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Improving Clinical Knowledge on the Efficacy of Brachial Plexus Blocks with Perineural Dexmedetomidine as an Adjunct Agent to Ropivacaine Compared to Brachial Plexus Blocks with Ropivacaine as a Sole Agent: An Educational Module

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Improving Clinical Knowledge on the Efficacy of Brachial Plexus Blocks with Perineural
Dexmedetomidine as an Adjunct Agent to Ropivacaine Compared to Brachial Plexus Blocks
with Ropivacaine as a Sole Agent: An Educational Module

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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TABLE OF CONTENTS

ABSTRACT	6
I. INTRODUCTION	7
Background	7
Problem Statement	7
Scope of Problem	9
Consequences of the Problem.....	9
Knowledge Gap	10
Proposal Solution.....	11
II. SUMMARY OF LITERATURE REVIEW	11
Rationale	11
Methodology	12
Eligibility Criteria	12
Information Sources.....	13
PICO Question	13
Search Strategy	14
Figure 1. Search Keywords.....	15
Results.....	15
Study Characteristics	15
Results of Individual Studies	16
Results Summary Table	24
Discussion.....	30

Summary of the Evidence	30
Conclusion	31
III. PURPOSE/PICO CLINICAL QUESTION/OBJECTIVES	32
Primary DNP Project Goal.....	32
Objectives	35
IV. DEFINITION OF TERMS	35
Dexmedetomidine	35
General Anesthesia	35
Regional Anesthesia	35
Peripheral Nerve block	36
V. CONCEPTUAL UNDERPINNING/ THEORETICAL FRAMEWORK	36
Theoretical Framework	36
Program Structure	36
Strengths	37
Weaknesses	38
Opportunities	39
Threats	39
Organizational Factors	39
Goals and Outcomes	40
VI. METHODOLOGY	42
Setting and Participants.....	42
Description of Approach and Project Procedures	42
Protection of Human Subjects	42

Data Collection	43
Data Management and Analysis Plan	43
Discussion of Results with Implications to Advanced Nursing Practice.....	43
VII. TIMELINE	44
Project Tasks.....	44
Figure 2. Project Timeline	45
VIII. RESULTS	45
Participant Demographics.....	45
Table 1. Demographics	45
Table 2. Experience	46
Pretest: Assessment of Baseline Knowledge	46
Figure 3. Pretest Question 11	47
Table 3. Pretest Results.....	47
Posttest: Assessment of Learning	48
Table 4. Posttest Results	48
Figure 4. Posttest Question 11	48
Table 5. Pretest vs. Posttest Scores.....	49
IX. DISCUSSION.....	49
Limitations	50
X. IMPLICATIONS OF ADVANCED PRACTICE NURSING.....	50
Future Implications for Practice and Career Development.....	50
XI. CONCLUSION.....	51
XII. REFERENCES	52

XIII. APPENDIX	55
APPENDIX A: IRB Approval	55
APPENDIX B: IRB Consent Form.....	56
APPENDIX C: Recruitment Letter.....	59
APPENDIX D: Pre and Post Questionnaire	60
APPENDIX E: Educational Module.....	65
APPENDIX E: DNP Symposium Presentation	67

ABSTRACT

Impact Statement: Ultrasound-guided Brachial Plexus Nerve Blocks (BPNBs) using Ropivacaine and Dexmedetomidine have been proven to shorten the block's onset, prolong the duration of action, and enhance the analgesic efficacy.

Background: Ultrasound-guided Brachial Plexus Nerve Blocks (BPNB) are commonly used as an alternative to general anesthesia. Research suggests that adding Dexmedetomidine 1mcg/kg to 15ml of 0.5% ropivacaine shortens the onset and prolongs the duration of the block.

Methods: A concise search strategy was implemented to identify suitable studies using Cumulative Index to Nursing and Allied Health (CINAHL) and PUBMED. Eleven articles remained, of which 6 studies met all the specifics of the literature review objectives. A virtual educational module was delivered to Florida International University's alumni CRNAs, along with a pre and post survey to evaluate gained knowledge.

Results: Of the 8 total participants ($N = 8$), 50% ($n = 4$) demonstrated gained knowledge, 25% ($n = 2$) had no change, and 25% ($n = 2$) exhibited a decrease in understanding. The results are neither favorable nor unfavorable.

