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An Educational Intervention on the PECS II Block and Its Role in Reducing Opioid Consumption and Acute Postoperative Pain in Mastectomy Patients

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**An Educational Intervention on the PECS II Block and Its Role in Reducing Opioid
Consumption and Acute Postoperative Pain in Mastectomy Patients**

A DNP Project Presented to the Faculty of the
Nicole Wertheim College of Nursing and Health Sciences

Florida International University

In partial fulfillment of the requirements
For the Degree of Doctor of Nursing Practice

By

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Approval Acknowledged _____, DNA Program Director

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TABLE OF CONTENTS

ABSTRACT	4
INTRODUCTION	5
Description of the Problem	5
Background	5
Systematic Review Rationale	8
Objectives of the Systematic Review	8
METHODOLOGY OF LITERATURE REVIEW	9
Search Strategy and Sources	9
Study Selection and Screening of Evidence	10
Collection, Analysis and Data Items.....	11
RESULTS OF LITERATURE REVIEW.....	12
Study Selection	12
Study Characteristics	14
Definitions and Outcomes	14
Risk of Bias	15
DISCUSSION OF LITERATURE REVIEW.....	16
Summary of Evidence	16
Limitations of the Systematic Review	16
Recommendations for Current Practice.....	17
Recommendations for Future Research	17
METHODOLOGY OF QUALITY IMPROVEMENT.....	18
Setting and Participants.....	18
Description of Approach and Project Procedures.....	18
Protection of Human Subjects.....	19

Data Collection.....	19
Management and Analysis.....	20
RESULTS OF QUALITY IMPROVEMENT.....	20
Pre- and Post-test Participant Demographics.....	20
Pre-and Post-test Knowledge Comparison About Breast Cancer and Mastectomy Surgery.....	21
Pre-and Post-test Knowledge and Perspective Comparison of PECS II Block.....	22
DISCUSSION OF QUALITY IMPROVEMENT.....	23
Limitations.....	23
Future Implications for Advanced Nursing Practice.....	23
CONCLUSION.....	23
REFERENCES	25
Appendix A: PRISMA Flow Diagram.....	27
Appendix B: Matrix Table	28
Appendix C: IRB Exemption Letter	34
Appendix D: QI Project Survey	35
Appendix E: Educational Module.....	39

ABSTRACT

Background: Regional anesthesia has been an excellent adjunct to anesthesia and has helped in the fight against the opioid epidemic seen within the United States. Cancer patients undergoing mastectomies can develop chronic pain as a result of not treating acute postoperative pain properly. This chronic pain can lead to increased opioid consumption and opioid dependence. Regional anesthesia, specifically the Pectoral Nerves II (PECS II) block, is a great technique that can help patients undergoing mastectomies.

Objectives: The purpose of this study is to improve anesthesia provider knowledge on the value of the PECS II Block for patients undergoing mastectomy surgery. A literature review addresses the PICO question: “In patients undergoing general anesthesia for mastectomy, would the use of a PECS II block compared to no block, reduce postoperative opioid consumption and acute postoperative pain.” The educational framework provided to improve provider knowledge was gathered through this literature review. Overall, this study aims to increase awareness of the PECS II block for mastectomy patients to improve healthcare outcomes for this patient population.

Methodology: An online educational intervention which focuses on the benefits of the PECS II Block for mastectomy patients will be administered to anesthesia providers. As part of this online educational intervention, a pre- and post- assessment survey will be used to measure improvement of provider knowledge.

Results: Overall, the statistical analysis between the pre-test and post-test showed there was an overall improvement in provider knowledge following the education intervention. Additionally, the likelihood of utilizing the PECS II block for mastectomy patients increased among providers.

Conclusions: The evidence illustrates how the PECS II block can be a safe and effective technique that can help decrease opioid consumption as well as improve postoperative pain scores when compared to using general anesthesia alone. More research must be done to determine the effect of the PECS II block on chronic pain within this patient population

Keywords: Mastectomy, PECS II block, Regional anesthesia, Opioids, Breast cancer

INTRODUCTION

Description of the Problem

The United States is presently battling an opioid epidemic. Approximately 11.5 million Americans described misusing opioids in 2015.¹ Surgery plays a vital role in patient exposure to opioids. Approximately, 6-8% of opioid-naïve patients undergoing non-cancer-related surgery develop ongoing opioid use and continue to refill prescriptions of opioids three to six months after their surgery.² For patients with cancer, that percentage increases significantly. In a study conducted by Lee et al.,¹ it was determined that 10% of opioid-naïve cancer patients undergoing curative-intent surgery developed ongoing opioid use.

Women affected by breast cancer are especially susceptible to opioid misuse. Breast cancer affects approximately 12% of females in the United States. In 2019, there were an estimated 268,000 cases of newly diagnosed breast cancer among women.³ As of late, the survivability rate for women with breast cancer has steadily increased. Caucasian women experienced a 16% increase in survivability from 1977 to 2015, and African American women experienced a 21% increase during the same period.⁴ This increase in survivability can be attributed to enhanced screening for breast cancer and better treatment. Various treatment modalities are available to women with breast cancer, such as Breast-Conserving Surgery (BCS), which removes the tumor and surrounding border, chemotherapy, radiation, and mastectomy. In a recent study, patients who were eligible to undergo BCS elected to undergo either unilateral or bilateral mastectomy due to various reasons that included fear of cancer reoccurrence, unwillingness to undergo radiation, and need for symmetry among both breasts.⁵

There is a significant amount of perioperative and postoperative pain associated with mastectomies, and as with many other surgeries, opioids have become a mainstay in the treatment of operative pain. Opioids are incredibly useful in treating acute pain but can have detrimental side effects. As previously mentioned, opioids have a high incidence of being abused, especially among oncology patients. Apart from abuse, there are many adverse side effects to consider when

administering and prescribing opioids. For example, opioids are associated with immunosuppression and can also increase the chances of the tumor or cancerous cells returning.⁶ Furthermore, opioids can complicate perioperative and postoperative management by increasing the patient's risk of experiencing falls, postoperative ileus, respiratory and central nervous system depression, and hyperalgesia.⁷ Unfortunately, even with the use of opioids, some patients still experience severe acute postoperative pain.

Approximately 20-30% of patients undergoing mastectomy experience chronic pain, which has contributed to increased opioid consumption.⁸ Chronic pain following mastectomy can dramatically and negatively affect women's lives by increasing healthcare costs, increasing feelings of anxiety and depression, and decreasing their overall quality of life.⁸ A significant contributing factor that can predict chronic pain following mastectomy is severe acute postoperative pain. Poleshuck et al.⁹ determined that severe acute postoperative pain and preoperative psychosocial distress were the main two determinants for developing chronic pain following mastectomy. It stands to reason that if acute postoperative pain were controlled and managed appropriately, there would be less chance that the patient would experience chronic pain later on in the recovery process. Regional anesthesia, particularly the Pectoral Nerves II (PECS II) block, could be an excellent modality that can effectively treat acute postoperative pain while avoiding the adverse side effects of opioids.

Background

Blanco, Fajardo, and Parras (2012) were the first to describe this novel regional anesthesia technique.¹⁰ The PECS II block aims to provide anesthesia to three sets of nerve groups that supply the Pectoralis Major muscle (PMm), Pectoralis minor muscle (Pmm), and the Serratus anterior muscle (SAM). By blocking these sets of nerves, the PECS II allows for sufficient axillary clearance and can also provide anesthesia for the wide excisions that are necessary during mastectomies.

The first set of nerves blocked by the PECS II are the pectoral nerves that arise from the brachial plexus. These nerves supply and innervate the pectoralis muscles and can be further divided into the lateral pectoral nerve and medial pectoral nerve. The lateral pectoral nerve arises from C5 through C7 and runs along a fascial plane in between the PMm and the Pmm. By coursing through this fascial plane, the lateral pectoral nerve's main purpose is to innervate the PMm. The medial pectoral nerve runs underneath the Pmm. It crosses the Pmm and the clavipectoral fascia to reach the lower third of the PMm.

The second set of nerves are the anterior divisions of the thoracic intercostal nerves from T2 through T6. These nerves lie in a fascia between the pleura and posterior intercostal membrane and can reach as far as the sternum. This set of nerves can also be further divided into the lateral and anterior branches. The lateral branches pierce the intercostalis externi and the serratus anterior muscle at the mid-axillary line to ultimately provide anterior and posterior terminal branches. The anterior branches supply the medial aspect of the breast by crossing in front of the mammary artery and pierce the intercostalis interni, intercostal membranes, and the PMm.

