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Efficacy of Erector Spinae Block versus Paravertebral or Thoracic Epidural in Cardiac Surgery: An Evidence-Based Educational Module

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By

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ABSTRACT

Background: Cardiac surgery is associated with significant postoperative pain, traditionally managed with opioids and epidural techniques. The erector spinae (ESP) block, providing analgesia to the anterior, lateral, and posterior chest wall, is described as a simplistic safe alternative to the thoracic epidural (TEA) or paravertebral block (PVB) for cardiac patients . The literature suggests that its minimal risk of vascular puncture, hypotension, or local anesthetic toxicity and superior postoperative pain scores enhance patient recovery after cardiac surgery. This doctoral project aimed to answer the PICO question: In adult cardiac surgical patients, is the use of the erector spinae block, compared to the paravertebral block or thoracic epidural analgesia, effective in decreasing postoperative pain and complications?

Methods: The proposed project's primary approach is to engage anesthesia providers with an online educational intervention that emphasizes the advantages of the ESP block for cardiac surgery. The improvement in provider knowledge before and after the intervention was measured using pre- and post-assessment surveys. There will also be an evaluation of the ESP block's likelihood of use and recommendation for heart surgery.

Results: The educational intervention led to a general enhancement in provider knowledge. Overall, the probability of using and endorsing the ESP block increased.

Conclusion: Inadequate postoperative pain management is linked to increased morbidity and mortality. The impact of enhanced recovery after surgery and fast-tracking protocols necessitates implementing effective multimodal techniques. The ESP block offers a cost-effective alternative for the cardiac surgery patient compared to the thoracic epidural and paravertebral block. The ESP block was found to have comparable pain control or better pain control with fewer adverse effects. Implementation of the ESP block as a multimodal analgesic strategy in the cardiac surgical patient can enhance recovery after cardiac surgery. Its favorable safety profile is a cost-effective alternative to the TEA and PVB.

Keywords: Erector spinae plane block, cardiac surgery, adult, regional anesthesia, thoracic epidural, thoracic paravertebral block

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INTRODUCTION

Description of Problem

Cardiac surgery is associated with significant postoperative pain, even with video-assisted operations using minimally invasive techniques.[2-4] Traditionally these surgeries are performed with heavy narcotic use. [1,2] The deleterious ramifications of narcotic in the recovery period have been extensively described.[2,3] The literature delineates multimodal anesthesia as the most comprehensive strategy to address this issue.[1-4] Multimodal anesthesia in cardiac surgery, typically incorporates regional methods such as epidural nerve block, paravertebral nerve block, with general anesthesia, as popular strategies which can provide optimal peri-operative and post-operative pain management.[2,3]

However, these multi-modal techniques come with severe complications such as hematomas, pneumothorax, or can be contraindicated because of patients' anatomy or anticoagulant therapy which the cardiac patient population is typically on.[2] The erector spinae plane block is an alternative that can continue to promote the fast-tracking approach which has revolutionized modern cardiac surgery.[3,4]

Background and Significance

The erector spinae plane (ESP) block is a novel regional anesthesia technique first described in the treatment of chronic thoracic neuropathic pain.[1,2] ESP block is classified as an intrafascial plane block that is injected through the fascial layers of the erector spinae muscle.[1] It targets the spinal nerve at the dorsal and ventral rami, and provides analgesia to the anterior, lateral, and posterior chest wall.[1-3] Following cardiac surgery inadequate pain management has been proven to increase morbidity and mortality.[2] The literature describes the use of opioids

exclusively, for analgesia as having a plethora of adverse effects that can complicate and lengthen the patient's recovery time.

Thoracic epidural (TEA) is currently considered the gold standard in regional anesthesia for postoperative cardiothoracic pain. While the outcomes indicate that TEA provides excellent pain relief, there are significant adverse effects that have been described such as bleeding, hematoma, infection, post-dural puncture headache, local anesthetic toxicity, and paresthesia. With placement of TEA block patients are typically required to stay in the cardiac intensive care unit automatically for one or more nights. This can be a determent for providers to the use of regional anesthesia for cardiothoracic patients. The ESPB can be placed bilaterally using continuous infusion catheters to provide postoperative analgesia that does not require a stay in the unit. The other regional technique commonly described in the cardiac surgery is the paravertebral block. This block has been noted to carry increased risk for pneumothorax. This complication alone deters providers from the implementation of this technique.

The ESPB has been described as simpler to perform in comparison to the TEA and paravertebral blocks. The literature indicates that it provided a safer alternative to both TEA and paravertebral block. With its decreased risk of adverse complications, better postoperative pain scores and more straightforward technique the ESPB can be a more lucrative choice for pain management in cardiac surgical patients.

Scope of Problem

In modern medicine enhanced recovery after surgery (ERAS) protocols have been heavily researched and implemented into practice.[4] These ERAS protocols are associated with shorter hospital stay, lower costs, and improved patient outcomes.[4] ERAS protocols in thoracic and cardiac surgery are not as well researched as colorectal surgery.[4] Yet, the prevalence of fast-

tracking in cardiac surgery today necessitates the implementations of multimodal techniques that facilitate fast-tracking and ERAS for this patient population.[2-4] In accordance with the literature, data indicates that the ESP block provides a safe and efficient pain control in cardiothoracic surgery.[1,3]

Research data regarding the efficacy of the ESP block in thoracic surgery is being continually conducted since it was first described in 2016 by Forero *et al*.[1,2] The current research focuses on comparing the use of ESP block versus other neuraxial techniques as well as opioid therapy alone.[2] The data indicates that the ESP block appears to be efficacious in avoiding complications such as hypotension, permeant spinal cord injury, urinary retention, epidural spread, vascular puncture, local anesthetic toxicity that are points of contingency with other blocks.[3] This is due to the anatomy of the target site, the transverse process of T5.[3] It is easily visualized with ultrasound and its location is relatively far from the pleura and major neural or vascular structures.[4-9]

Consequences of the Problem

The consequences to not addressing the issue of finding alternatives to multimodal fast-tracking approach in cardiac surgery can result in delayed recovery for patients as well as unnecessary complications, and inappropriate pain management.[1-4]

Studies conducted comparing ESP to other more commonly used neuraxial techniques indicated lower numerical pain scale ratings and longer analgesia duration with the ESP block.[2-4] The data also indicated that patients who received an ESP block had decreased Intensive Care Unit length of stay and time on mechanical ventilator.[1,2] The ease of visualization of the structures in plane and needle trajectory promote the ESP block as being advantageous for morbidly obese patients and patients with spinal deformities.[3] The literature describes another

added benefit of the ESP block as being able to be performed in various positions.[1,2] These included seated, prone, lateral decubitus or post induction with the patient in surgical position.[2]

Lastly, the literature indicated that the single shot ESP block demonstrated a wide craniocaudal (C7-T1 to T10) spread of the local anesthetic, and more profound blockade with analgesia when compared to other neuraxial techniques such as thoracic epidural or paravertebral block.[2,3]

Knowledge Gaps

Due to the novelty of the ESPB and its emergence into clinical practice in recent years, there is a notable gap in knowledge. The ESP block was first utilized in 2016 for thoracic neuropathic pain. Forero *et al*. described the ESPB as a rescue analgesic technique for failed TEA or paravertebral block. Yet, in cardiac surgery the ESPB is being underutilized due to the notable lack of knowledge between anesthesia providers in regards the efficacy of the regional technique. The small research size of some of the studies indicates knowledge gaps. It is necessary to do a more thorough analysis of the utility of ESP in different cardiothoracic procedures. [1-4]

Proposal Solution

The goal of the ESP block is to enhance the recovery time post cardiac surgery.[1-4] When compared to other neuraxial techniques more commonly used ESP proved to be safe and reliable.[2,3]

LITERATURE REVIEW

Search strategy

The search comprised a full examination of online databases. Several databases were utilized to support the search query these including CINAHL, MEDLINE, EBSCO, Open Access

Journals, Google Scholar, ScienceDirect, Nursing & Allied Health Database, and EMBASE. To increase relevance to topics inclusion and exclusion criteria were added to the search which included full-text, peer-reviewed journals, and randomized control trials. Evidenced-based qualitative studies with high specificity to the research question and RCTs comparing Erector Spinae Plane block to other regional techniques for adult cardiac surgery were selected based on the search inclusion criteria. Searches were conducted using keywords and included the following: “Pain during cardiac surgery”, “Erector Spinae Plane Block”: returned 100 results, “ESP,” “Cardiac surgery,” “ESP compared to TEA”: returned 36 results, “Cardiac surgery,” “ESP”: returned 524 results, “Erector Spinae Plane Block”, “Thoracic Epidural Anesthesia”, “Cardiac surgery” “Cardiac surgery postoperative pain” “RCT”: returned 18 results.