Discussion: There was a significant improvement on the likelihood of considering perineural dexmedetomidine. The small sample size, the project's cybernetic dependence, and the virtual aspect of delivery were limitations of this project.

Conclusion: Considering the ambiguity of the results and the project's limitations, it is recommended that further research is conducted to educate, guide, and possibly alter current practice standards.

Keywords: brachial plexus block; supraclavicular; interscalene; infraclavicular; neuraxial dexmedetomidine; precedex; perineural dexmedetomidine; ropivacaine, regional anesthesia.

I. INTRODUCTION

Background

The main goal for anesthesia providers is to provide safe and efficacious anesthesia for patients undergoing surgical procedures with minimal adverse effects during the entire operative period. Standards of practice guidelines on peripheral nerve blocks have been implemented to achieve the best patient outcomes and improve the quality of care. As new research unveils, practitioners have a moral duty to modify their practice for what is shown to work best. Current practice modalities of patients undergoing upper extremity surgeries with a brachial plexus block have shown a deficiency in adequately satisfying the pain management needs in the postoperative surgical period.¹

The deficits in clinical practice have redirected clinicians to seek better alternatives that may enhance patient outcomes and overturn current hospitalization shortfalls. Recent studies have evaluated the effects of adjunct perineural additives to brachial plexus blocks, such as dexmedetomidine, opioids, midazolam, magnesium sulfate, dexamethasone, and neostigmine.² These studies have quantified the outcomes of adding these pharmacological adjuncts to the peripheral nerve blocks, and the addition of dexmedetomidine has been an outlier in enhancing the efficacy of peripheral nerve blocks.³

Problem Statement

Regional anesthesia has been widely used and accepted in the anesthesia practice as an alternative to general anesthesia for various surgical procedures, including those involving the upper extremities. The regional approach can be used as the primary anesthetic for selected cases and can also be utilized for pain control in the postoperative period and mobility management. It

is a known alternative or additive to the usage of general anesthesia for surgical procedures and a method of decreasing opioid use in the post-anesthesia period.^{4,5}

Surgeries involving the upper extremity may be covered by the administration of an ultrasound-guided brachial plexus nerve block. The brachial plexus is an extensive network of nerves extending from the neck to the axilla, which innervates the upper extremity. It comprises ventral rami, nerve trunks, divisions, cords, and terminal branches.⁶ Brachial plexus blocks are generally administered using 0.5% ropivacaine, an amide local anesthetic. Local anesthetics inhibit voltage-gated sodium channels, thus producing a local sensory and motor neural blockade.⁶ The local anesthetics used in brachial plexus blocks have been known to provide adequate procedural anesthesia and some postoperative pain coverage, depending on the anesthesia provider administering the block. Anesthesia providers must consider various patient-specific circumstances to evaluate the choice in the anesthetic plan. That evaluation may include the patient's coexisting medical conditions, comfort level, pain tolerance, body habitus, and the location of the injury or surgical site in question. Compared to general anesthesia, brachial plexus halts the transmission of nerve signals, thus significantly minimizing the systemic effects of surgical stimulation and the body's pain response.⁶

As new research is generated and randomized clinical trials (RCTs) are conducted, evidence of current practice deficiencies on the onset, duration, and quality of brachial plexus blocks using 0.5% ropivacaine as the sole agent has emerged.² The onset and course of action of local anesthetics have been found to lack rapidity and enough blockage duration to make a lasting impact on patients in the postoperative period.¹ The mean blockade duration of local anesthetics alone is about 8 hours.⁷ Patients have still reported pain-related adverse effects, such

as nausea, vomiting, and sleep disturbance.⁸ These negative effects of both the pain response and the usage of general anesthesia have led providers to resort to adjunct pharmacological interventions in the postoperative period. These medications are often accompanied by multiple adverse outcomes such as prolonged post-anesthesia care unit times, respiratory depression, and delayed discharge.⁸ RCT studies and meta-analysis reviewed and have demonstrated that the addition of dexmedetomidine to 0.5% ropivacaine has accelerated the onset of action and prolonged the duration of brachial plexus and has shown to be effective in minimizing reported pain and enhanced patient satisfaction.¹