The last set of nerves include the long thoracic and thoracodorsal nerves. The long thoracic nerve, also known as the serratus anterior nerve, arises from C5-C7. It enters the axilla behind the brachial plexus and supplies the serratus anterior. It is important to note that during mastectomies, the long thoracic nerve can become damaged and produce a winged scapula. The thoracodorsal nerve is a branch of the posterior cord of the brachial plexus. This nerve runs beside the thoracodorsal artery and innervates the latissimus dorsi in the posterior wall of the axilla.

In their study, Blanco et al. (2012) conducted this regional anesthetic technique under ultrasound guidance using a two-injection approach. The patient should be in supine position with the arm abducted 90 degrees. Once the patient is in position, the anesthetic provider should place the transducer at the midclavicular level and angled infero-laterally. At this point, the axillary artery, axillary vein and the second rib can be identified. The transducer should slide caudally until the third rib is in view. Once the third rib is seen, the transducer should be rotated to allow for an

in-plane needle approach from medial to lateral. The transducer is then moved towards the lateral aspect of the Pmm until all three muscles can be identified. Using an in-plane approach, the needle is inserted from medial to lateral until it reaches the fascial plane between the PMm and the Pmm. Proper placement can be confirmed by hydro-dissection of the two muscles when local anesthetic is injected. After proper separation, the needle is inserted further until it reaches the fascial plane between the Pmm and the serratus anterior muscle. As with the first injection, proper placement can be confirmed when local anesthetic is injected, and hydro-dissection occurs.

The PECS II block offers a simpler and safer regional anesthesia technique for mastectomies when compared to other blocks such as the paravertebral block or epidural. Since the PECS II block is a fascial plane block, the chances for intravascular local anesthetic injection is dramatically decreased when compared to other regional anesthetic techniques. Furthermore, the PECS II block is able to block medial and lateral pectoral nerves as well as long thoracic and thoracodorsal nerves, whereas the other techniques are not able to.

Systematic Review Rationale

The purpose of this study is to determine anesthesia provider knowledge on the PECS II block for treatment of postoperative pain in patients undergoing mastectomy surgery. A PowerPoint presentation will be provided to Certified Registered Nurse Anesthetists (CRNAs) as part of an educational intervention project. The goal of this project is to improve CRNA knowledge regarding the PECS II block and increase the likelihood of utilizing this block to decrease postoperative pain and opioid consumption.

Objectives of the Systematic Review

Increased pain in the acute postoperative period following mastectomy surgery has been shown to be a significant factor in the development of chronic pain with this patient population. As a result, these patients depend heavily on opioids to cope with their pain. Utilizing the PECS II block as an anesthetic adjunct in these patients could substantially decrease the amount of pain

experienced in the acute postoperative period, decrease opioid usage, and avoid the risks associated with other regional anesthetic techniques

The first objective of this review is to determine if the PECS II block reduces acute postoperative pain experienced by patients undergoing mastectomy surgery. The second objective is to research if opioid usage decreases with the application of the PECS II block. Once PECS II have been proven to decreased postoperative pain and opioid usage, a plan will be put into place to include PECS II blocks in future ERAS protocols.

METHODOLOGY OF LITERATURE REVIEW

Search Strategy and Sources

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was used to organize and complete a search for the subject of this literature review.¹¹ A clinical question related to mastectomies and the PECS II block was formatted using the PICO problem statement approach. Afterward, various databases, such as PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and MedLine (ProQuest), were searched to gather information regarding the subject matter. Keywords and BOOLEAN operators included ‘pectoralis nerve block AND mastectomy OR breast surgery’, ‘opioid consumption AND mastectomy or breast surgery’, ‘postoperative pain OR chronic pain AND mastectomy or breast surgery’. Search restrictions and filters included publication dates within the last five years, human subjects, English language, female patients, and randomized controlled trials.

The PICO question for this paper is as follows: **(P)** In patients undergoing general anesthesia for mastectomy, **(I)** would the use of a PECS II block **(C)** compared to no block, **(O)** reduce postoperative opioid consumption and acute postoperative pain. This PICO question was explicitly formulated to guide the literature review search as well as any specific keywords and Boolean phrases. Through the systematic review, 89 articles were found. The MEDLINE database provided 50 results, the PUBMED database provided 19 results, and lastly, the CINAHL database

provided 20 results. After accounting for duplicate articles, there were 50 articles available for appraisal. Literature review search strategy is represented in the PRISMA diagram in Appendix A.

Table 1. Database Search Table

Database	PubMed	CINAHL	Medline (ProQuest)
Boolean Phrase	‘pectoralis nerve block AND mastectomy OR breast surgery’, ‘opioid consumption AND mastectomy or breast surgery’, ‘postoperative pain OR chronic pain AND mastectomy or breast surgery’	-	-
Search Results	19	20	50

Study Selection and Screening of Evidence

The remaining 50 articles were reviewed in comparison to the PICO question. Of those 50 articles, 30 were excluded for not being full-text articles. Finally, various inclusion and exclusion criteria were created based on the PICO question to refine the 20 available studies. Inclusion criteria included mastectomy procedures, female gender, pectoralis nerve block II, and randomized controlled trials. After reviewing the 20 articles and applying the inclusion/exclusion criteria, it was determined that 7 of these articles appropriately answered the PICO question. Inclusion and exclusion criteria used to select appropriate articles are represented in Table 2.

Table 2. Inclusion and Exclusion Conditions	
Inclusion conditions	Exclusion conditions
Type of study: <ul style="list-style-type: none"> ➤ Randomized controlled trials (RCT) ➤ Single or double-blinded study ➤ Prospective RCTs ➤ Publication within the last five years 	Type of study: <ul style="list-style-type: none"> ➤ Quasi-experimental ➤ Systematic reviews ➤ Publication date not within the last five years

Population: <ul style="list-style-type: none"> ➤ Human ➤ Female 	Population: <ul style="list-style-type: none"> ➤ Nonhuman ➤ Male
Types of procedure: <ul style="list-style-type: none"> ➤ Mastectomy ➤ Radical Mastectomy 	Types of procedure: <ul style="list-style-type: none"> ➤ Breast augmentation ➤ Breast Reconstruction
Intervention: <ul style="list-style-type: none"> ➤ The studies involved patients undergoing mastectomies and receiving PECS II Block 	Intervention: <ul style="list-style-type: none"> ➤ Pain management not related to PECS II block
Outcomes: <ul style="list-style-type: none"> ➤ Decreased opioid consumption in the postoperative period ➤ Improved postoperative pain rating scores 	Outcomes: <ul style="list-style-type: none"> ➤ Any outcome than did not relate to the patients receiving a PECS II block

Collection, Analysis, and Data Items

The Johns Hopkins Nursing Evidence-based Practice (JHNEBP) tool was instrumental in selecting the highest quality studies for this review. The JHNEBP has two rating scales to evaluate the strength and quality of the research evidence.¹² The first rating scale, which deals with the strength of the evidence, has three levels. The first level is the strongest and comes from experimental studies, randomized controlled trials (RCTs), or systematic reviews of RCTs that may or may not have meta-analyses accompanying them.¹² The second level corresponds with the second strongest type of evidence and derives from evidence obtained from quasi-experimental studies. Lastly, evidence from quantitative, non-experimental studies or systematic reviews that include RCTs, quasi-experimental, and non-experimental is considered level three and the weakest of the three groups.

The second rating scale of the JHNEBP considers the quality of the research evidence and is divided into three grades. The first grade, A – high, determines that the research evidence is consistent, has a sufficient sample size and definitive conclusions, amongst other things.¹² The second grade, B- good, determines that the research evidence has reasonable, consistent results, a sufficient sample size, and relatively definitive conclusions. Lastly, the final grade, C- low or major

flaw, determines that the research has little to no evidence, does not have consistent results, and conclusions cannot be drawn based on the information.

Using the JHNEBP, this author selected the highest research studies available that were most relevant to the PICO questions proposed earlier in this paper. Studies selected for this review are illustrated in Appendix B.