Inclusion and exclusion criteria

The top nine publications that were the most pertinent to ESP block in adult cardiac surgery were reviewed and selected from the search. After application of inclusion & exclusion criteria, the remaining eight studies that address the research question were included. Inclusion criteria included male and female adults undergoing cardiac surgery, ESP block, comparison of ESP block versus TPBP or TEA, cardiac surgery via midline sternotomy and thoracotomy, English language, randomized controlled trials publications dating 2016- present, case studies, systematic reviews, and meta-analysis. Exclusion criteria included age less than 18 years old, procedures using ESP block that were not cardiac or thoracic in nature, non-English, and publications greater than 7 years old.

Results of Individual Studies

Singh et al. compared a continuous catheter ESPB to a continuous TEA in cardiac surgery patients. This randomized controlled trial included a total of 50 cardiac surgical patients. The two groups (Group A and Group B): included 25 people in each. Group A was the Thoracic Epidural (TEA) and Group B for Erector Spinae Block (ESP). After the surgery patients were monitored in the cardiac intensive care unit and were assessed to meet appropriate extubation criteria. Group A received a 15 mL bolus dose of 0.25% plain bupivacaine administered through the catheter placed into the thoracic epidural space, followed by a continuous infusion of 0.125% plain bupivacaine at the rate of 0.1 mL/kg/h until 48 hours post-extubation. Group B received a 15 mL bolus dose of 0.25% plain bupivacaine followed by a continuous infusion of 0.125% plain bupivacaine at 0.1 mL/kg/hour until 48 hours post-extubation, injected in each catheter.

A Visual analog scale (VAS) was recorded in both the groups during rest and cough at the various time intervals post-extubation. Comparable VAS scores were shown between both groups at zero, three, six, and 12 hours of rest and during cough. Both groups indicated a P value > 0.05. Group A demonstrated a statistically significant higher VAS score than Group B at 24 h, 36 h, and 48 h with P values ranging between 0.0001 and 0.007, indicating the likelihood of a longer duration of analgesia with the ESPB. While incentive spirometry measurements and length of ventilator times did not show any statistically significance and were similar between both groups. A finding of notable importance was the difference in cardiac intensive care unit length of stay. Patients in Group A remained in the unit for a total of 3842 ± 962.25 m, while patients in Group B remained in the unit for a total of 3270 ± 1209.34 m resulting in a P value of 0.07. One limitation of note was the small sample size.

In Kukreja et al, continuous thoracic epidural analgesia (TEA), thoracic paravertebral block (PVB) and erector spinae plane (ESP) block are compared for postoperative pain management, opioid requirements, postoperative nausea, and vomiting (PONV), respiratory events and length of stay. The study placed 104 cardiothoracic patients in two three different groups. The groups were the erector spinae plane (n=20), paravertebral (n=34), or thoracic epidural (n=96, only first 50 included for data analysis). The participants PACU discharge time were analyzed. From start of PACU to six hours post-op, six to 12 hours post-op, and 12-24 hours post-op. Other criteria assessed in this study were participants postoperative (within 24 hours) naloxone administration, documented hypoxic event (oxygen saturation <90% or any supplemental oxygen greater than 6L/min nasal cannula or documented respiratory distress), postoperative reintubation within 24 hours, total length of stay, postoperative nausea and vomiting (evidenced by antiemetic administration), failed block evidenced by catheter removal within two days of placement not in the setting of hospital discharge), and patient- controlled analgesia (PCA) pump initiation within 24 hours.

The results of this level II retrospective cohort study indicated that the ESP block when compared with TEA for postoperative pain management in cardiac surgery revealed comparable VAS scores at 0 h, 3 h 6 h, and 12 h. Patients receiving PVB catheter had significantly higher OME requirements than both ESP catheter and TEA patients in PACU ($p < 0.001$). The data collected indicated that the ESP was used as a rescue analgesic for failed TEA after thoracotomy and concluded it was a safe alternative to TEA and PVB.

Krishna et al., a prospective level 1 randomized controlled, single-blinded study. The authors illustrate the analgesic efficacy of the bilateral Erector Spinae block compared with conventional treatment for pain post cardiac surgery in adult patients. 106 cardiac surgery

patients on cardiopulmonary bypass were evaluated in the cardiothoracic intensive care unit. Patients were randomized into 2 groups. ESP block group received ultrasound-guided bilateral ESP block with 3 mg/kg of 0.375% ropivacaine before anesthesia induction at the T6 transverse process level. The paracetamol and tramadol group received paracetamol (1 gm every 6 hours) and tramadol (50 mg every 8 hours) intravenously in the postoperative period. Results indicated that the median pain score at rest after extubation in group 1 was 0 of 10 until hour 6, 3 of 10 at hour 8, and 4 of 10 at hours 10 and 12 post-extubation. These were significantly less in comparison with group 2 ($p = 0.0001$). Patients in group 1 had a significantly higher mean duration of analgesia (8.98 ± 0.14 hours), during which NRS was < 4 of 10, compared with group 2.

Ragavendran et al., compared the use of ultrasound-guided bilateral erector spinae plane block versus a thoracic epidural analgesia in aorto-femoral arterial bypass surgery for analgesic efficacy, hemodynamic effects, and pulmonary rehabilitation. The study design utilized randomization and control over 20 cardiac surgical patients. The participants of the study were placed into two groups Group A: Erector Spinae Block (ESP) (n=10) and Group B: Thoracic Epidural Analgesia (TEA) (n=10. The groups hemodynamic parameters were assessed in the cardiac intensive care unit. The participants heart rate, mean arterial pressure and time interval to receive first analgesic modality post block were measured.

The results demonstrated the heart rate in group B compared to group A at 1 and 2 h post-surgery and at 0.5, 16, 20, and 32 h post-extubation has a P value of < 0.05. The MAP in group B was greater than group A at 60, 90, 120, 150, 180, 210, 240, 270 minutes and at 0 hour post-surgery and at 4 hours, every 4 hours till 32 hours post-extubation demonstrating a P value of < 0.05. Time to receive the first rescue analgesia in group A was less than B ($P < 0.05$). This study

indicated that both ESP block and TEA provided comparable analgesia at rest. However, the risks of the TEA were highlighted as points of contingency when compared to the safety profile of ESP block in cardiac patients. The limitations of note with this study were the sample size.

Summary of Evidence

The literature indicates the ESP block is both a safe and effective analgesic modality for the cardiac surgical patient. It provides similar or more effective pain management after cardiac surgery than both the TEA and the PVB while avoiding adverse effects. Singh et al and Krishna et al, both level one randomized controlled trials, described the ESP block as providing superior analgesia in the cardiac surgical patient when compared to commonly utilized methods of pain relief. Ragavendran et al described the ESP block as having comparable analgesic pain scores to the TEA. However, the risks of the TEA were highlighted as points of contingency when compared to the safety profile of ESP block in cardiac patients. In Kukreja et al, the ESP was used as a rescue analgesic for failed TEA after thoracotomy and concluded it was a safe alternative to TEA and PVB. The nine articles reflect several favorable features for the ESP block in cardiac surgical patients. Collectively the data indicates the ESP block is effective in avoiding complications of hypotension, permanent spinal cord injury, urinary retention, epidural spread, vascular puncture, local anesthetic toxicity, pneumothorax, and hematoma, often observed in epidural and other regional blocks.

Risk of Bias

The potential for bias cannot be eliminated from most epidemiological studies. All studies had the propensity for bias. Therefore, the aim must be to identify bias, weather intentional or unintentional, and minimize or avoid it altogether. There are several sources of bias in the studies, and the Cochrane Handbook Collaboration's Risk of Bias tool was utilized to

evaluate whether there was bias in any of the seven studies used in this systematic review. Out of the of the 9 studies, 6 had an overall low risk of bias because the participants used were randomly selected. The randomized control trials mentioned in this review were single-blinded, this may contribute to bias, but the risks are low. The studies attrition bias was also assessed and there was a low risk of bias noted.