Scope of the Problem

The administration of brachial plexus blocks has already been implemented for various surgical procedures involving the upper extremities. These blocks have been shown to provide surgical anesthesia but fail to sufficiently deliver postoperative pain control and minimize the associated adverse effects of pain stress in patients following upper extremity procedures.⁶ The use of local anesthetics alone, such as Ropivacaine, bupivacaine, levobupivacaine, and lidocaine, lacks the duration of sensory block needed for optimal pain coverage in the first 24 hours of the postoperative period. Patients have reported severe pain levels ranging from 4-5 on the pain scale, overall malaise, and delayed post-anesthesia care unit (PACU) times following surgical procedures and the administration of a peripheral nerve block (PNB).⁸ The patients that received supplemental pharmacological interventions with opioids reported nausea, vomiting, respiratory depression, constipation, prolonged PACU times, and delayed discharge times.⁸

Consequences of the Problem

Brachial plexus nerve blocks for upper surgical procedures are acknowledged as being an effective anesthesia technique over a general anesthetic approach.⁶ This methodology improves the conventional use of anesthetics and diverts patients from experiencing the adverse effects of general anesthesia.⁶ Current practice on the use of peripheral nerve blocks has improved tremendously, but as new research is done, better alternatives have come forth. In today's practice, the use of local anesthetics alone, such as Ropivacaine, bupivacaine, levobupivacaine, and lidocaine, have not adequately provided postoperative pain control in patients undergoing specific upper extremity procedures.⁸ This insufficiency has led to undesirable clinical patient outcomes. The patients have reported deleterious postoperative symptoms from both the lack of pain control and the administration of pharmacological adjuncts.^{4-6,8} The patient's hospital experience has been negatively affected and increased consumption of hospital reserves. Patients with uncontrolled pain postoperatively require additional resources that extend the time in PACU and prolong hospital discharge, which leads to increased costs of hospitalization. These patients are also prone to receiving increased nursing care, supplementary medication administration, and enhanced medical management.⁸

Knowledge Gaps

The implementation of perineural dexmedetomidine is relatively a new practice study that is still being widely researched. Dexmedetomidine is a highly selective α_2 adrenergic agonist used in clinical practice to alleviate pain and induce sedation.⁹ Recent studies have evaluated the use of dexmedetomidine in adjunct to local anesthetics when administering peripheral nerve blocks. Substantial evidence has identified that adding dexmedetomidine, about 1mcg per kg has significantly shortened the onset of action and prolonged the duration of the sensory block, thus minimizing pain in the postoperative time frame.² A study performed by Qianchuang showed a

decrease in reported pain up to 8 hours more postoperatively than patients only receiving local anesthetics.¹⁰ This change in current practice can lead to eliminating or at least decreasing the adverse outcomes in the postoperative period for patients undergoing surgeries with brachial plexus blocks.

Proposal Solution

As more research is conducted, standard practice guidelines evolve to provide the utmost quality of care. This change can be facilitated by educating anesthesia providers with the most recent evidence on dexmedetomidine as an adjunct to the local anesthetics used in a brachial plexus block. Clinicians and hospital organizations must improve patient outcomes and minimize adverse effects during the hospital stay. Clear and concise display of evidence ranging from improved outcomes, decreased hospitalization cost, and overall enhanced patient experience are all methods that may generate an impact and lead to systematic procedural change.¹¹

II. SUMMARY OF THE LITERATURE

Rationale

The administration of brachial plexus blocks has already been implemented for various surgical procedures involving the upper extremities. These blocks have been shown to provide surgical anesthesia adequately but fail to sufficiently deliver postoperative pain control and minimize the associated adverse effects of pain stress in patients following upper extremity procedures.⁶ The use of local anesthetics alone, such as Ropivacaine, bupivacaine, levobupivacaine, and lidocaine, lacks the duration of sensory block needed for optimal pain coverage in the first 24 hours of the postoperative period.⁶ Patients have reported moderate pain levels ranging from 4-5 on the pain scale, overall malaise, and delayed post-anesthesia care unit