RESULTS OF LITERATURE REVIEW

Study Selection

Eighty-nine articles were found when searching various databases. Of those eighty-nine articles, fifty were duplicates, which left thirty-nine articles. After investigating the titles and abstracts, thirty articles were eliminated, which left a total of twenty full-text articles to assess for eligibility. Using the inclusion and exclusion criteria, thirteen full-text articles were excluded for multiple reasons including: level 2 and 3 evidence, outcomes other than opioid consumption and pain ratings, interventions other than the use of PECS II block, and language other than English. Eventually, the study selection resulted in seven RCTs that were included in this systematic qualitative review that answered the PICO question: “In patients undergoing general anesthesia for mastectomy, would the use of a PECS II block compared to no block, reduce postoperative opioid consumption and acute postoperative pain.” Table 3 provides a summary of all RCTs included in the systematic review.

Table 3. Studies included in appraisal

Author (Year) & Level of Evidence	Study, Participants, Interventions, & Setting	Findings in PECS II Group (O Group)
Al Ja'bari et al. (2019) Level 1	50 ASA 1-3 pts, \geq 18 years old, undergoing unilateral radical mastectomy with or without axillary node clearance under General Anesthesia. Pts were randomly allocated to either the PECS II block group (25) or the control group with only General Anesthesia (25).	Reduced 24h and 48h postoperative morphine dose (P=0.04) Pain scores at 24h and 48h were similar for both groups. (P=0.39 and P=0.09 respectively)

<p>Neethu et al. (2018) Level 1</p>	<p>60 ASA 1-2 pts, 18-70 years old, undergoing modified radical mastectomy with or without sentinel lymph node biopsy or axillary lymph node dissection. Pts were randomly allocated into either the PECS group (30) or control group with only GA (30)</p>	<p>Decreased fentanyl requirements in the PECS group perioperative and postoperatively (P<0.001) for both respectively. Visual Analog Scores (VAS) for pain were also decreased in the PECS group</p>
<p>Najeeb et al. (2019) Level 1</p>	<p>120 ASA 1-2 pts, ≥ 18 years old, undergoing elective modified radical mastectomy under GA. 60 pts were randomly allocated into the PECS group and 60 pts were randomly allocated into the control group with GA only</p>	<p>Decreased intraoperative opioids (P=0.009) Postoperative morphine consumption to keep pain scores less than 3 were relatively equal between both groups (P=1.0) Decreased pain scores at 0hr, 6hr, 12hr, and 24 hr (P<0.001)</p>
<p>Senapathi et al. (2019) Level 1</p>	<p>50 ASA 1-2 pts, 16-65 years old, undergoing unilateral modified radical mastectomy. Patients were randomly allocated to either receive the PECS II block with 0.25% Bupivacaine (25) or receive the PECS II block with 0.9% NaCl (25)</p>	<p>Decreased intraoperative opioid consumption (P<0.001) Decreased VAS Pain scores at 3, 6, 12, and 24hrs (P<0.001) Decreased postoperative opioid consumption (P<0.001)</p>
<p>Versyck et al. (2017) Level 1</p>	<p>140 ASA 1-3 pts, 18-80 years old undergoing mastectomy or lumpectomy with sentinel or axillary lymph node dissection. Pts were randomized in a 1:1 ratio to either the PECS group which received 0.25% levobupivacaine or the control group which received 0.9% NaCl</p>	<p>Decreased Numerical Rating Scale (NRS) pain scores in the PACU setting (P=0.048) Decreased postoperative opioid requirement (P=0.037)</p>
<p>Khemka et al. (2019) Level 1</p>	<p>100 ASA 1-2, 18-65 years old undergoing mastectomy requiring axillary node dissection. Pts were randomly allocated either into the PECS group (50) or the control group (50)</p>	<p>Decreased postoperative opioid consumption Decreased VAS pain scores</p>
<p>Kumar et al. (2018) Level 1</p>	<p>50 ASA 1-2 undergoing unilateral modified radical mastectomy. Pts were randomly allocated into Group I which underwent surgery only using GA (25) or Group II which underwent</p>	<p>Decrease total tramadol consumption (P<0.0001) Decreased VAS pain score at rest (P<0.0001) Decreased VAS pain score on abduction (P<0.0001)</p>

	surgery using GA in conjunction with the PECS II block (25)	
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Study Characteristics

Altogether, the selected RCTs had a total of 380 participants who received the PECS II block. The selected studies were published between 2017 to 2019 and in the English language. Patient demographics were quite similar across all selected studies. All patients within the selected RCTs underwent some form of mastectomy surgery with or without node involvement and were of the female gender. Most of the studies' patient demographics included patients with ASA levels of 1-2, with the exception being Al Ja'bari et al. and Versyck et al. who included ASA level 3 patients in their respective studies.^{12,16}

Methodology. Five RCTs conducted their study by comparing the PECS II block with general anesthesia to the use of general anesthesia alone.^{13,14,15,18,19} Two of the studies compared the PECS II block with a local anesthetic to the PECS II block with 0.9% normal saline.^{16,17} While most of the studies administered the PECS II block while the patients were under general anesthesia, Kumar et al. administered the PECS II block in the preoperative setting.¹⁹ Three of the studies performed the PECS II block with 0.25% bupivacaine, while administering 10 milliliters of the local anesthetic between the Pmm and the PMm, and 20 milliliters between the Pmm and the serratus anterior muscle.^{15,16,19} 0.5% Ropivacaine was used for two of the studies with the same amounts used for the injections.^{13,14} The last two studies utilized 0.25% levobupivacaine as their local anesthetic, again with the same amount of local anesthetic injected into the fascial planes.^{17,18}

Definitions and Findings of Outcomes

Six studies reported statistically significant differences in terms of the postoperative pain experienced by the patients. Neethu et al. and Khemka et al. reported that Visual Analog Scores (VAS) for pain were decreased in the PECS group immediately after surgery.^{14,18} Similarly, Najeeb et al. found a statistically significant reduction immediately after surgery at 0hr, 6hr, 12hr, and 24 hr ($P < 0.001$).¹⁵ Senapathi et al. discovered a statistically significant decrease in VAS pain scores at 3, 6, 12, and 24 hours after surgery ($P = 0.001$).¹⁶ Versyck et al. found that pain scores on the Numerical Rating Scale (NRS) were significantly lower in the PACU setting ($P = 0.048$).¹⁷ Kumar

et al. found a significant decrease in VAS pain scores at rest and on abduction at all time intervals ($P < 0.0001$ for both).¹⁹ However, one study reported no statistically significant difference in terms of postoperative pain experienced by the patients. Al Ja'bari et al. reported that pain scores at 24h and 48h were not significantly different between the two groups ($P = 0.39$ and $P = 0.09$ respectively).¹³

Six studies reported a decrease in opioid consumption. Al Ja'bari et al. reported a significant reduction in 24h and 48h postoperative morphine dose ($P = 0.04$).¹³ Similarly, Neethu et al. found a significant reduction in 24h fentanyl requirements in the PECS group perioperatively ($140.66 \pm 31.80 \mu\text{g}$) and postoperatively ($438 \pm 71.74 \mu\text{g}$) when compared to the control group perioperatively ($218.33 \pm 23.93 \mu\text{g}$) and postoperatively ($609 \pm 53.00 \mu\text{g}$, $P = 0.001$).¹⁴ Senapathi et al. found a statistically significant reduction in the intraoperative and 24h postoperative opioid consumption ($P \leq 0.05$).¹⁶ Versyck et al. and Khemka et al. also reported a significant reduction in postoperative opioid requirement ($P = 0.037$ and $P < 0.01$, respectively).^{17,18} Versyck et al. further note that patients in the PECS group required significantly fewer interventions for postsurgical opioid administration as compared to the patients in the control group ($P = 0.045$).¹⁷ Kumar et al. also reported a significant reduction in 24h total tramadol consumption in the group who had received general anesthesia along with ultrasound-guided PECS block ($114.4 \pm 4.63 \text{ mg}$) as compared to the group who had received general anesthesia alone (402.88 ± 74.22 , $P < 0.0001$).¹⁹ However, one study showed no significant reduction in opioid consumption. In this regard, Najeeb et al. found that although intraoperative opioid use significantly decreased ($P = 0.009$), postoperative morphine consumption to keep pain scores less than three was statistically non-significantly different between both groups ($P = 1.0$).¹⁵

Risk of Bias

As there can be many sources of bias in RCTs, Cochrane Handbook Collaboration's Risk of Bias tool was applied to evaluate bias in all seven studies included in this systematic review.²⁰ All seven studies utilized a random sequence generation and therefore had a low risk of selection

bias. All the authors except Najeeb et al. and Versyck et al. discussed their concealment method including sequence-generated codes, using a statistical department to allocate randomly, or utilizing sequentially numbered, opaque, sealed envelopes.^{13,14,16,18,19}

Performance bias was also a concern that is mentioned in Cochrane's tool. Five of the studies included in this systematic review were single-blinded meaning only the participants did not know which treatment they were receiving.^{13,14,15,18,19} Two of the studies were double-blinded meaning neither the participants nor the clinicians knew which treatment they were receiving.^{16,17}

Lastly, attrition bias was assessed as part of Cochrane's tool. Only the authors of Versyck et al.'s study discussed exclusion reasons of participants for a protocol violation, which placed this particular study at high risk of attrition bias and must be considered for bias because of incomplete data collection.¹⁷ Although none of the studies stated the possibility of selective outcome reporting, reporting bias is still a concern and may have occurred in the studies.