Summary of the Literature

The research demonstrates that when compared to other neuraxial techniques more commonly in cardiac surgery the ESP proved to be safe and reliable. ESPBs have been included in recently published Enhanced Recovery After Cardiac Surgery (ERACS) guidelines, which emphasize the effectiveness of perioperative analgesia, decreased narcotic intake, hemodynamic support, and simplicity of administration. Due to the novelty of the ESPB and its emergence into clinical practice in recent years, there is a notable gap in knowledge. The small research size of some of the studies indicates knowledge gaps. It is necessary to do a more thorough analysis of the utility of ESP in different cardiothoracic procedures. The ESP block is a simple, regional anesthetic that shows promising pain control with no significant adverse effects, even in the anti-coagulated patient.

Literature Review Matrix

Citation	Design/Method	Sample/Setting	Major Variables Studied and Their Definitions	Measurement And Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Nagaraja PS, Ragavendran S, Singh NG, et al. 2018	RCT. Efficacy of continuous thoracic epidural analgesia vs bilateral erector spinae plane block for postoperative pain management in patients undergoing cardiac surgery.	50 cardiac surgical patients. Randomization n=2 groups of 25 each. CVICU.	Group A: TEA (n = 25) Group B: ESP block (n = 25)	Visual analog scale (VAS) was recorded in both the groups during rest and cough at the various time intervals postextubation. MedCalc software version 12.2.1.0 (Ostend, Belgium).	Independent Student's t-test. A two-tailed value of $P < 0.05$ was considered statistically significant. Both groups: VAS scores were revealed at 0 h, 3 h, 6 h, and 12 h ($P > 0.05$) at rest and during cough.	Group A: $P \leq 0.05$) at 24 h, 36 h, and 48 h compared to Group B. Mean VAS in either of the Group was ≤4 both at rest and during cough.	ESP block is easy to perform and can serve as a promising alternative to TEA in optimal perioperative pain management in cardiac surgery.	John Hopkins Evidence-Based Practice Appendix C this article: Level 1 randomized control trial (RCT) without meta-analysis Good quality as defined by the John Hopkins tool kit. Limitation: amount of literature indicating the efficacy of the ESP, with the focus of the literature being on noncardiac patients.

Ragavendran S, Raghu C, Prasad SR, et al. 2022	RCT. Use of ultrasound-guided bilateral erector spinae plane block .vs thoracic epidural analgesia in aorto-femoral arterial bypass surgery for analgesic efficacy, hemodynamic effects, and pulmonary rehabilitation.	20 cardiac surgical patients. Randomization of the two groups of 10 each. CVICU.	Group A: Erector Spinae Block (ESP) (n=10) Group B: Thoracic Epidural Analgesia (TEA) (n=10)	10 cm visual analog scale (VAS).	Student T-test or Mann-Whitney U test Two-tailed value of P < 0.05 HR, MAP, and pain assessment at rest and deep breathing using visual analog scale (VAS) were done till 48-h post-extubation.	HR: ↓ in group B than group A at 1 and 2 h post-surgery and at 0.5, 16, 20, and 32 h post-extubation ($P < 0.05$) MAP: ↓ in group B than group A at 60, 90, 120, 150, 180, 210, 240, 270 minutes and at 0 hour post-surgery and at 4 hours, every 4 hours till 32 hours post-extubation ($P < 0.05$) Time to receive the first rescue analgesia ↓ in group A than B ($P < 0.05$).	Both ESP block and TEA provided comparable analgesia at rest. Further studies with larger sample size are required to evaluate whether ESP block could be an alternative to TEA in aorto-femoral arterial bypass surgery.	Level II randomized control trial (RCT) without meta-analysis. Low quality with a major flaw being the inadequate sample size

Gawęda B, Borys M, Belina B, et al. 2020	RCT, prospective double-blinded. Compare the postoperative pain intensity of patients undergoing cardiac surgery with either an ESP block or an ESP and PECS block combination	30 patients mitral/tricuspid valve repair via mini-thoracotomy CVICU.	ESP or PECS= IV ESP group = DV (1:1 randomization)	Prince Henry Hospital Pain Score (PHHPS) Visual analog scale (VAS) Patient satisfaction Statistica 13.1 software (Stat Soft. Inc., Tulsa, OK, USA)	Student's t-test. The Mann–Whitney U test. A two-tailed value of P < 0.05	PECS + ESP group used significantly less oxycodone than those in the ESP group: median 12 [interquartile range (IQR): 6–16] mg vs. 20 [IQR: 18–29] mg ($p = 0.0004$) No difference was noticed between both groups in PHHPS and spirometry.	The addition of PECS blocks to ESP reduced consumption of oxycodone via PCA, reduced pain intensity on the VAS, and increased patient satisfaction with pain management in patients undergoing mitral/tricuspid valve repair via mini-thoracotomy.	Level II randomized control trial (RCT) with a systematic review Good quality based on John Hopkins toolkit.

Hoogma DF, Rex S, Tournoy J, et al 2021	double-blind, prospective, placebo-controlled trial efficacy of an ESP block with intermittent boluses of ropivacaine on postoperative pain and recovery compared with normal saline following MIMVS.	64 patients undergoing MIMVS PACU CVICU	ESP block with a catheter with either intermittent ropivacaine 0.5% (ropi group)= IV Normal saline 0.9% (placebo group)= DV	NRS for pain two-sided test for a ratio of means (with an alpha=5%) coefficient of variation (CV) (SD divided by the mean) equals to 0.40 p value < 0.05 will be considered significant	A Mann-Whitney U test Shapiro-Wilk W test statistic Timing of analgesic request from the PCIA pump and NRS for pain	ESP block with ropi showed improvement in post op pain and earlier extubateon.	Reduced opioid consumption, pain scores and even faster postoperative recovery after cardiac surgery have been reported with ESP block.	Level II prospective study. John Hopkins toolkit: good quality

Krishna SN, Chauhan S, Bhoi D, et al. 2019	prospective, randomized, controlled, single-blinded study analgesic efficacy of bilateral erector spinae plane (ESP) block compared with conventional treatment for pain after cardiac surgery in adult patients	106 patients' elective cardiac surgery with cardiopulmonary bypass cardiothoracic intensive care unit (ICU)	Group 1: ESP block group= IV Group 2: Intravenous group= DV	Pearson chi-squared test Mann-Whitney U test unpaired Student *t* test Kolmogorov-Smirnov test Statistical Package for Social Sciences version 21 software (SPSS Inc., Chicago, IL)	A value of $p < 0.05$ was considered statistically significant NRS score at rest starting immediately postextubation until 12 hours postextubation. secondary outcomes measured were the total intraoperative fentanyl usage and rescue analgesia requirement in the form of postoperative fentanyl consumption.	Median NRS score reported by group 1 patients until the sixth hour postextubation was 0 of 10 (min-max- 0-0) 8^{th} hour it was 3 of 10 (2-3), at the 10^{th} hour 4 of 10 (3-6), and at the 12^{th} hour 4 of 10 (3-7) The mean duration of analgesia during which the NRS score was < 4 of 10 was significantly higher in group 1 compared with group 2 ($p = 0.0001$)	ESP block provided superior analgesia for a longer duration compared with an intravenous paracetamol plus tramadol regimen	Level 1 RCT. John Hopkins toolkit: good quality

D'hondt N, Rex S, Verbrugghe P, Van den Eynde R, Hoogma D. et al, 2020	Retrospective study efficacy of a continuous Erector Spinae Plane Block (ESP) in Minimally Invasive Mitral Valve Surgery (MIMVS) regarding postoperative pain, opioid consumption and recovery	50 patients undergoing cardiac surgery requiring CPB	ESP group (n=25) received ESP; the control group (n=25) received local wound infiltration	Pearson's correlation coefficient (r)	A value of $p < 0.05$ was considered statistically significant (NRS) for pain postoperative morphine consumption in the post anesthesia care unit (PACU) incidence of postoperative nausea and vomiting (PONV) need for intensive care unit (ICU) admittance and length of hospital stay	NRS for pain was significantly lower on the second day after surgery (3±2 vs 4±2; p = 0,008) ESP was associated with a reduction of PONV (2,5±2,7 vs 4,7±3,8; p = 0,024) Duration of postoperative acetaminophen requirements was shorter in the ESP group (4,2±2,1 vs 5,3±1,2days; p = 0,045)	Favorable effect of the ESP block on analgesia with lower pain scores and a reduction in PONV incidence as compared to the control group. Incidence of adverse events did not differ between the groups.	Level III retrospective study.