(PACU) times following surgical procedures and the administration of a peripheral nerve block (PNB).⁸ The patient's hospital experience has been negatively affected and depletes hospital reserves. Patients with uncontrolled pain postoperatively require additional resources such as lengthy PACU times and prolonged discharge, which increase the cost of hospitalization. These patients are also prone to receiving increased nursing care, supplementary medication administration, and enhanced medical management.⁸ The cascade of undesirable outcomes escalates with each intervention required to control postoperative pain. The patients that received supplemental pharmacological interventions with opioids also reported nausea, vomiting, respiratory depression, prolonged PACU times, and delayed discharge times.⁸

Current practice on the use of peripheral nerve blocks has been enhanced tremendously. Still, as new research is done, better alternatives that improve all sectors of the patient hospital stay, such as the addition of dexmedetomidine, have come forth. These studies have countified the outcomes of adding these pharmacological adjuncts to the peripheral nerve blocks, and the addition of dexmedetomidine has been an outlier in enhancing the efficacy of peripheral nerve blocks.⁷

Methodology

Eligibility Criteria

The RCT studies and systematic reviews selected for this literature review underwent a concise evaluation that included exclusion and inclusion criteria to match the goal and objective of this review accordingly. The inclusion criteria entailed peer-reviewed studies within the past 5 years, in the English language, with full-text availability. Exclusion criteria included studies that included subjects under 18 years old, ASA classification above III, the use of any other local anesthetics other than Ropivacaine, patients with musculoskeletal disorders, patients with

extremity neuropathy, and patients with preexisting chronic pain modalities. The study focused on the identifying efficacy of ultrasound-guided brachial plexus blocks with a control group using Ropivacaine and a study group using dexmedetomidine as an adjunct agent for patients undergoing upper extremity procedures. All the databases used during the literature review were acquired using Florida International University's library recourses.

Based on the target clinical question and study objective, the following keywords were used to identify high-quality RCTs and systematic reviews: "Brachial plexus block," "supraclavicular," "interscalene," "infraclavicular," "neuraxial dexmedetomidine," "Precedex," "perineural dexmedetomidine," "Ropivacaine," and "regional anesthesia."

Information Sources

The debases used for this literature review were accessed via Florida International University's library resources and involved the use of The Cumulative Index to Nursing and Allied Health Literature (CINAHL) and MEDLINE (ProQuest).

PICO Question

Does the addition of perineural dexmedetomidine to local anesthetics in adult patients receiving U/S-guided brachial plexus block for elective surgery, compared to adult patients only receiving the brachial plexus block with local anesthetics, lead to an enhanced block quality in the intraoperative and postoperative period.

Population (P): Adult patients receiving a U/S-guided brachial plexus block for elective surgery.

Intervention (I): Adding perineural dexmedetomidine as an adjunct agent to Ropivacaine when administering brachial plexus blocks for upper extremities.

Comparison (C): Compared to patients only receiving Ropivacaine as a sole agent.

Outcomes (O): Analgesic onset, duration, and block efficacy. (Measured in recovery times,

the patient reported pain postoperatively and usage of additional analgesia)

Time (T): Intraoperative and postoperative period (1 hour postoperative, 2 hours postoperative, or the entire postoperative period)

Search Strategy

Using the resources available at Florida International University's library databases, critical terms used in the search for quality substances pertinent to the literature review included: Brachial plexus block OR supraclavicular OR interscalene block OR infraclavicular OR axillary AND neuraxial OR perineural AND dexmedetomidine OR precedex AND Ropivacaine. The search results were later reduced with the inclusion conditions of articles published from 2014 to the current year and written in English. Journal articles encompassing procedures for cancer treatment, brachial plexus blocks using the coracoid approach, and articles covering local anesthetics other than Ropivacaine were excluded. Articles that included neonates, patients under the age of 18, and ASA classification above III were also excluded from the election process.

A total of 11 articles remained for revision of the abstract and further evaluation. Of the 11 articles, 1 of the articles did not permit full access to the entire study specifics, and 4 articles included a brachial plexus nerve approach not relevant to the study in question. The final studies selected consisted of 4 randomized clinical trials and 2 meta-analyses of randomized clinical trials. The 6 articles left were of the utmost quality of research and met all the specifics of the literature review objectives.