DISCUSSION OF LITERATURE REVIEW

Summary of Evidence

There were two main outcomes evaluated for this review: postoperative pain experienced by the patient and opioid consumption. As far as postoperative pain, four of the studies employed a visual analog scale (VAS) to assess pain experienced by the patients.^{14,15,18,19} Three of the studies instead used a Numerical Rating Scale (NRS) to assess pain in the postoperative period.^{13,16,17} Six of the seven studies concluded that the use of the PECS II block resulted in improved pain scores when compared to the control group. For opioid consumption, six of the seven studies concluded that patients who received the PECS II block required a decreased amount of opioids whether in the perioperative or postoperative setting.

Limitations of the Systematic Review

One of the strengths of this systematic review is that the studies included in this review had a similar study design. They were all randomized controlled trials representing a high level of evidence. Another strength is that the objective of the systematic review, the inclusion and

exclusion criteria, and the flow chart is clearly presented, which could help in replicating the review by other reviewers.

One of the limitations of this systematic review is that the studies included in this review considered different opioids, including tramadol, morphine, and fentanyl, thereby showing heterogeneity in the treatment given to the participants. Moreover, the sample size showed some variation in the studies, though the variation is not large. In some of the studies, such as that conducted by Al Ja'bari et al., Neethu et al., Senapathi et al., and Kumar et al., the sample size is small that could affect the statistical significance of the findings.^{13,14,16,19} Another limitation is that not all studies considered the blinding of the researchers or experts or participants, such as that conducted by Khemka et al. and Kumar et al. that could be associated with an influence on the pain management during and after the surgery, and could be linked to the biasedness of the findings.^{18,19} Al Ja'bari et al. has not presented any information regarding blinding in their research, so biasedness could not be assessed for this finding.¹³

Recommendations for current practice

The findings of this review show that general anesthesia along with ultrasound-guided PECS block could be recommended in reducing opioid requirements during and after surgery involving breast cancer. The use of ultrasound-guided blocks could also allow the real-time visualization of the placement of the needle, thereby reducing the chances of further complications by reducing the risk of the needle traversing the tumor. Moreover, in clinical practice, the use of PECS block offers several other advantages, such as those related to post-operative pain relief and overall patient satisfaction. The use of PECS block is also recommended as it has also been found helpful in the quick recovery of patients and reducing their hospital stay.

Apart from its advantages, it is also important to consider that ultrasound-guided PECS block is not only a simpler technique, but it is also better as compared to several other techniques, such as paravertebral block and thoracic epidural analgesia after breast surgery. Therefore, this technique could be recommended in situations where all of these techniques could be used.

Recommendations of Future Research

In the future, large-scale randomized controlled trials could be conducted that would also positively affect the statistical significance of the findings. Furthermore, the studies, in the future, must have adequate power so that the larger sample size along with adequate power could help in increasing the chances of applying the conclusions to a larger population. Moreover, the blinding of the researchers, experts, and participants needs to be ensured. Along with the blinding, the allocation concealment (a process in which nobody knows whether the next eligible participant will be placed in the treatment group or the control group) must also be ensured so that the chances of bias can be reduced in the future studies. Researchers may also explore the differences between different types of opioids in association with the study of PECS block. For example, the differences between morphine and fentanyl or the differences between tramadol and any other opioid in association with the intervention of ultrasound-guided PECS block could be studied.

METHODOLOGY OF QUALITY IMPROVEMENT PROJECT

Settings and Participants

The setting for this project will be through an online survey and an educational PowerPoint module with the members of the Anesthesia Department from Miami Beach Anesthesiology Associates (MBAA) at Mount Sinai Medical Center in Miami Beach, Florida. The study will be comprised of anesthesia providers such as CRNAs and Anesthesiologists. Participation will be based on individuals who were invited to take part in the survey through an email list provided by MBAA and will be asked to provide feedback based on their experience with the educational module. The anticipated sample size will be between 5-15 participants.

Description of Approach and Project Procedures

The primary methodology of the proposed project is to administer an online educational module to anesthesia providers that focuses on administering the PECS II block to patients undergoing mastectomy surgery to decrease postoperative pain and opioid consumption. The project will be administered in three stages. The first stage will consist of an online pre-assessment

test that will assess the anesthesia providers knowledge regarding breast cancer, mastectomies, and the PECS II block.

The second stage will include an educational PowerPoint with information regarding the administration of the PECS II Block and its effect on the amount of pain experienced by patients after mastectomy surgery as well as the amount of opioids needed for peri- and post- operative pain management. Providing this education to anesthesia providers is essential to improving outcomes and experiences of patients undergoing mastectomy surgery. Recent studies have shown that the use of the PECS II block as an adjunct for mastectomy surgery has decreased the amount of pain experienced by patients as well as the amount of opioids required for peri- and post- operative pain management. The third and final stage will include a post-assessment survey that will measure the amount of learning experienced by the anesthesia providers as well as their perception of the educational presentation. This information will provide immediate feedback concerning the impact of the educational intervention and will assist in determining how to further provide information on the benefits of the PECS II block for mastectomy surgery.

Protection of Human Subjects

Providers who participated in this survey remained unidentified and the data was secured using a randomized number sequence allocation. The data collected from both surveys were protected on a laptop secured with a password, which ensured the safety of the data. There are minimal perceived risks to the study as it only requires the time spent by each anesthesia provider in the educational intervention.

Data Collection

The primary means of data collection will include a pre-assessment and post-assessment survey to determine the effects of the educational intervention. Both surveys will be done through Qualtrics and will consist of approximately ten questions which focus on knowledge and current practice. The pre-assessment survey will assess knowledge and current perceptions on the educational material, while the post-assessment survey will determine if the participants gained

knowledge from the intervention. The instrument reliability and validity will be measured in accordance with the intervention provided and its effectiveness for the participants. The data collected will be confidential, and no subject identifiers will be recorded during any component of the study.

Data Management and Analysis Plan

The DNP student, who is a co-investigator for this project, will be responsible for administering the survey. The investigator conducted the statistics that will be utilized to evaluate, compare, and analyze the pre-assessment and post assessment. Each question will be compared and analyzed, and the responses recorded to identify the knowledge base before and after the intervention was provided. The outcome of the educational intervention will be measured solely on the results of the pre- and post-test survey questions. Through statistical analysis, the study results will likely identify patterns that will be used to determine the effectiveness of educational intervention.

RESULTS OF QUALITY IMPROVEMENT PROJECT

Pre- and Post- Test Participant Demographics

The demographics are shown in Table 4 below.

Table 4.

Participant Demographics

Demographics	N (%)
Total Participants	12 (100%)
Gender	
Male	7 (60%)
Female	5 (40%)
Age	
<18 yr	0 (0%)
18 – 29 yr	4 (30%)
30 – 49yr	8 (70%)
> 50 yr	0 (0%)
Ethnicity	

Hispanic	1 (8%)
Caucasian	9 (75%)
African American	1 (8%)
Asian/Pacific-Islander	1 (8%)
Other	0 (%)
Education	
Masters	2 (16%)
Doctorate	10 (84%)
Years of CRNA Practice	
0 – 2 yr	3 (25%)
2 – 5 yr	7 (58%)
5 – 10 yr	1 (8%)
10 – 20 yr	1 (8%)
> 20 yr	0 (%)

There were 12 participants in the pre- and post- test demographics. Most of the participants were male (n=7, 60%), as opposed to female (n=5, 40%). More than half of the participants were between the ages of 30 – 49 years old (n=8, 70%), and the remaining participants were between the ages of 18 – 29 years old (n=4, 30%). The following ethnicities were represented: Caucasian (n=9, 75%), African American (n=1, 8%), Hispanic (n=1, 8%), and Asian/Pacific-Islander (n=1, 8%). Information was obtained about the participant's level of education, and it was found that the majority had a doctorate's degree (n=10, 84%) and only a few had a master's degree (n=2, 16%). Participants were also questioned about their years of practice as a certified registered anesthetist (CRNA) and a mix of experience was found: 0 – 2 years (n=3, 25%), 2 – 5 years (n=7, 58%), 5 – 10 years (n=1, 8%), and 10 – 20 years (n=1, 8%).