Borys M, Gawęda B, Horeczy B, et al. 2019	prospective observational cohort study efficacy of the ESP block in patients undergoing mitral and/or tricuspid valve repair through a right mini thoracotomy	100 adult cardiac patients undergoing MV repair CVICU PACU	ESP block group: IV non-ERAS group: CV	Student's *t*-test Visual analog scale (VAS) Numerical rating scale (NRS) from 0 to 10 Statistica 12.5 software (Stat Soft. Inc., Tulsa, OK, USA)	patient satisfaction with pain management, assessed at the discharge from the hospital. Patients could describe their satisfaction with pain management as perfect (5), good (4), moderate (3), poor (2), or very poor (1) VAS at 2, 4, 6, 8, 12, and 24 h after surgery by nurses. A value of $p < 0.05$ was considered statistically significant	Total oxycodone use was found between women (15.50 (1.17–19.83) mg) & men (20.89 (17.71–24.07) mg) ($t = 2.24$; $p = 0.039$) positive correlation was observed between pain intensity and oxycodone consumption ($r^2 = 0.30$; $p = 0.01$ ESP group (0.6 (0.4–1.1) h) than in the control one (10 (8–17) h, $p = 0.00001$). patients in the ESP group spent fewer days in the intensive care unit (ICU) (1 (1–1)) than individuals in the control group (2 (2–	The ESP block seems to be safe & efficient for pain control in patients undergoing right mini-thoracotomy for mitral and/or tricuspid valve repair.	Level II Study Good quality.

Kukreja P, Herberg TJ, Johnson BM, et al. 2018	retrospective cohort study continuous thoracic epidural analgesia (TEA), thoracic paravertebral block (PVB) and erector spinae plane (ESP) block are compared for postoperative pain management, opioid requirements, postoperative nausea, and vomiting (PONV), respiratory events and length of stay	104 cardiothoracic patients PACU ICU	erector spinae plane (n=20), paravertebral (n=34), or thoracic epidural (n=96, only first 50 included for data analysis)	visual analog scale (VAS) of pain oral morphine equivalents (OMEs) ANOVA and chi-square tests Shapiro-Wilk test Kruskal-Wallis test Fisher's exact test two-sample t-test p-value < 0.05 was considered statistically significant SAS version 9.4 (SAS Institute Inc., Cary, NC, USA)	PACU discharge to six hours post-op. six to 12 hours post-op, and 12-24 hours post-op. postoperative (within 24 hours) naloxone administration, documented hypoxic event (oxygen saturation <90% or any supplemental oxygen greater than 6L/min nasal cannula or documented respiratory distress), postoperative reintubation within 24 hours, total length of stay, postoperative nausea and vomiting (evidenced by antiemetic administration), failed block (evidenced by catheter removal within two days of	2), p = 0.0001). ESP block when compared with TEA for postoperative pain management in cardiac surgery revealed comparable VAS scores at 0 h, 3 h 6 h, and 12 h. Patients receiving PVB catheter had significantly higher OME requirements than both ESP catheter and TEA patients in PACU (p < 0.001) ESP block was utilized in this case report as rescue analgesic technique in thoracotomy after failed TEA	The ESP block can serve as a useful and safe alternative to either TEA or PVB techniques in thoracic surgeries for perioperative pain management.	Level II Good quality

Sobhy MG, Abd El-Hamid AM, Elbarbary DH, Elmeliegy MF. 2021	RCT efficacy of the ultrasound-guided erector spinae plane (ESP) block in analgesia after thoracotomies	60 adult patients undergoing thoracotomies PACU ICU	ESP block group= IV No block = CV	visual analogue scale (VAS) pain scores which were assessed every 6 h for 24 h G*Power© software version 3.1.7 two-sided (two tails) type I error 0.05 and power of 80%, effect size (d) factor 0.8, each group should involve ≥ 27 subjects Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 20 Student's t tests, non-parametric data was presented as (median and interquartile range) Mann-Whitney U test p value was less than 0.05, and the confidence interval was 95%.	placement not in the setting of hospital discharge), and patient-controlled analgesia (PCA) pump initiation within 24 hours. mean in group ESP was 136.33 ± 18.93, and in group C was 131.33 ± 20.16, which is statistically non-significant ($p = 0.32$) type of surgery, there are no statistically significant differences between both groups ($p = 0.8$) both groups in favour of the ESP group with p value < 0.001	Postoperative morphine consumption was 22.06 ± 6.24 mg in the ESP group and 30.6 ± 6.23 mg in the C group ($p < 0.001$). Results showed that there was a significant difference between both groups in favour of the ESP group regarding visual analogue score (VAS) at rest and with coughing ($p < 0.001$).	study findings show that US-guided ESP block exhibits a significant analgesic effect in patients undergoing thoracotomy surgery.	Level I RCT Good quality

					both groups were compared regarding the duration of hospital stay in days, there were highly significant differences in favour of the ESP group with p value < 0.001			

DNP PROJECT OBJECTIVES

PICO Question

In adult cardiac surgical patients, is the use of the erector spinae block, compared to the paravertebral block or thoracic epidural analgesia effective in decreasing postoperative pain and complications?

Primary DNP Project Goal

The ESP block was first utilized in 2016 for thoracic neuropathic pain. Forero *et al*. described the ESP block as a rescue analgesic technique for failed TEA or paravertebral block. When literature comparing other commonly utilized neuraxial techniques was reviewed, it was noted that the ESP block proved to be safe and reliable.[2,3] However, due to the novelty of the ESP block and its emergence into clinical practice in recent years, there is an evident gap in knowledge amongst anesthesia providers. Currently, some providers at the clinical site have begun using the ESP block for certain thoracic lung and cardiac procedures. Yet, the need for continued educational reinforcement cannot be discounted.[1-4]

The goal of this doctoral research project is to educate anesthesia providers at the clinical/immersion site on the benefit of utilizing the ESP block to enhance patient outcomes and recovery post cardiac surgery.[1-4]

Goals and Outcomes

The identification of specific, measurable, attainable/achievable, relevant, and time bound (SMART) goals is necessary to close the gap in knowledge. Creating goals based on the SMART framework allows for a clear and concise plan of action. This framework will assist the author to track progress based on practical goals.[6] The goal is specific and geared towards the educational benefit of ESP block on the adult cardiac surgical patient population. Enhancing

anesthesia providers knowledge on the ESP block will improve patient outcomes. The quantification of the goal will be measured via a pre and posttest that will be conducted at the initiation of the quality improvement project and at the end. The number of providers who understand the benefits of the ESP block should increase by at least 80% from those who participated.

The goal must remain attainable. Therefore, understanding that not all of providers will achieve 100% in their posttest assessment will safeguard the achievability of the goal. Increasing anesthesia providers knowledge on the novel ESP block is relevant to improved patient outcomes, fast-tracking cardiac surgery, providing patients with high-quality and ultimately safe anesthesia care. The goal will be time-bound to three to six months giving the providers ample time to receive their surveys, disseminate the information, and retain the new knowledge learned via the educational module.

CONCEPTUAL UNDERPINNING/ ORGANIZATIONAL ASSESSMENT

Program Structure

To achieve the primary goal of this quality improvement project an educational intervention will be conducted. The educational module will be presented to the anesthesia providers in a 589-bed tertiary care hospital in South Florida. The hospital houses 12 technologically advanced operating room, with three of the rooms dedicated primarily to cardiac surgery.

SWOT analysis

A SWOT analysis was utilized to compartmentalize an organizational assessment of the clinical immersion site. The strengths noted were the high volume of cardiac surgical cases completed daily at the site, the willingness from MDA's and CRNA's to implement regional

techniques into their anesthetic care, and last immersion site being an educational facility. The weaknesses noted were the lack of provider knowledge on what an ESP block entails, and the lack of an enhanced recovery plan for fast-tracking cardiac surgical patients. These weakness result in opportunities for further education and enhancing the anesthesia providers knowledge on ESP block in cardiac surgery. Threats to the implementation would be providers lack of enthusiasm towards the ESP block due to its novelty.[1-4]

METHODOLOGY

Setting and Participants

The primary participants will include providers within the scope of Certified Registered Nurse anesthesiologist (CRNAs) and Medical Doctor Anesthesiologists (MDA) employed within the anesthesia group of the hospital. The anesthesia providers will be asked to participate on a voluntary basis. The anticipated sample size will be between 10-20 participants.