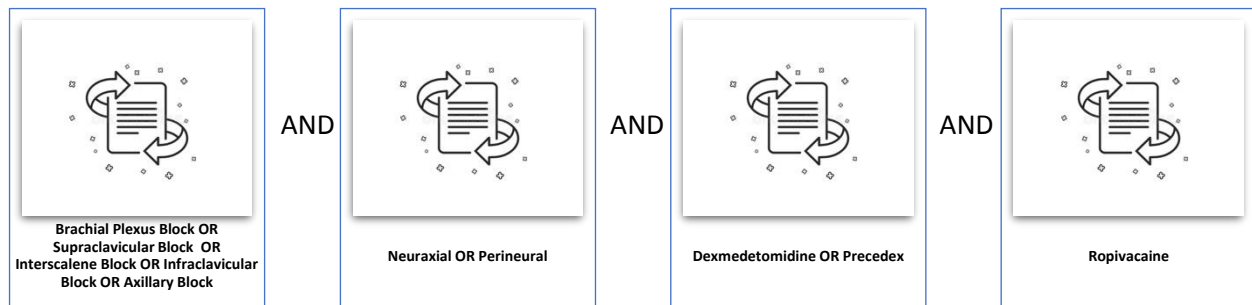


Figure 1. Search Keywords

Results

Study Characteristics

The six selected studies were inclusive of all the search criteria, displayed a significant level of research, and provided high-quality results that added value to this literature review's conclusions. The final studies selected consisted of four randomized clinical trials and two meta-analyses of randomized clinical trials. Each research study aimed to evaluate and compare the efficacy of brachial plexus blocks for upper extremity procedures using Ropivacaine as the sole agent and adding dexmedetomidine in adjunct to Ropivacaine. The four randomized clinical trials by Koraki,¹² Liu,² Bharti,⁹ and Hwang¹³ encompassed appraisal of the onset, duration of sensory and motor blockade, duration of analgesia, and overall quality of the block.^{2,9,12,13} The meta-analysis produced by Vorobeichik et al.³ evaluated the onset, duration, and quality of analgesia and the adverse effects associated with adding perineural dexmedetomidine. El-Boghdadly et al.¹⁴ conducted a systematic review and meta-analysis to target the clinical inconsistencies regarding the efficacy of perineural dexmedetomidine in comparison to the efficacy of perineural clonidine, which is in the same pharmacological class as

dexmedetomidine. The RCT done by Hwang extended the study to assess the patient's objective and subjective pain using standardized scales such as The Visual Analog Scale (VAS).¹³ Hwang also explored more profound and quantified potential pain markers intraoperatively and in the postoperative period. These markers included plasma cortisol, IL-6, IL-8, IL-1 β , and substance P levels in the blood.¹³ All the articles on the respective RCT studies included in this literature review were marked as a level II on the level of evidence scale. They had evidence from one well-established and designed RCT using randomly selected participants. The meta-analysis by Vorobeichik et al.³ was marked as a level I on the level of evidence scale. This meta-analysis included an appraisal of a total of 32 RCTs. The 4 research articles contributed high-quality substance and reliable data to complete this literature review.

Results of Individual Studies

In the study by Hwang et al., the authors focused on evaluating one of the most common brachial plexus blocks performed in the clinical setting: the interscalene block. Their RCT aimed to compare the effects of administering an interscalene block with dexmedetomidine combined with Ropivacaine and an interscalene block with Ropivacaine alone. The patient population selected was patients undergoing arthroscopic rotator cuff repairs. The author's commencing hypothesis was that dexmedetomidine added to Ropivacaine when administering Interscalene brachial plexus blocks would enhance the duration of action and analgesic effect when compared to Ropivacaine alone. They also intended to assess these block's impact on pain signifiers such as plasma interleukins, cortisol, and substance-P levels.¹³ The data retrieved from obtaining these specific pain markers further enhanced the quality of the study, as it assessed possible pain outside the objective and subjective realm. This RCT evaluated 50 patients undergoing rotator cuff repair as an outpatient procedure. Hwang et al. utilized standardized scales such as the

Visual Analog Scale (VAS) and the Patient Satisfaction Scale (SAT) to properly assess the effectiveness of both control groups. The division between the control and dexmedetomidine groups was equal, with each including 25 patients.¹³ The procedures were evaluated before study entry, and they ensured that all the arthroscopic procedures were performed by one surgeon, using a standard accepted method. The block administration technique remained the same throughout both groups, using ultrasound guidance in the supine position.¹³ The study demonstrated no significant difference between the two groups in the operative period.