Pre- and Post-test Knowledge Comparison About Breast Cancer and Mastectomy Surgery

Table 5

Questions	Pre-test	Post-test	Difference
What percentage of cancer patients undergoing curative-intent surgery develop chronic opioid use?	17%	83%	66%
Breast cancer affects approximately what percentage of females within the United States?	50%	100%	50%

Approximately what percentage of mastectomy patients experience chronic pain that often leads to chronic opioid use?	17%	83%	66%
Which significant contributing factor can predict chronic pain following mastectomy surgery?	67%	75%	8%

In table 5, knowledge regarding breast cancer and mastectomy surgery is compared between the pre-test and post-test based on the percentage of participants that answered the question correctly. Overall, the higher scores in the post test questions reflect that the knowledge of the participants regarding breast cancer and mastectomy surgery did improve after watching the PowerPoint presentation. The question regarding contributing factors for developing chronic pain had the lowest percentage increase (n=1, 8%), with only one more person answering correctly in the post test. However, there was a 66% increase in participants that were able to correctly identify percentage of patients that develop chronic opioid use and chronic pain. Lastly, there was an increase of 50% in participants that were able to identify the percentage of females affected by breast cancer.

Pre- and Post-test Knowledge and Perspective Comparison of PECS II Block

Table 6

Questions	Pre-test	Post-test	Difference
The PECS II block aims to block the nerves that supply which muscle(s)?	75%	100%	25%
The PECS II Block involves how many fascial planes?	66%	100%	34%
When compared to a paravertebral block or an epidural, the PECS II block offers what advantages?	83%	100%	17%
How effective is the PECS II block in reducing acute postoperative pain and opioid consumption	66%	100%	34%
How likely are you to use alternative methods to decrease postoperative acute pain in patients undergoing mastectomy surgery?	83%	100%	17%
How likely are you to recommend the PECS II block as an anesthetic adjunct for women undergoing mastectomy surgery?	83%	100%	17%

In table 5, knowledge regarding the PECS II block is represented in the first three questions and is compared between the pre-test and post-test based on the percentage of participants that answered the question correctly. Overall, knowledge regarding the PECS II block improved after watching the PowerPoint presentation, as this is reflected by the increase in post-test scores. The question regarding how many fascial planes are involved in the PECS II block experienced the highest difference in post-test scores (n=4, 34%), followed by the question regarding the nerves involved with the PECS II block (n=3, 25%), and lastly the question regarding advantages over other nerve blocks (n=1, 17%).

The last three questions dealt with the practitioner's perceptions of the PECS II block. As seen in table 5 overall perception of the PECS II block increased among the anesthesia providers. The biggest difference is seen in the question regarding the effectiveness of the PECS II block where there was an increase of 34% (n=4). Both questions regarding including the PECS II block in current practice also saw an increase of 17% (n=2).

DISCUSSION OF QUALITY IMPROVEMENT PROJECT

Limitations

Limitations of the study include a small sample size; the survey was emailed to the MBAA email list which was composed of 31 emails but only 12 participants completed the study. A larger sample size could have strengthened the results of the study and provide a sample population that is indicative of the anesthesia providers at Mount Sinai Medical Center. Also, the survey link which contained both surveys and the PowerPoint presentation was only available online for two weeks, perhaps increasing the time allotted to review the material and surveys could have increased the number of responses. Lastly, the project was implemented completely online hindering its delivery by other methods.

Future Implications

The outcomes of this study are important in determining strategies available to participants that will improve knowledge and potentially change practice to improve outcomes in patients

undergoing mastectomy surgery. According to the data collected, the educational intervention provided was effective in increasing anesthesia provider knowledge on the PECS II block and its role in decreasing acute postoperative pain and opioid consumption. Furthermore, there was an increase in the likelihood of utilizing the PECS II block for this patient population. The results of this study can be applied to a wider audience of certified registered nurse anesthetists.

CONCLUSION

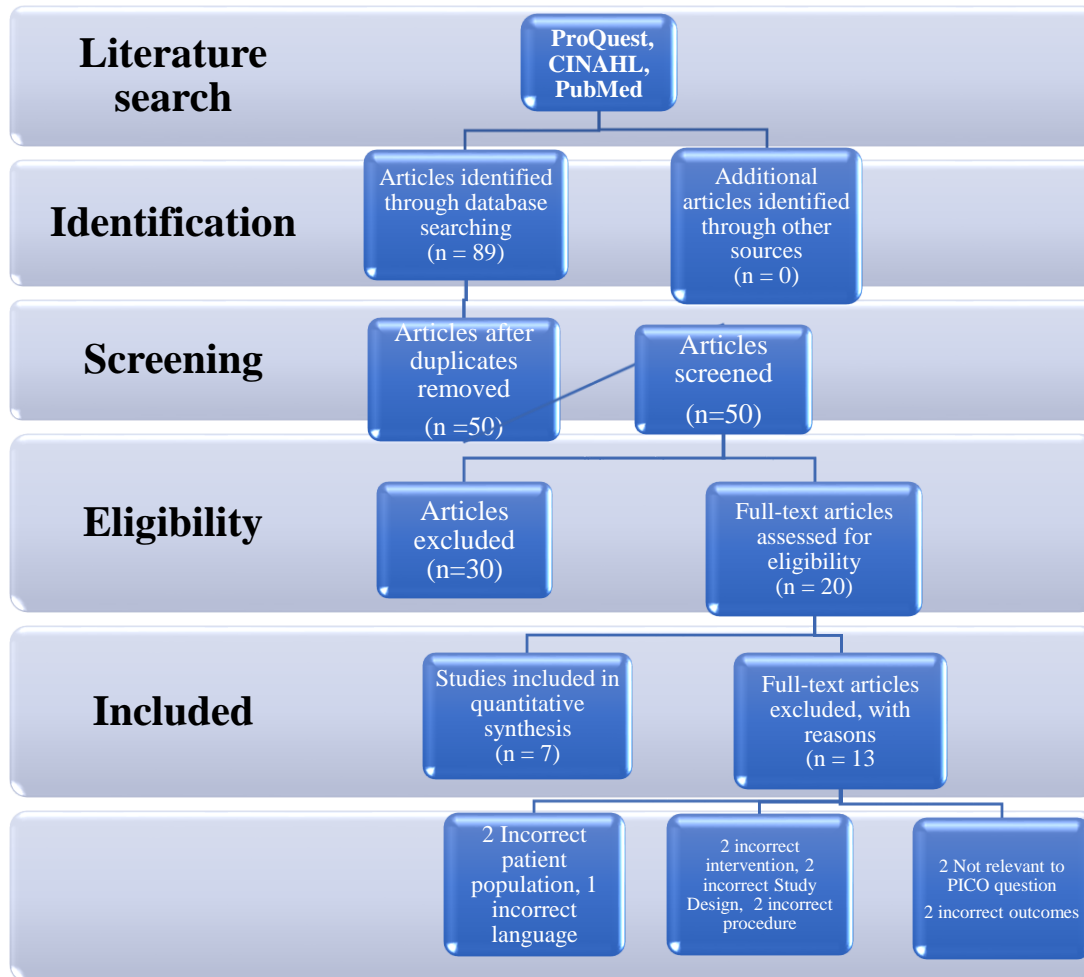
Patient's undergoing mastectomy surgery experience a great amount of pain which can lead to increased opioid consumption and acute postoperative pain scores. As healthcare providers, our first priority is to our patients and to develop plans that set them on the best path to recovery. With mastectomy surgery being so painful, it is prudent to include modalities other than opioids to help decrease pain. As presented in this paper, the PECS II block is an excellent alternative or adjunct that can both decrease opioid consumption and postoperative pain. The quality improvement project which included an educational module regarding the PECS II block showed that anesthesia providers are willing to include this regional technique in their plans for patients undergoing mastectomy surgery.

