy, H., & Roshan, T. F. (2018, September 15). Ultrasound-Guided Transversus Abdominis Plane and Quadratus Lumborum Nerve Blocks. *NSQIPRA*. <https://www.nyora.com/regional-anesthesia-for-specific-surgical-procedures/ultrasound-guided-transversus-abdominis-plane-quadratus-lumborum-blocks/>
- 4. Forster, C., Doucet, V., Perreault, I. Y., Abdelchour-Berthod, E., Zellweger, M., Marucci, C., Krueger, T., Rothen, L., & Gonzalez, M. (2020). Impact of Compliance With Components of an ERAS Pathway on the Outcomes of Intra-aortic Balloon Pump Primary Resections. *Journal of Endovascular and Vascular Anesthesia*, 24(7), 1839–1846. <https://doi.org/10.1053/j.jvea.2020.01.016>
- 5. Gasmitch, L., Nelson, G., Nelson, A., Lagertha, L., Gilmour, L. E., & Wasylyk, T. (2020). Moving enhanced recovery after surgery from implementation to sustainability across a health system: A qualitative assessment of leadership perspectives. *BMC Health Services Research*, 20. <https://doi.org/10.1186/s12913-020-05227-0>
- 6. Hariri, K., Hechenbleikner, E., Dong, M., Joon, S. U., Fernandez-Ramirez, G., & Heron, D. M. (2019). Ketorolac: Use Shortens Hospital Length of Stay After Bariatric Surgery: A Single-Center 5-Year Experience. *Obesity Surgery*, 29(8), 2160–2166. <https://doi.org/10.1007/s11895-019-03934-4>
- 7. Helander, E. M., Mearns, B. L., Hanson, C. M., Harris, B. K., Alkhn, A. V., Borstein, G. J., Weyche, M. Q., Pashoo, L. W., Lawriva, A., & Kaye, A. D. (2017). Multimodal Analgesia, Current Concepts, and Acute Pain Considerations. *Current Pain and Headache Reports*, 21(1), 3. <https://doi.org/10.1007/s12658-017-0807-y>
- 8. Heehs, R. S. Link to external site, this link will open in a new window. Seitz, A. P., Singer, E. E., Thompson, J. R., & Watkins, B. M. (2015). Enhanced Recovery Protocol for Laparoscopic Sleeve Gastrectomy: Are Narcotics Necessary? *Journal of Gastrointestinal Surgery*, 23(8), 1541–1546. <http://dx.doi.org/10.1007/s11305-018-04001-y>
- 9. Hübner, M., Aden, V., Steiner, J., Grottel, A. C., Lohmann, E., Blum, C., & Thewissen, N. (2015). The Impact of an Enhanced Recovery Pathway on Nursing Workload: A Retrospective Cohort Study. *International Journal of Surgery*, 24, 45–50. <https://doi.org/10.1016/j.ijsu.2015.10.025>
- 10. Jones, J. B., & Aldrich, R. (2020). Interfacial Plane Blocks and Laparoscopic Abdominal Surgery: A Narrative Review. *Local and Regional Anesthesia*, 13, 159–169. <https://doi.org/10.2147/LRA.S272924>
- 11. Kaffar, G. E., Sarik, M., Cagil, U., Kivirci, R., & Yildiz, S. (2018). Comparison of intravenous buprenorphine and acetaminophen for postoperative multimodal pain management in bariatric surgery: A randomized controlled trial. *Journal of Clinical Anesthesia*, 50, 3–11. <https://doi.org/10.1016/j.jclinane.2018.06.030>

REFERENCES

- 1. Ma, F., Liang, A., McDaniel, M., Moore, R., Jackson, A., Boone, J., & Higa, R. (2020). Reduction of opioid use after implementation of enhanced recovery after bariatric surgery (ERAS). *Surgical Endoscopy*, 34(5), 2184–2190. <https://doi.org/10.1007/s00464-019-07006-3>
- 2. Morris, S. V., Ruff, L., Carone, J., Winkler, E., Sanders, C., & Sirovica, N. C. (2021). Reduction in Opiate Use, Pain, Nausea, and Length of Stay After Implementation of a Bariatric Enhanced Recovery After Surgery Protocol. *Obesity Surgery*, 25(7), 2086–2093. <https://doi.org/10.1007/s11895-021-01838-9>