Protection of Human Subjects

Recruitment of participants for this educational intervention will be exclusive to anesthesia providers employed by the anesthesia group within the 589-bed tertiary hospital in Miami Beach, Florida. These will include CRNA's and MDA's. The recruitment will be conducted electronically via email. All CRNA's and MDA's employed by the anesthesia group will receive an email invitation to participate in the study. It will be made clear that the participation is voluntary, and that the participants can withdraw at any point without repercussions. The participants identity and data collected will be protected. The participants will potentially benefit from this educational module and improve adult patient outcomes in cardiac surgery. There are no perceived risks to the study.

Data Collection

The collection of data for the educational intervention will be conducted via a pre and post-test that the participants will be asked to complete. These assessments will assess whether the educational module was effective. The participants will complete the pre and post-test through a Qualtrics survey link that will be sent to them via email. The test will comprise of maximum 10-12 questions which focus on recall knowledge and application into practice of the ESP block. The questions will also assess the likelihood of the participants implementing the ESP block into their practice, and the likelihood of recommending the ESP block for cardiac surgical patients. The pre-test will gauge the providers current knowledge and understanding of ESP block. The post-test questions will be geared towards assessing if the quality improvement project was effective as an educational module. All data collected will remain confidential. There will be no subject identifiers at any stage of this research study.

Data management and analysis plan

The data will be collected using Excel software to propagate the information obtained from the pre and post-test surveys. Collection of data will be completed by the principal investigator of this study, the DNP student. All data will be kept in the principal investigator's password-protected laptop. The response of each question will generate a result as a percentage. This will assist in analyzing the participants knowledge before and the improvement or lack thereof after the educational module was completed. This lead investigator will then disseminate the results and observe a specific pattern. Based on the observed pattern or patterns a determination will be made on whether the educational intervention was effective and the impact it will have on clinical practice.

RESULTS

Participant Demographics

The pre-test demographics are seen in **Table 1.**

Table 1. Pre-test Participant Demographics

Demographic	***n* (%)**
Total Participants	10 (100.00%)
Gender	
Male	8 (80.00%)
Female	2 (20.00%)
Age (Free Response)	
20-29	3 (30.00%)
30-39	7 (70.00%)
Ethnicity	
Caucasian	2 (20.00%)
Black	2 (20.00%)
Hispanic	6 (60.00%)
Position/Title (Free Response)	
CRNA	10 (100.00%)
Level of Education	
DNP	8 (80.00%)
MSN	1 (10.00%)
Experience as an Anesthesia Provider	
5-10 years	1 (10.00%)
2-5 years	6 (60.00%)
1-2 years	3 (30.00%)

The study consisted of 10 participants (*n*= 10) in total. Of the 10 participants there were more male (*n*= 8, 80.0%), than female (*n*=2, 20.0%). A quarter of the participants were between the ages of 30-49 years (n=7, 70.0%), while the rest were between the ages of 18-29 years (n=3, 30.0%). Three ethnic groups participated in this study. The majority were Hispanic (n=6, 60.0%), and 4 were either Caucasian (n=2, 20.0%), or Black (n= 2, 20.0%). Among the participants, the majority were doctoral prepared (n=8, 80.0%), and only one had a master's level

degree (n=1, 10.0%). As of years, of practice as an anesthesia provider; 0-2 years (n=3, 30.0%), 2-5 years (n=3, 30.0%), 5- 10 years (n=1, 10.0%), over 10 years (n=2, 20.0%).

Pre-test Knowledge about ESP block for Cardiac Surgery

A total of 10 participants completed the pre-test evaluating their knowledge about the use of ESP block in cardiac surgery. More than half of the participants (60%) knew the two most common complications of ESP block were failed block and pneumothorax. Only 40% of the participants understood that the ESP block shows minimal risk of bleeding in the anticoagulated patient. Only one of the participants (10%) knew that the thoracic epidural should be avoided in the anticoagulated cardiac patient. Two (20%) understood that regional anesthesia is considered an important component of fast-track, multimodal approach in cardiac surgery. Less than half (30%) of the providers knew that when comparing the paravertebral block to the ESP block, the ESP block has a smaller chance of pneumothorax. None of the participants (0%) demonstrated an understanding of which dermatomes will be covered with a T5 single shot ESP block at T5, (T2-T9). Half of the providers understood that a thoracic epidural would require the patients to be sent to the critical care unit. One provider (10%) knew that the transverse process structure the landmark location for the ESP block with the US guided technique.

Finally, more than half (70%) of the participants were extremely likely (50%) or somewhat likely (20%) to consider using the ESP block for cardiac surgery. Two of them were (20%) were neither likely nor unlikely, and one participant (10.0%) answered that they were somewhat unlikely to implement the use of ESP block in cardiac surgical patients. In assessing whether the providers would recommend using ESP block for cardiac surgery, a little over half of the participants were either extremely likely (20 %) or somewhat likely (40.0%) to recommend. Only one (10%) was somewhat unlikely to recommend using the ESP block for cardiac surgery.

Post-test Knowledge about ESP block for Cardiac Surgery

The post-test evaluation of newly acquired knowledge on the use of ESP block in cardiac surgery was completed by all 10 participants. All questions had an increase in percentage from pre to post. With more than half of the questions demonstrating a greater than 50% increase from the pretest. All the participants (100%) demonstrated understanding on the two most common complications of ESP block, failed block, and pneumothorax. There was an increase of (60%) in the participants who understood that the ESP block shows minimal risk of bleeding in the anticoagulated patient. There was a (80%) increase in the participants that understood these three concepts: which block should be avoided in the anticoagulated cardiac patient; the landmark location of the ESP block and that regional anesthesia is considered an important component of fast-track approach. There was a 70% increase in the providers that understood the ESP block has a smaller chance of pneumothorax when compared to PVB. There was a 100% improvement in the providers that demonstrated an understanding of which dermatomes will be covered with a T5 single shot ESP block at T5, (T2-T9). Finally, there was an improvement of (50%) in the providers that understood which block would require the patient to be sent to the critical care unit.

Lastly, after the educational intervention was almost all the providers (90%) were extremely likely (80%) or somewhat likely (10%) to consider using the ESP block for cardiac surgery. One participant (10.0%) answered that they were somewhat unlikely to implement the use of ESP block in cardiac surgical patients. In assessing whether the providers would recommend using ESP block for cardiac surgery, almost all (90%) of the participants would recommend using the ESP block. One provider (10%) appeared to be indifferent on whether they would recommend the ESP block for cardiac surgery.

Table 2.

Differences in Pre- and Post-test Responses

Correct Responses	*Pre-test*	*Post-test*	*Difference*
Complications of the ESP block can include? (Select 2)	60.0%	100.0%	**40.00%**
Which of the following statements are true regarding the ESP block?	40.0%	100.0%	**60.00%**
An important component of fast-track, multimodal approaches to cardiac surgery includes what?	20.0%	100.0%	**80.00%**
Which of the following regional anesthesia techniques should be avoided in the anticoagulated patient?	10.0%	90.0%	**80.00%**
When compared to the paravertebral block the ESP block has a smaller chance of what complication?	30.0%	100.0%	**70.00%**
A single shot ESP block at the T5 will provides analgesia from:	0.0%	90.0%	**10.00%**
Which regional anesthetic requires a stay in the unit?	50.0%	100.0%	**50.00%**
Which structure is the landmark location for the ESP block on the Ultrasound ?	10.0%	90.0%	**80.00%**

Table 3.

Difference in Pre- and Post-test Likelihood of Use in Practice

How likely are you to consider using thoracic ESP block for cardiac surgical patients?	Pre-test	Post-test	Difference
EXTREMELY LIKELY	50%	80%	**30%**
SOMEWHAT LIKELY	20%	10%	**10%**
NEITHER LIKELY NOR UNLIKELY	20%	0%	**-20%**
SOMEWHAT UNLIKELY	10.0%	10.0%	**0 %**
EXTREMELY UNLIKELY	0%	0%	**0%**

Table 4.