The participants in group 1, the dexmedetomidine group, showed significantly lower VAS levels and significantly higher SAT scores at various times evaluated during the study (1, 3, 6, 12, and 18 hours postoperatively).¹³ The study's conclusion revealed that ultrasound-guided interscalene block with Ropivacaine and dexmedetomidine (Group 1) resulted in a lower VAS score and higher SAT scores in the first 48 hours following shoulder arthroscopy repair. The study also exposed those patients receiving interscalene block with Ropivacaine and dexmedetomidine. They displayed lower levels of plasma IL-6 and IL-8 in the first 48 hours of surgery and the delayed presence of rebound pain.

In the RCT completed by Koraki et al., the authors guided their research to elucidate the effects of adding dexmedetomidine to Ropivacaine on the onset and duration of the sensory and motor blockade of the analgesia duration of ultrasound-guided axillary brachial plexus blocks.¹² This study included a total of 37 participants who were randomly divided into two groups. Group RD contained 19 participants that were administered axillary brachial plexus blocks with the use of 15mL of 0.5% ropivacaine and 1mL of 100mcgs of dexmedetomidine. Group R was comprised of 18 participants who were administered axillary brachial plexus blocks using 15mL 0.5% ropivacaine and 1mL of normal saline. All participants were scheduled for upper extremity

surgery, and an anesthesiologist not related to the study utilized an ultrasound-guided technique.¹² The authors focused the analysis on evaluating the duration of both sensory and motor blockade, as well as the duration of analgesia.

The results of the study revealed significant differences between the two groups. Group RD containing the patients receiving an axillary brachial plexus block with the use of both Ropivacaine and dexmedetomidine displayed an increase in the duration of the sensory, motor, and duration of analgesia when compared to participants in group R.¹² The results also demonstrated a shortened onset of sensory block in group RD, with no significant difference in the start of motor blockade.¹² Some findings unique to this RCT were the adverse effects experienced by the participants in the dexmedetomidine group that were not reported in the ropivacaine group. Out of the patients receiving the addition of dexmedetomidine, two patients were observed to have bradycardic effects, and three displayed hypotension.¹² These patients received the same dose of 1mL 100mcg dexmedetomidine without consideration of patient specificity. The adverse effects could be caused by an overdose of medication for the patients' reported weight.

Continuing the randomized controlled study by Liu et al., the authors investigated the analgesic effects of adding dexmedetomidine to Ropivacaine versus Ropivacaine as the sole agent when administering a brachial plexus block for patients undergoing upper extremity surgery.⁹ A total of 114 participants were selected for this RCT. The participants were all classified by the American Society of Anesthesiologists (ASA) physical status classification of ASA I or II. The study primarily assessed the analgesic effects of both groups at baseline, 2, 4, 8, 12, and 24 hours after surgery by utilizing the postoperative Visual Analog Scale (VAS). Evaluation of intraoperative stability was achieved by recording vital signs such as heart rate

(HR), mean arterial pressure (MAP), and percentage of blood saturation (SPO₂). The participants were randomly divided into 2 groups of 57 participants, with group 1 being the control group receiving a brachial plexus block with only 20mL of 0.375% ropivacaine. Group 2 received a combination of 20mL of 0.375% ropivacaine and 1mL 100mcg of dexmedetomidine.

The study concluded that there was no significant difference in VAS scores between the dexmedetomidine group and the control group at baseline and at the fourth hour postoperatively. The participants who received both Ropivacaine and dexmedetomidine presented with a faster onset of analgesic effects and longer sensory and motor nerve blockade duration.⁹ The study also identified a decrease in both HR and MAP and an increase in SPO₂ intraoperatively, which the authors stated to be a favorable outcome. The reduction in HR and MAP was significant but remained within normal limits.⁹ A finding specific to this study was the presence of increased adverse effects such as nausea and lethargy in the patients in the control group only receiving Ropivacaine.