- 3. Montgomery, R., & Mulholland, S. A. (2016). Multimodal Pain Management for Enhanced Recovery: Reinforcing the Shift From Traditional Pathways Through Nurse-Led Interventions. *ADON Journal: The Official Voice of Postoperative Nursing*, 12(6), 98–103. <http://dx.doi.org/10.1053/j.adon.2016.06.003>
- 4. Noth, D., Pavin, M., Frazee, R., Harris, I. M., Dimitri, S., Luffo, A., & Harris, M. (2018). Quality Improvement Initiative to Improve Postoperative Pain with a Clinical Pathway and Nursing Education Program. *Pain Management Nursing*, 23(5), 147–153. <https://doi.org/10.1016/j.pmn.2018.06.005>
- 5. Peraza, M., Miller, D., Wu, C., Williamson, M., O'Keefe, K., Stratos, D., & Wright, F. (2019). Implementation of Enhanced Recovery After Surgery in a Community Hospital: An Evidence-Based Approach. *Journal of Perianesthesia Nursing*, 34(3), 188–197. <https://doi.org/10.1016/j.pan.2018.02.005>
- 6. Patel, J. R., Cook, M. L., & Martin, A. C. (2017). Randomized Prospective Trial Comparing the Use of Intravenous versus Oral Acetaminophen in Total Joint Arthroplasty. *The Journal of Arthroplasty*, 32(4), 1219–1227. <https://doi.org/10.1016/j.arth.2016.10.028>
- 7. Saarna, A. J., & Abdalla, N. M. (2012). Multimodal analgesia with tramadol and dexamethasone in healthy obese patients undergoing laparoscopic sleeve gastrectomy: A prospective randomized double-blind placebo controlled study. *European Journal of Anaesthesiology*, 23(7), 291–298. <https://doi.org/10.1016/j.ejwa.2012.04.008>
- 8. Sherman, M., Ho, H., Chu, B., Burgess, J., Gumbert, S., Liu, C., Andrus, R., Poudyal, J., Slocum, J., & Hains, E. (2020). Reducing opioid consumption in postoperative renal transplant patients: A retrospective analysis. *Indian Journal of Transplantation*, 44(3), 130. <https://doi.org/10.1016/j.ijt.2020.06.002>
- 9. Song, L., Mistry, M. J., & Whipple, O. C. (2014). Optimizing Multimodal Analgesia with Intravenous Acetaminophen and Opioids in Postoperative Bariatric Patients. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 34(5), 140–151. <https://doi.org/10.1002/jcp.1217>
- 10. Townsend, W. R., Norman, W. M., Robinson, W. M., Smith, H., Parker, S., Linton, K. E., Clark, K. L., & Higgs, S. R. (2020). Implementation of a Lidocaine Enhanced Recovery after Surgery (ERAS) Program for Medical Cystectomy Patients: A Prospective Cohort Study. *Journal of Clinical Anesthesia*, 106, 108–116. <https://doi.org/10.1016/j.jclinane.2020.08.010>
- 11. Varga, Matt (2021). Varga Anesthesia Mega App (Mobile application software).
- 12. Warren, J. A., Goodfellow, C., Hunter, J. A., Horton, A. J., Anagnost, C., Fung, J. L., Pukar, S., Conroy, V. A., Walker, K. B., Cobb, W. S., Carbonell, A. M., & Morgan, R. R. (2017). Effect of Multimodal Analgesia on Opioid Use After Open Ventral Hernia Repair. *Journal of Gastrointestinal Surgery*, 21(1), 189–199. <https://doi.org/10.1007/s11305-017-0204-4>
- 13. Wick, E. C., Grant, M. C., & Wu, C. L. (2017). Postoperative Multimodal Analgesia Pain Management With Nonopioid Analgesics and Techniques: A Review. *JAMA Surgery*, 152(7), 691. <https://doi.org/10.1093/jama.2017.08.018>