Difference in Pre- and Post-test Likelihood of recommend

How likely are you to recommend thoracic ESP block for cardiac surgery?	Pre-test	Post-test	Difference
EXTREMELY LIKELY	20%	80%	**60%**
SOMEWHAT LIKELY	40%	10%	**30%**
NEITHER LIKELY NOR UNLIKELY	20%	10%	**10%**
SOMEWHAT UNLIKELY	10.0%	0%	**-10.0%**
EXTREMELY UNLIKELY	0%	0%	**0%**

Summary of Data

The data indicates that there was a substantial increase in learned information between the pre- and post-test surveys. There was 90% raise in the number of participants that increased their knowledge following the educational intervention. Only one participant (10%) demonstrated a lack of interest in the education delivered. Upon analysis there appears to be a net gain difference noted in questions answered correctly in the post-test survey. The data demonstrates that the educational intervention was advantageous in increasing provider awareness about the use of ESP block in cardiac surgery.

DISCUSSION

Limitations

The principal limitation of note for this QI project is the small sample size. The survey was sent to Florida International University Alumni via email, however only (n=10) providers were willing to partake in the educational intervention. The strength and trustworthiness of the

study would have increased exponentially with a larger sample size to analyze. It must be taken into consideration the delivery of this study was fully online. This could have limited or influenced the results further. The time frame of completion for the educational module could have inhibited the number of participants willing to undertake this task. Lastly, the learning styles if participants were not integrated in this educational intervention, adding to another possible limitation. Had the setting of this study been postulated in a more controlled setting, with a longer time restraint, and learning styles considered this would provide less limitations and yielded greater accuracy.

Future Implications

The implementation the ESP block in adult cardiac surgery can be monumental in enhancing the recovery of this patient population. The results of this study can be used to increase awareness and knowledge of anesthesia providers regarding ESP block for cardiac surgical patients. This increase in provider knowledge would be influential in shaping strategies that utilize the ESP block as a multimodule technique to improve outcomes in patients undergoing cardiac surgery. In correlation with the data collected, the educational module was effective in increasing anesthesia provider knowledge on the ESP block and the comparative regional anesthesia techniques for the cardiac surgical patient. This evidence-based educational intervention aimed at improving the quality of cardiac surgical patients by increasing the likelihood that anesthesia providers would utilize the ESP block over other regional anesthesia techniques.

CONCLUSION

The evidence obtained from the review of current scholarly studies support the premises for this quality improvement (QI) project. This project seeks to improve provider knowledge on the efficacy of the ESPB in cardiac surgery, and how alternative regional strategies may enhance the recovery of this patient population. However, further research, including randomized controlled trials, is required to certify the safety and effectiveness of the ESP block in cardiac surgery. Yet, it should be considered as a promising technique that may aid anesthesia providers in promoting the fast and safe recovery of patients undergoing cardiac surgery.

Finally, the goal of this quality improvement project was to increase provider awareness on this novel regional technique, in hopes that it may utilized in future anesthetic plans for enhanced recovery after cardiac surgery. Based on the results the author believes that the educational intervention had a positive impact on the anesthesia providers as evidence by the increased likelihood of future use of the ESPB in cardiac surgical patients.

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Appendix A: IRB Exemption

FIU | Research & Economic Development
FLORIDA INTERNATIONAL UNIVERSITY

MEMORANDUM

To: Dr. Valerie Diaz

CC: Camila Marcos

From: Carrie Bassols, BA, IRB Coordinator CeB

Date: March 6, 2023

Proposal Title: "Efficacy of Erector Spinae Block versus Paravertebral or Thoracic Epidural in Cardiac Surgery: An 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-23-0093 **IRB Exemption Date:** 03/06/23
TOPAZ Reference #: 112789

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.
1) 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.

Appendix B: QI Project Consent

FIU | FLORIDA INTERNATIONAL UNIVERSITY

CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT

Efficacy of Erector Spinae Block versus Paravertebral or Thoracic Epidural in Cardiac Surgery: An Evidence-Based Educational Module

SUMMARY INFORMATION
Things you should know about this study:

- **Purpose:** Educational module to increase providers awareness of the benefit of utilizing the ESP block to enhance patient outcomes and recovery post cardiac surgery.
- **Procedures**: If the participant chooses to participate, they will be asked to complete a pretest, watch a voice PowerPoint, and then a post test
- **Duration:** This will take about a total of 20 minutes total.
- **Risks**: There will be minimal risks involved with this project, as would be expected in any type of educational intervention, which may include mild emotional stress or mild physical discomfort from sitting on a chair for an extended period.
- **Benefits:** The main benefit to you from this research is increase the participants knowledge on the ESP block in enhancing patient outcomes in cardiac surgery.
- **Alternatives:** There are no known alternatives available to the participant other than not taking part in this quality improvement project.
- **Participation:** Taking part in this quality improvement project is voluntary.

Please carefully read the entire document before agreeing to participate.

NUMBER OF STUDY PARTICIPANTS:

If the participant decides to be in this study, they will be one of 10 people in this research study.

PURPOSE OF THE PROJECT

The participant is being asked to be in a quality improvement project. The goal of this project is to increase providers' knowledge of the benefit of utilizing the ESP block to enhance patient outcomes and recovery post cardiac surgery you decide to participate, you will be 1 of 15 participants.

DURATION OF THE PROJECT
The participation will require about 20 minutes

PROCEDURES
If the participant agrees to be in the project, PI will ask you to do the following things:
1. Complete an online 10 question pre-test survey via Qualtrics, an Online survey product for which the URL link is provided

2. Review the educational PowerPoint Module lasting 15 minutes via Qualtrics, an Online survey product for which the URL link is provided.
3. Complete the online 10 question post-test survey via Qualtrics, an Online survey product for which the URL link is provided.

RISKS AND/OR DISCOMFORTS
The main risk or discomfort from this research is minimal. There will be minimal risks involved with this project, as would be expected in any type of educational intervention, which may include mild emotional stress or mild physical discomfort from sitting on a chair for an extended period.

BENEFITS
The following benefits may be associated with participation in this project: enhance patient outcomes and recovery post cardiac surgery with increased usage of ESP block. The overall objective of the program is to increase the providers' knowledge based on the current literature.

ALTERNATIVES
There are no known alternatives available to the participant other than not taking part in this project. However, if the participant would like to receive the educational material, it will be provided to them at no cost.

CONFIDENTIALITY
The records of this project will be kept private and will be protected to the fullest extent provided by law. If, in any sort of report, PI might publish, it will not include any information that will make it possible to identify the participant. Records will be stored securely, and only the project team will have access to the records.

PARTICIPATION: Taking part in this quality improvement project is voluntary.

COMPENSATION & COSTS
There is no cost or payment to the participant for receiving the health education and/or for participating in this project.

RIGHT TO DECLINE OR WITHDRAW
The participation in this project is voluntary. The participant is free to participate in the project or withdraw the consent at any time during the project. The participant's withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove the participant without their consent at such time that they feel it is in their best interest.

RESEARCHER CONTACT INFORMATION
If you have any questions about the purpose, procedures, or any other issues relating to this research project, you may contact Camila Marcos at 305-967-1822/ cmarc053@fiu.edu or Valerie Diaz at 305-348-9027/ vdiaz@fiu.edu, thank you.

IRB CONTACT INFORMATION
If the participant would like to talk with someone about their rights pertaining to being a subject in this project or about ethical issues with this project, the participant may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT
I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. By clicking on the "consent to participate" button below I am providing my informed consent.

Appendix C: QI Project Letter of Support

FIU
Department of Nurse Anesthesiology

Nicole Wertheim College of Nursing & Health Sciences

February 7, 2023

Valerie J. Diaz, DNP, APRN, CRNA, CNE, CAPT, USN, NC
Clinical Assistant Professor
Department of Nurse Anesthesiology
Florida International University

Dr. Diaz,

Thank you for inviting FIU alumni to participate in the Doctor of Nursing Practice (DNP) project conducted by Camila Marcos titled Efficacy of Erector Spinae Block versus Paravertebral or Thoracic Epidural: An Educational Module in the Nicole Wertheim College of Nursing and Health Sciences, Department of Nurse Anesthesiology at Florida International University. I have granted the student permission to conduct the project using our providers.

Evidence-based practice's primary aim is to yield the best patient outcomes by selecting interventions supported by the evidence. This proposed quality improvement project seeks to utilize the latest literature to increase providers awareness regarding the benefit of ESP block in cardiac surgery.

We understand that participation in the study is voluntary and carries no overt risk. All Anesthesiology providers are free to participate or withdraw from the study at anytime. The educational intervention will be conveyed by a 15-minute virtual PowerPoint presentation, with a pretest and posttest questionnaire delivered by a URL link electronically via Qualtrics, an online survey product. Responses to pretest and posttest surveys are not linked to any participant. The collected information is reported as an aggregate, and there is no monetary compensation for participation. All collected material will be kept confidential, stored in a password-encrypted digital cloud, and only be accessible to the investigators of this study: Camila Marcos and Dr. Valerie Diaz.