The additional article being appraised and included in this literature review is a meta-analysis conducted by Vorobeichik et al.³ This meta-analysis was published in 2017 and intended to reevaluate their previous meta-analysis where it was not recommended to use dexmedetomidine as an adjunct agent for brachial plexus blocks. The authors structured their research to evaluate the duration of sensory and motor blockade, time of onset, analgesia duration, consumption of supplemental analgesic agents, the severity of pain, patient satisfaction, and the associated side effects with the use of dexmedetomidine.³ The meta-analysis identified 32 clinical trials with a total patient count of 2,007. Out of the actual 2,007 patients reported, 1,026 received dexmedetomidine as an adjunct to local anesthetics, and 986 were part of the control group. They aimed to quantify their findings by assessing the total time of sensory and

motor blockade from administration to complete recovery of the blockade. They assessed postoperative pain by recording the time after completion of the surgical procedure to the first request for supplemental analgesics. They also evaluated the postoperative VAS scale.

To conclude the meta-analysis, Vorobeichik et al.³ findings suggest that the addition of dexmedetomidine to brachial plexus blocks prolonged the duration of sensory block by 46%, shortened motor block onset time by 39%, prolongs analgesic effects by 60%, reduced analgesic consumption in the postoperative period by 10.2mg, reduced pain on the VAS scores, and improved patient satisfaction.³ The study also reported that patients receiving dexmedetomidine displayed a higher instance of perioperative bradycardia and hypotension, as well as excessive undesired sedation.³ Overall, the authors reformed their initial meta-analysis findings and recommended the use of dexmedetomidine as an adjunct agent for brachial plexus blocks with careful consideration of the side effects listed above.

The contributions made by El-Boghdadly et al.¹⁴ were a valuable addition and provided more profound insight into the topic at hand. El-Boghdadly et al.¹⁴ conducted a systematic review and meta-analysis to target the clinical inconsistencies regarding the efficacy of perineural dexmedetomidine compared to the effectiveness of perineural clonidine. This meta-analysis acknowledged the lack of clinical research on perineural dexmedetomidine due to the novelty of the α^2 agonist.¹⁴ The authors of this systematic review focused on measuring the sensory and motor blockade, the duration of action, the effect onset, analgesic duration, and the potential for block complications. The authors underwent vigorous research incorporating articles from over 12 research databases. The final appraisal consisted of 14 clinical studies totaling 868 patients.¹⁴ The total sample size was equal, with 419 patients receiving perineural clonidine and 419 patients receiving dexmedetomidine as an adjunct to local anesthetics. The

study included patients who received various local anesthetics, including 8 studies with bupivacaine, 4 studies receiving Ropivacaine, and 2 studies receiving levobupivacaine. The dose of dexmedetomidine and clonidine were equal in all trials except for two studies. One of the studies used a set of 50mcg of dexmedetomidine and clonidine, while the other trial administered 150mcgs of dexmedetomidine and only 100mcgs of clonidine. The authors gathered all the data and generated a detailed meta-analysis.¹⁴

The results of the systematic review were listed in a concise report, displaying the study's findings. Of the 14 studies evaluated, all the studies demonstrated dexmedetomidine superior in the sensory block duration. The sensory block was prolonged by an estimated 1.2 compared to the administration of perineural clonidine. Similarly, the study displayed that dexmedetomidine also extended the effects of motor blockade by 1.2, compared to clonidine. On the topic of onset of action, El-Boghdadly et al.¹⁴ reported that dexmedetomidine hastened the onset of action of both the sensory and motor block with a ratio of 0.9, in contrast to clonidine. In evaluating the analgesic outcomes, analgesia was appraised by various modalities, including dynamic pain scores, analgesic consumption, and overall patient satisfaction. Dexmedetomidine ranked superior in prolonging the analgesic effects of the block. All the studies gauged in the meta-analysis reported the successful completion of the surgical procedure. The research also exposed a higher incidence of excessive sedation and transient bradycardia in the Dexmedetomidine group.