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Appendix A: PRISMA Flow Diagram



Appendix B: Matrix table

Citation	A. Al Ja'bari, M. Robertson, K. El-Boghdadly and E. Albrecht. <i>A randomised controlled trial of the pectoral nerves -2 (PECS-2) block for radical mastectomy</i> ¹³
Design/Method	Prospective, randomized control trial. Researchers utilized a computer-generated randomisation table to allocate a total of 50 women in a 1:1 ratio, in blocks of 10, to PECS-2 block or no block.
Sample/Setting	Sample: 50 total patients, n=25 experimental group patients, n=25 control group patients. ASA I – III females \geq 18y. Setting: Lausanne University Hospital
Major Variables Studied and Their Definitions	The primary outcome was cumulative morphine dose at 24 postoperative hours. Secondary outcomes were cumulative morphine doses at 2 and 48 postoperative hours, morphine consumption at 24–48 postoperative hours, interval pain scores at rest at 2, 24 and 48 postoperative hours, rates of nausea, vomiting and pruritus at 24 and 48 postoperative hours and participant satisfaction (VAS, 0–10) at 48 postoperative hours
Measurement and Data Analysis	Researchers used a visual analogue scale (VAS) (0–10) to measure immediate postoperative pain and injected morphine 1–2 mg i.v. for pain $>$ 3 or in response to direct request.
Findings	Pectoral nerves-2 block reduced mean (SD) 24-h postoperative morphine dose from 9.7 (8.9) mg to 5.0 (5.4) mg and 48-h morphine dose from 12.8 (12.5) mg to 6.0 (6.5). The 24–48-h interval morphine consumption was 0.8 (1.7) mg and 3.2 (4.5) mg with and without block, respectively
Results	Patients in the experimental group experienced a decrease in postoperative morphine consumption when compared to the control group. Secondary outcomes were not statistically different between the two groups.
Conclusions	Researchers found that the PECS-2 block with ropivacaine 0.5% reduced cumulative 24 h and 48 h morphine dose after radical mastectomy, when compared with no block
Appraisal: Worth to Practice/Level	Strengths: Level I Prospective, randomized control trial. Weaknesses: Small sample size in a university hospital that may limit generalizability of results. Feasibility of use: Authors successfully demonstrated that PECS II block is an effective adjunct to general anesthesia, and doing so reduces postoperative opioid consumption
THEME	This research study addresses the decreased opioid consumption variable addressed within the PICO question

Citation	Neethu M , Ravinder Kumar Pandey, Ankur Sharma, Vanlalnghaka Darlong, Jyotsna Punj, Renu Sinha, Preet Mohinder Singh, Nandini Hamshi, Rakesh Garg, Chandralekha Chandralekha, Anurag Srivastava. <i>Pectoral nerve blocks to improve analgesia after breast cancer surgery: A prospective, randomized and controlled trial</i> ¹⁴
Design/Method	Prospective, randomized, control trial. Patients were randomized into two groups consisting of 30 patients in each group. The first group was the PECS (P) group and the second group was the control (C) group. Group P, patients received both general anesthesia and ultrasound guided combined pectoral nerve blocks (PECS I and II). In group C, patients received only general anesthesia.

Sample/Setting	Sample: 60 total patients. n=30 experimental group patients. n=30 control group patients. ASA I-II females aged 18-70; Setting: Operating rooms in a tertiary care hospital of Northern India
Major Variables Studied and Their Definitions	The primary outcome of this study was to evaluate the analgesic efficacy of combined PECS I and PECS II block with GA in these patients as compared to conventional group (only GA). The secondary outcomes were to find out time to first analgesic request (VAS N3) in post-operative period, limitation of shoulder movement on the operative site at 4 h, 5 h, 6 h and 24 h after surgery, incidence of post-operative nausea and vomiting (PONV) and patient's satisfaction with postoperative analgesia.
Measurement and Data Analysis	The primary outcome was measured by amount of fentanyl requirement in the intraoperative and post-operative period (24 h)
Findings	The mean total fentanyl consumption in the intraoperative period in group P was $140.66 \pm 31.80 \mu\text{g}$ and in group C was $218.33 \pm 23.93 \mu\text{g}$. The VAS scores at rest and movement were significantly less in group P at immediate post-operative period, 30 min, 1 h, 2 h and 4 h in the post-operative period. VAS scores at rest and movement were not statistically significant in all other study periods between the groups
Results	Less fentanyl requirement was observed in the P group during intraoperative and post-operative period up to 24 h. The time to first analgesic requirement was also more in P group in comparison to C group during post-operative period. Less limitation of shoulder movement on the operative site at 4 h and 5 h after surgery in P group in comparison to C group. Patients in group P had a better satisfaction with postoperative analgesia than C group.
Conclusions	Adult women undergoing modified radical mastectomy with a PECS II block as compared to the conventional group experienced a decrease in the total amount of fentanyl required in the intraoperative and post-operative period, decreased pain rating scales in the postoperative period which led to an increased duration for time to first analgesic requirement, and experienced less limitation of shoulder movement (pain free mobilization) on the operative site at 4 h and 5 h after surgery.
Appraisal: Worth to Practice/Level	Strength: Level 1 RCT, excellent data collection that adds value to the study's conclusions. Weakness: small sample size at one clinical site, not able to check success of the block as it was done after induction. Feasibility of use: These authors provided more than enough information to warrant the use of PECS II block as an adjunct to general anesthesia for patients undergoing mastectomies.
THEME	The theme of this research study parallels the PICO question set forth in this paper. The authors were able to successfully demonstrate that patients who received a PECS II block had a decreased opioid consumption postoperatively and decrease Visual Analog Scale (VAS) scores.

Citation	Hammad Nabeel Najeeb, Syed Raza Mehdi, Athar Mukhtar Siddiqui and Syeda Kiran Batool. <i>Pectoral Nerves I, II and Serratus Plane Blocks in Multimodal Analgesia for Mastectomy: A Randomised Clinical Trial</i> ¹⁵
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Design/Method	Prospective, randomized control trial. Patients were then randomly assigned to one of the 2 groups using a predetermined random 1:1 sequence. Group A (PECS block group) received pectoral nerve I, II and serratus plane block and general anesthesia (n=60) and Group B (Control group) received general anesthesia alone (n=60) along with standard perioperative analgesia which included paracetamol, non-steroidal anti-inflammatory medication and morphine intravenously.
Sample/Setting	Sample: 120 total patients. n=60 experimental group patients, n=60 control group patients. Setting: Department of Anesthesiology, Shaukat Khanum Memorial Cancer Hospital Lahore (SKMCH)
Major Variables Studied and Their Definitions	Primary objective was to assess pain score in first 24 hours in PECS block group undergoing mastectomy; secondary objective was to observe opioid and antiemetic consumption in the postoperative period
Measurement and Data Analysis	Registered nurses, that were blinded to the patient grouping, assessed the postoperative pain using the Numerical Pain Rating Scale at the time of arrival at PACU (0 minute) and then at 30 minutes after surgery and at discharge from PACU. Pain score was further assessed at the surgical floor at 6 hours, 12 hours and 24 hours post-surgery by the ward nurses who were trained in pain assessment and NPRS
Findings	Patients who received the PECS block had an average pain score of 1 in the immediate postoperative period whereas the control group had an average 2.4 in the same time period. Furthermore, at 6hrs postop, the PECS group had an average score of 0.8, whereas the control group had an average of 2.2 in the same time period
Results	Patients in the PECS experienced significantly lower NPRS scores when compared to the control group. Patients in the PECS group also consumed less opioids in the postoperative period when compared to the control group
Conclusions	The authors concluded that the PECS block produced better quality analgesia when combined with general anesthesia than with general anesthesia alone.
Appraisal: Worth to Practice/Level	Strengths: Level I RCT, generous sample size, authors were able to successfully demonstrate how PECS II block decreases NPRS scores Weakness: As with other studies, the level or density of the block could not be determined as it was done under anesthesia. Feasibility of use: This study not only showed the efficacy of PECS II block but also showed how it led to decreased opioid consumption which in turn led to decreased Postoperative nausea and vomiting and therefore less use of ondansetron.
THEME	This study adequately addresses the main concepts in the aforementioned PICO question. The authors were able to demonstrate how the PECS II block sufficiently decreases opioid consumption and acute postoperative pain