Once the Institutional Review Board's approval is achieved, this scholarly project's execution will occur over two weeks. Camila Marcos will behave professionally, follow standards of care, and not impede hospital performance. We support the participation of our Anesthesiology providers in this project and look forward to working with you.

Sincerely,

Jorge A. Valdes, DNP, CRNA, APRN, FAANA
Chair, Department of Nurse Anesthesiology
Associate Professor

Appendix D: QI Project Pre-test and Post-test Survey

FIU | FLORIDA INTERNATIONAL UNIVERSITY

Pretest and Posttest Questionnaire:

Efficacy of Erector Spinae Block versus Paravertebral or Thoracic Epidural in Cardiac Surgery:

An Evidence-Based Educational Module

INTRODUCTION

The primary aim of this QI project is to increase the anesthesia providers awarness regarding the safety and efficacy of the use of thoracic Erector Spinae Block for cardiac surgery.

Please answer the question below to the best of your ability. The questions are in multiple choice and true and false format and are meant to measure knowledge and perceptions of the thoracic Erector Spinae Block.

PERSONAL INFORMATION

1. **Gender:** Male Female Other_____
2. **Ages 25 and above:** _____
3. **Ethnicity:** Hispanic Caucasian African American Asian Other_____
4. **Position/Title:** CRNA Anesthesiologist Resident
5. **Level of Education:** Certificate Bachelors Masters DNP PhD
6. How many years have you been a perioperative provider?

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

QUESTIONNAIRE

1. Complications of the ESP block can include? (Select 2)
    a. Pneumothorax
    b. Spinal anesthesia
    c. Failed block
    d. Post-Dural puncture headache
2. Which of the following statements are true regarding the ESP block?
    a. The ESP block shows significant risk of bleeding in the anticoagulated patient
    b. The ESP block shows minimal risk of bleeding in the anticoagulated patient
    c. Bleeding is never a concern when performing an ESP block
    d. The ESP block shows moderate risk of bleeding in the anticoagulated patient
3. An important component of fast-track, multimodal approaches to cardiac surgery includes what?
    a. Regional Anesthesia
    b. IV opioids
    c. Oral opioids
    d. Ketamine
4. Which of the following regional anesthesia techniques should be avoided in the anticoagulated patient?
    a. TAP block
    b. Thoracic ESP block
    c. Thoracic epidural
    d. Intercostal block

5. When compared to the paravertebral block the ESP block has a smaller chance of what complication?
    a. Pneumothorax
    b. Injecting the pleura
    c. Injecting the intrathecal space
    d. Missed block

6. A single shot ESP block at the T5 will provides analgesia from
    a. C7-T10
    b. T2-T9
    c. T4-T10
    d. T1-T10

7. Which regional anesthetic requires a stay in the unit?
    a. Continuous bilateral ESP block
    b. Paravertebral Space block
    c. Continuous Thoracic Epidural
    d. Intracoastal block

8. Which structure is the landmark location for the ESP block on the Ultrasound ?
    a. Epidural space
    b. Rib
    c. Ligamentum flavum
    d. Transverse Process

9. . How likely are you to consider using thoracic ESP block for cardiac surgical patients?
    a. Most likely

b. Somewhat likely

c. Somewhat unlikely

d. Most unlikely

10. How likely are you to recommend thoracic ESP block for cardiac surgery?

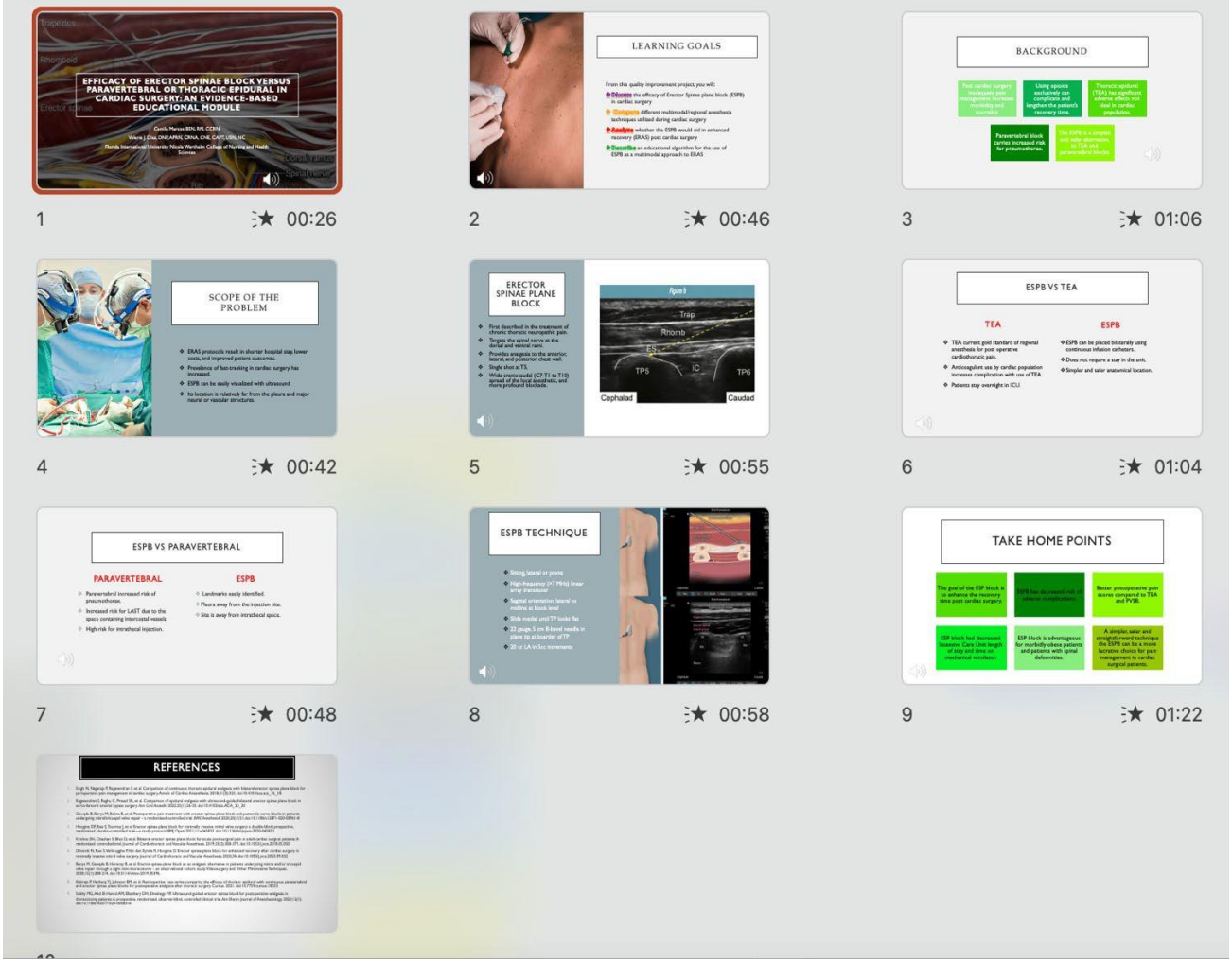
a. Most likely

b. Somewhat likely

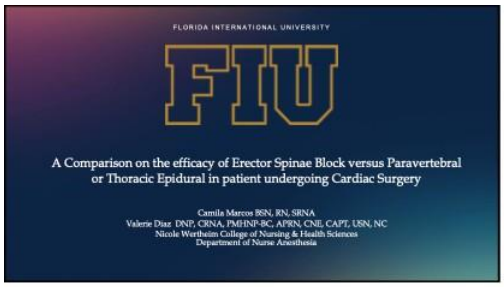
c. Somewhat unlikely

d. Most unlikely

Appendix E: QI Educational Module



Appendix F: DNP Symposium Presentation



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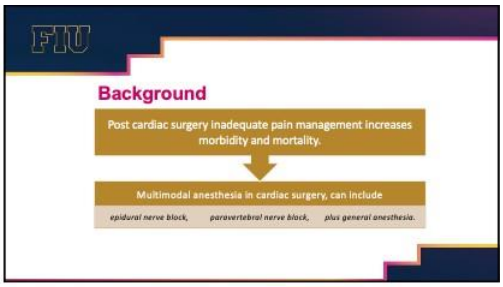

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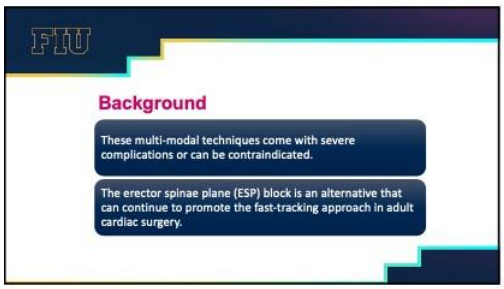

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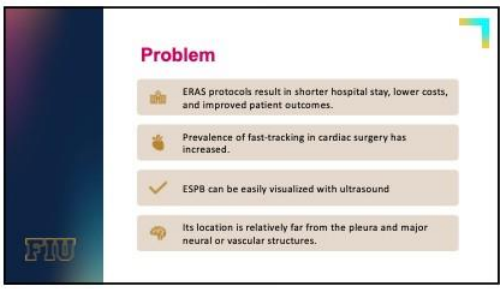

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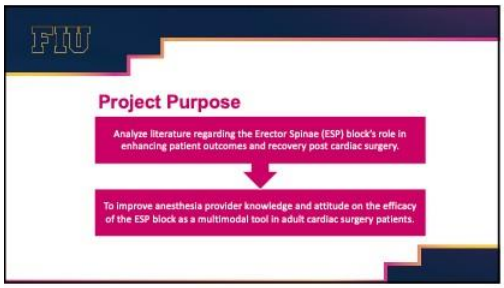

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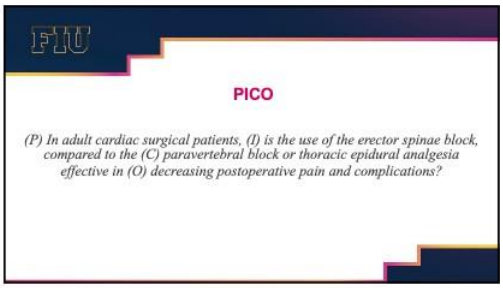

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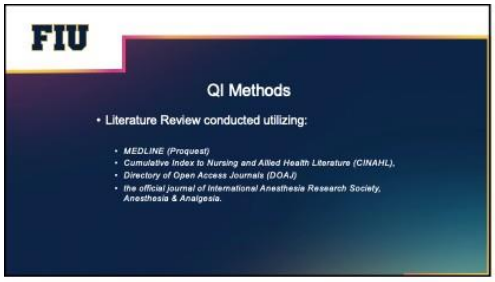
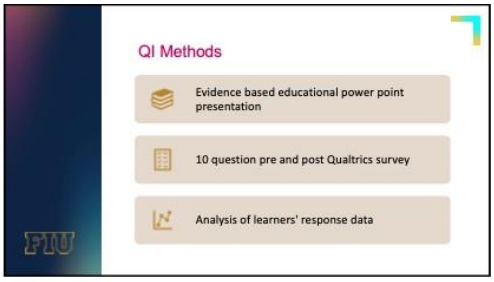
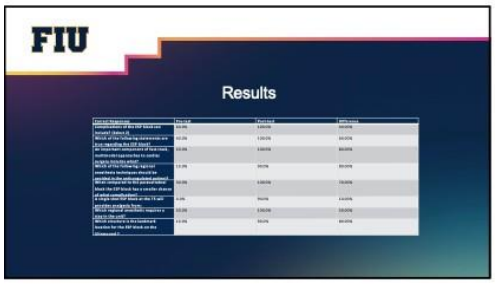

FIU
QI Methods
• Literature Review conducted utilizing:
• MEDLINE (Proquest)
• Cumulative Index to Nursing and Allied Health Literature (CINAHL),
• Directory of Open Access Journals (DOAJ)
• the official journal of International Anesthesia Research Society, Anesthesia & Analgesia.

7


QI Methods
Evidence based educational power point presentation
10 question pre and post Qualtrics survey
Analysis of learners' response data
FIU

8


FIU
Results

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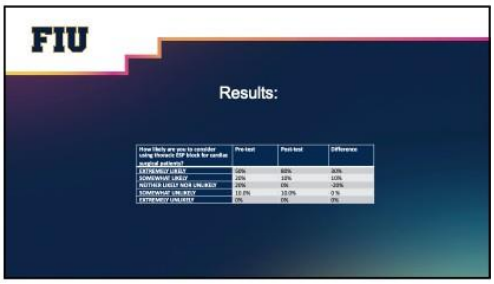
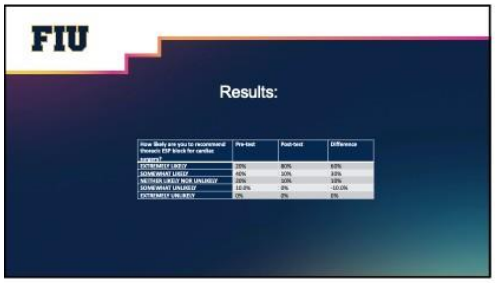
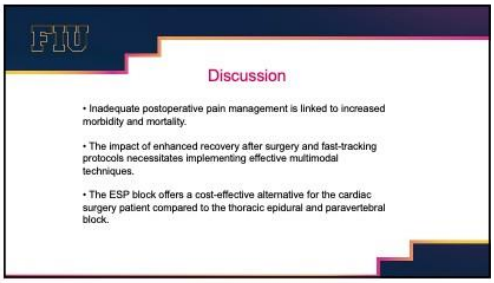

FIU
Results:
How likely are you to consider using thoracic ESP block for cardiac surgical patients?
Pre-test
Post-test
Difference
EXTREMELY LIKELY 50% 80% 30%
SOMEWHAT LIKELY 25% 10% -15%
NEITHER LIKELY NOR UNLIKELY 25% 0% -25%
SOMEWHAT UNLIKELY 0% 10.0% 0 %
EXTREMELY UNLIKELY 0% 0% 0%

10


FIU
Results:
How likely are you to recommend thoracic ESP block for cardiac surgical?
Pre-test
Post-test
Difference
EXTREMELY LIKELY 35% 80% 45%
SOMEWHAT LIKELY 45% 10% 35%
NEITHER LIKELY NOR UNLIKELY 20% 10% 10%
SOMEWHAT UNLIKELY 10.0% 0% -10.0%
EXTREMELY UNLIKELY 0% 0% 0%

11


FIU
Discussion
• Inadequate postoperative pain management is linked to increased morbidity and mortality.
• The impact of enhanced recovery after surgery and fast-tracking protocols necessitates implementing effective multimodal techniques.
• The ESP block offers a cost-effective alternative for the cardiac surgery patient compared to the thoracic epidural and paravertebral block.

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Discussion
• The ESP block was found to have comparable pain control or better pain control with fewer adverse effects.
• Implementation of the ESP block as a multimodal analgesic strategy in the cardiac surgical patient can enhance recovery after cardiac surgery.
• Its favorable safety profile is a cost-effective alternative to the TEA and PVB.

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Conclusion
• Research demonstrates that when compared to other neuraxial techniques more commonly in cardiac surgery the ESP proved to be safe and reliable.
• Due to the novelty of the ESPB and its emergence into clinical practice in recent years, there is a notable gap in knowledge.

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Conclusion
• The small research size of some of the studies indicates knowledge gaps.
• It is necessary to do a more thorough analysis of the utility of ESP in different cardiothoracic procedures.
• The ESP block is a simple, regional anesthetic that shows promising pain control with no significant adverse effects, even in the anticoagulated patient.

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Special thanks to Dr. Valerie Diaz; my doctoral project advisor, the faculty of FIU Nurse Anesthesiology Program, and my clinical mentors for all the support and encouragement.
As well as my future colleagues who so graciously took time out of their day to complete my questionnaire.
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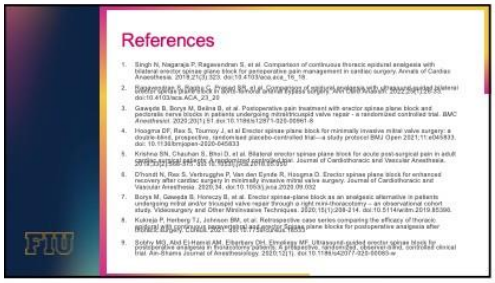
References
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