Citation	Senapathi, Tjokorda Gde Agung; Widnyana, I. Made Gede; Aribawa, I. Gusti; Ngurah Mahaalit; Jaya, A. A. Gde Putra Semara; Junaedi, I. Made Darma. <i>Combined ultrasound-guided Pecs II block and general anesthesia are effective for reducing pain from modified radical mastectomy</i> ¹⁶
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Design/Method	Double-blind RCT. Patients were split into two groups: PECS groups or control group. The PECS group received the PECS block with 0.25% bupivacaine. The control group received the PECS block with 0.9% NaCl.
Sample/Setting	Sample: 50 total patients. n=25 experimental group patients. n=25 control group patients. ASA I-II, ages 16-65 years Setting: Sanglah Hospital
Major Variables Studied and Their Definitions	The independent variable in this study is the is the PECS II block either with 0.25% bupivacaine or 0.9% NaCl. The dependent variables are intraoperative opioid consumption, postoperative pain, and postoperative opioid consumption.
Measurement and Data Analysis	Postoperative pain was measured with the VAS score. Intraoperative opioid consumption was measured in terms of mcg of fentanyl. Postoperative opioid consumption was measured in terms of mg of morphine
Findings	Intraoperative opioid consumption was 125 mcg of fentanyl for the Pecs group and 250 mcg of fentanyl for the control group. VAS scores at 3 hours postoperatively were 0.8 for the PECS group and 2.8 for the control group. Postoperative opioid consumption was 3 mg of morphine for the PECS group and 11 mg of morphine for the control group
Results	The PECS group did significantly better than the control group in all aspects of the dependent variables
Conclusions	The authors of this study concluded that the PECS II block in conjunction with general anesthesia is an effective modality in reducing intra and post-operative pain for patients undergoing mastectomies
Appraisal: Worth to Practice/Level	Strengths: Level I double-blinded RCT, effective data retrieval supporting the use of PECS II block Weakness: Small sample size Feasibility of use: The authors were able to explain the advantages of the PECS block as opposed to other regional techniques
THEME	This study was able to support both aspects of the PICO question proposed earlier in this paper.

Citation	Barbara Versyck, MD, Geert-Jan van Geffen, MD, PhD, Patrick Van Houwe, MD. <i>Prospective double-blind randomized placebo-controlled clinical trial of the pectoral nerves (Pecs) block type II</i> ¹⁷
Design/Method	Double-blind RCT. Patients were split into two groups: PECS groups or control group. The PECS group received the PECS block with 0.25% levobupivacaine. The control group received the PECS block with 0.9% NaCl.
Sample/Setting	Sample: 140 total patients. n=70 experimental group patients. n=70 control group patients. ASA I-III females, ages 18 – 80 years with tumor stage 1-3 breast cancer undergoing mastectomy. Setting: GZA Ziekenhuizen Campus Sint-Augustinus hospital in Belgium
Major Variables Studied and Their Definitions	Independent variable in this study is the PECS II block with either 0.25% levobupivacaine or 0.9% NaCl. Dependent variables include postoperative pain and postoperative opioid consumption
Measurement and Data Analysis	Postoperative pain was measured using the NPRS system. Postoperative opioid consumption was measured in oral morphine equivalents (OME)

Findings	Patients in the PECS group averaged 9 mg of OME in order to achieve a NPRS of less than 3 while patients in the control group averaged 15 mg of OME to achieve the same score.
Results	Patients in the PECS group experienced less pain than those in the control group in the immediate postoperative period. As a result, the PECS group had a lower consumption of OME in the postoperative period when compared to the control group
Conclusions	The authors of this study determined that the PECS II block results in lower pain levels and ultimately reduces postoperative opioid consumption during the PACU stay
Appraisal: Worth to Practice/Level	Strengths: Level I Double-blinded RCT. Impressive sample size. Weaknesses: Due to a protocol violation by one anesthesiologist, some participants had to be excluded from data analysis
THEME	This study adequately addressed both aspects of the PICO question.

Citation	Rakhi Khemka, Arunangshu Chakraborty, Sanjit Agrawal, Rosina Ahmed. <i>Is COMBIPECS the answer to perioperative analgesia for breast surgery? A double blinded randomized controlled trial</i> ¹⁸
Design/Method	Double-blinded randomized control trial. Patients were randomized into a PECS experimental group and a control group. The PECS group received the PECS II block whereas the control group underwent surgery with no PECS block
Sample/Setting	Sample: 100 total patients. n=50 experimental group patients. n=50 control group patients. ASA I-II females ages 18-65 years. Setting: Tata Medical Center, India
Major Variables Studied and Their Definitions	The independent variable in this study is the administration of the PECS II block. Dependent variables in this study include postoperative pain and postoperative opioid consumption.
Measurement and Data Analysis	Postoperative pain was measured using the VAS scale, while postoperative opioid consumption was measured by cumulative intravenous morphine consumption from patient-controlled analgesia (PCA) pump.
Findings	Patients in the PECS group reported an average VAS score of 0.96 in the immediate postoperative period whereas patients in the control group reported an average of 2.2. Patients in the PECS group used an average of 0.4 mg of morphine on the PCA pump in the immediate postoperative period whereas patients in the control group used an average of 2.42 mg of morphine.
Results	Patients in the PECS group experienced better VAS scores as well as decreased postoperative consumption.
Conclusions	The authors of this study determined that the PECS II block in conjunction with general anesthesia effectively reduced perioperative opioid consumption and VAS scores.
Appraisal: Worth to Practice/Level	Strengths: Level I double-blinded RCT. The authors provide a new manner in completing the PECS II block with a sole injection. Weaknesses: The anesthesiologists could not be blinded to group allocation.
THEME	This study further solidifies the two points proposed in the PICO question regarding opioid consumption and reducing acute postoperative pain.

Citation	Satish Kumar, Deepali Goel, Santosh Kumar Sharma, Shahbaz Ahmad, Priyanka Dwivedi, Narendra Deo, Raka Rani. <i>A randomised controlled study of the post-operative analgesic efficacy of ultrasound-guided pectoral nerve block in the first 24 h after modified radical mastectomy</i> ¹⁹
Design/Method	Prospective, randomized control trial. Patients were randomized into two groups. Group I underwent mastectomy under general anesthesia alone. Group II underwent mastectomy under general anesthesia combined with PECS II block.
Sample/Setting	Sample: 50 total patients. n=25 experimental group patients. n=25 control group patients. ASA I-II females undergoing mastectomy surgery for breast cancer. Setting: Tertiary care teaching hospital in India
Major Variables Studied and Their Definitions	The independent variable in this study is the use of a PECS II block for pain management. Dependent variables include patient-reported pain intensity and postoperative opioid consumption
Measurement and Data Analysis	Patient's reported postoperative pain using the VAS system. Postoperative opioid consumption was reported as 24-h tramadol consumption
Findings	VAS scores for group I averaged 3-4 in the postoperative period whereas the VAS scored for group II averaged 1-2.
Results	Group II patients who received the PECS II block experienced significantly lower VAS scores as well as decreased opioid consumption when compared to group I
Conclusions	The authors concluded that the PECS block offers superior advantages for the treatment of postoperative pain management.
Appraisal: Worth to Practice/Level	Strengths: Level I RCT. The PECS block was done before induction and so researchers were able to determine the density of the block. Weaknesses: Small sample size.
THEME	This study supports the two variables proposed in the PICO question regarding opioid consumption and postoperative pain.

Appendix C: IRB Exemption



Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To: Dr. Vicente Gonzalez

CC: Erik Gonzalez

From: Elizabeth Juhasz, Ph.D., IRB Coordinator *EJ*

Date: June 4, 2021

Protocol Title: "PECS II Block and Its Role in Reducing Opioid Consumption and Acute Postoperative Pain in Mastectomy Patients: An Evidence Based Educational Module"

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the **Exempt Review** process.

IRB Protocol Exemption #: IRB-21-0204 **IRB Exemption Date:** 06/04/21
TOPAZ Reference #: 110219

As a requirement of IRB Exemption you are required to:

- 1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
- 2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
- 3) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at <http://research.fiu.edu/irb>.

EJ

Appendix D: QI Project Survey



Pretest and Posttest Questionnaire:

PECS II Block to Reduce Acute Postoperative Pain and Opioid Consumption in Mastectomy Patients

INTRODUCTION

The primary aim of this QI project is to improve the knowledge of CRNAs regarding the use of the PECS II block to decrease acute postoperative pain and opioid consumption in women undergoing mastectomy surgery.

Please answer the question below to the best of your ability. The questions are either in multiple choice or true/false format and are meant to measure knowledge and perceptions on Acute postoperative pain treatment using the PECS II Block.

PERSONAL INFORMATION

1. **Gender:** Male Female Other _____
2. **Age:** _____
3. **Ethnicity:** Hispanic _____ Caucasian _____ African _____ American Asian _____
Other _____
4. **Position/Title:** _____
5. **Level of Education:** Associates _____ Bachelors _____ Masters _____ Other _____
6. **How many years have you been an anesthesia provider?**

Over 10 5-10 years 2-5 years 1-2 years

QUESTIONNAIRE

- 1. What percentage of cancer patients undergoing curative-intent surgery develop chronic opioid use?**
 - a. 20%
 - b. 10%
 - c. 15%
 - d. 65%

- 2. Breast cancer affects approximately what percentage of females within the United States?**
 - a. 8%
 - b. 12%
 - c. 15%
 - d. 3%

- 3. Approximately what percentage of mastectomy patients experience chronic pain that often leads to chronic opioid use?**
 - a. 20-30%

b. 10-20%

c. 40-50%

d. 80-90%

4. Which significant contributing factor can predict chronic pain following mastectomy surgery?

a. Severe acute postoperative pain

b. Procedure duration

c. Patient age

d. Patient gender

5. The PECS II block aims to block the nerves that supply which muscle(s)?

a. Pectoralis Major Muscle

b. Pectoralis Minor Muscle

c. Serratus Anterior Muscle

d. All of the above

6. The PECS II Block involves how many fascial planes?

a. 1

b. 3

c. 2

d. 4

7. When compared to a paravertebral block or an epidural, the PECS II block offers what advantages?

- a. Avoids intravascular local anesthetic injection
- b. Blocks the long thoracic nerve
- c. Blocks thoracodorsal nerves
- d. All of the above

8. The PECS II block reduces acute postoperative pain and opioid consumption

- a. Effectively
- b. Somewhat effectively
- c. Somewhat ineffective
- d. Most ineffectively

9. How likely are you to use alternative methods to decrease postoperative acute pain in patients undergoing mastectomy surgery

- a. Most likely
- b. Somewhat likely
- c. Somewhat unlikely
- d. Most unlikely

10. How likely are you to recommend the PECS II block as an anesthetic adjunct for women undergoing mastectomy surgery?

- a. Most likely
- b. Somewhat likely
- c. Somewhat unlikely
- d. Most unlikely

Appendix E: QI Presentation

PECS II BLOCK FOR MASTECTOMY PATIENTS: AN EDUCATIONAL MODULE

Erik Gonzalez RN, BSN, DNP Student

1


Learning Goals

After this module you will:

- Understand acute postoperative pain and opioid consumption associated with mastectomy surgery
- Explain the anatomy and nerves blocked with the Pectoralis II (PECS II) block
- Discuss the use of the PECS II block in mastectomy patients to decrease acute postoperative pain and opioid consumption

2


Background



- There is a growing opioid epidemic in the United States and unfortunately surgery plays a vital role in the relationship between patients and opioids
- Approximately 6-8% of opioid-naïve patients undergoing non-cancer related surgery develop ongoing opioid use
- For cancer patients undergoing curative-intent surgery, up to 32% of patients develop ongoing opioid use
- One specific population that can suffer from ongoing opioid use is females undergoing mastectomy surgery

3

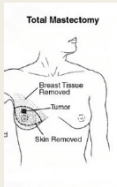
Breast Cancer Prevalence



- Breast cancer affects approximately 32% of females in the United States
- In 2018, there were an estimated 286,000 cases of newly diagnosed breast cancer
- As of late, breast cancer mortality has steadily increased due to enhanced screenings for breast cancer and better treatment
- Treatment can include Breast conserving surgery (BCS), chemotherapy, radiation and mastectomy
- In a recent study, patients that were eligible to undergo BCS opted instead to undergo mastectomy surgery for various reasons including fear of cancer recurrence, unwillingness to undergo radiation, and need for symmetry among both breasts

4

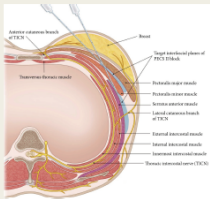
Mastectomy Surgery and Chronic Pain



- Approximately 20-30% of patients undergoing mastectomy surgery experience chronic pain 6 months into recovery
- Chronic pain in this patient population can have several deleterious side effects such as increased healthcare costs, increased feelings of anxiety and depression, and reliance on opioids for pain management
- Recent studies have shown that one predictive factor for increased prevalence of chronic pain in mastectomy patients is the amount of acute postoperative pain they experience
- Therefore, if acute postoperative pain can be managed appropriately then the incidence of these patients experiencing chronic pain could potentially decrease
- One adjunct that could possibly help with the management of acute postoperative pain is the PECS II Block

5

PECS II Block



- The PECS II Block is a regional anesthesia technique that could be employed to decrease the amount of acute postoperative pain experienced by mastectomy patients
- Muscles involved in the PECS II BLOCK:
 - Pectoralis Major muscle (PMJ)
 - Pectoralis Minor muscle (PMI)
 - Serratus Anterior muscle (SA)
- Nerve groups blocked:
 - Pectoral nerves
 - Anterior divisions of the thoracic intercostal nerves from T2 through T6
 - Long thoracic and musculocostal nerves

6

How to perform a PECS II Block

- First, place the transducer at the midaxillary level and angled laterally, the adjust for the axillary artery, axillary vein and the internal TB to be identified.
- Second, slide the transducer caudally until the third rib is in view. At this point, the transducer should be rotated to allow for an in-plane needle approach from medial to lateral.
- Third, move the transducer towards the lateral aspect of the Pinn until all three muscles can be identified.
- Fourth, using an in-plane approach, the needle is inserted from medial to lateral until it reaches the fascial plane between the Pinn and the Pinn. Proper placement can be confirmed by hydro-dilatation of the two muscles when local anesthetic is injected. Pinn, after proper separation, the needle is inserted further until it reaches the fascial plane between the Pinn and the serratus anterior muscle. As with the first injection, proper placement can be confirmed when local anesthetic is injected, and hydro-dilatation occurs.

7

Advantages of PECS II Block

- When compared to a paravertebral block or epidural, the PECS II block is a relatively simpler and safer regional anesthesia technique.
- Changes for intravascular injection of a local anesthetic are decreased because the PECS II block is a fascial plane block.
- Also, the PECS II block can block the medial and lateral pectoral nerves as well as long thoracic and thoracoacromial nerves, whereas the other techniques cannot.

8

Studies and Data

Author/Year/Level of Evidence	Study, Population, Intervention, & Setting	Findings in PECS II Block (9 Studies)
Chen et al. (2015) Level 1	50 patients with breast cancer undergoing mastectomy. PECS II block vs. general anesthesia. PECS II block resulted in lower opioid consumption.	PECS II block vs. general anesthesia. PECS II block resulted in lower opioid consumption. P=0.002.
Wang et al. (2015) Level 1	50 patients with breast cancer undergoing mastectomy. PECS II block vs. general anesthesia. PECS II block resulted in lower opioid consumption.	PECS II block vs. general anesthesia. PECS II block resulted in lower opioid consumption. P=0.002.
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9

Discussion and Findings

- 5 of the studies compared the PECS II block with general anesthesia, while the other 2 studies compared the PECS II block with a local anesthetic versus the PECS II block with normal saline.
- All seven studies determined that the use of the PECS II block decreased overall opioid requirements in patients undergoing mastectomy surgery.
- Six of the studies were able to prove that the use of the PECS II block can lead to improved pain scores in the postoperative period.

10

Conclusion

- Females with breast cancer undergoing mastectomy surgery are at an increased risk for experiencing chronic pain and opioid dependency.
- The PECS II block is an excellent adjunct that is safer than other regional anesthetic techniques.
- As seen in the studies, the PECS II block decreases opioid consumption both intra- and post-operatively and also improves pain scores in the postoperative period.

11

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1. Chen et al. (2015) PECS II Block vs. General Anesthesia for Breast Cancer Mastectomy: A Randomized Controlled Trial. *Journal of Clinical Anesthesia*, 28(1): 1-6.

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12