The randomized control trial conducted by Bharti et al.² was directed to assess the effects of dexmedetomidine on the onset of action and duration of block and analgesia postoperatively during supraclavicular brachial plexus block in patients undergoing upper limb surgeries. The study targeted a total of 60 patients that received supraclavicular brachial plexus blocks for upper

limb surgeries. The selection process included patients ranging from 20 to 40 years of age, all categorized as ASA I or II. Six of the 60 patients initially admitted to the study were excluded due to anesthetic preference and early discharge. All the patients were advised of the risks and received signed consent for the study. The patients were equally divided into two groups. The control group consisted of 27 patients who received a supraclavicular brachial plexus block with equal volumes of 0.75% ropivacaine and 2% lidocaine with epinephrine [1:200,000]. The dexmedetomidine group consisted of 27 patients who received the same block and included equal volumes of 0.75% ropivacaine and 2% lidocaine with epinephrine [1:200,000], as well as the addition of 1mcg/kg dexmedetomidine.² The block modality of both groups was performed in the same manner using ultrasound guidance. The study listed a maximal volume of 40ml. The authors aimed to evaluate the hemodynamic stability, onset, and duration of both sensory and motor blockade, post-operative pain, and adverse side effects.²

Bharti et al.² completed the research study and reported the findings concisely, including the statistical and numerical results. The patients in the dexmedetomidine group experienced more favorable outcomes in all fields evaluated.² The onset of the block was significantly shorter, and the duration of both sensory and motor blockade was extended in the dexmedetomidine to those from the control group. The analgesic duration in the dexmedetomidine group was prolonged compared to the control group.² Patients who received the perineural dexmedetomidine as an adjunct to local anesthetics experienced analgesia for an average of 17 hours, whereas the control group's analgesic coverage was 12 hours. The analgesic effects were also quantified by administering supplemental pain medication and VAS scores. The patients in the dexmedetomidine group had decreased additional pain medication administration and lower VAS scores.² When evaluating advised effects, the dexmedetomidine

group displayed lower levels of blood pressure and lower heart rates from baseline than the control group. The decrease in heart rate and blood pressure did not result in hypotension or bradycardia. The authors concluded that the administration of 1mcg/kg dexmedetomidine prolongs block duration, speeds the onset, and provides more extended analgesia compared to patients receiving local anesthetics alone.²

Author(s)	Purpose	Methodology/ Research Design	Intervention(s)/ Measures	Sampling/Setting	Primary Results	Relevant Conclusions
Hwang et al. ¹³ 2020	The aim of this study focused on comparing the effects of dexmedetomidine (DEX) combined with interscalene block (ISB) and interscalene block alone on post-operative pain, satisfaction, and pain related cytokines within the first 48 hours after shoulder arthroscopic rotator cuff repair. ¹³	Randomized Clinical Trial (RCT) Level 1	Experimental study used subjects and interventions according to the aim of focus. The authors ensured the quality of the research by conducting a double blind randomized clinical trial study eliminating any bias or preferential involvement. They examined the effects of dexmedetomidine (DEX) combined with interscalene block (ISB) and interscalene block alone on post-operative pain, satisfaction, and pain related cytokines within the first 48 hours after shoulder arthroscopic rotator cuff repair. ¹³	The study was conducted in a single center and included subjects undergoing shoulder arthroscopic rotator cuff repair. The sample size consisted of 50 ($N = 50$) patients with rotator cuff tears. 25 subjects were allocated to group #1 and received ultrasound guided ISB using a mixture of 1 ml (100 mcg) of DEX and 8 ml of 0.75% ropivacaine. The remaining 25 subjects were placed in group #2 and underwent ultrasound guided ISB alone using a mixture of 1 ml of normal saline and 8 ml of Ropivacaine. ¹³	The results of the participants in group 1, the dexmedetomidine group, showed significantly lower VAS levels and significantly higher SAT scores at various times evaluated during the study (1,3,6,12, and 18h postoperatively). ⁸ The conclusion of the study revealed that ultrasound-guided interscalene block with both Ropivacaine and dexmedetomidine (Group 1) resulted in a lower VAS score and higher SAT scores in the first 48 hours following shoulder arthroscopy repair. The study also exposed those patients receiving interscalene block with both Ropivacaine and dexmedetomidine, displayed lower levels of plasma IL-6 and IL-8 in the first 48h of surgery as well as the delayed presence of rebound pain.	The participants in group #1 receiving ultrasound guided ISB using a mixture of 1 ml (100 mcg) of DEX and 8 ml of 0.75% ropivacaine demonstrated lower VAS scores, higher SAT scores, lower pain related cytokines, and delayed rebound pain.
Koraki et al, ¹² 2018	The aim of the study was to elucidate the effects of DEX added to Ropivacaine (ROPI) on the onset, duration of motor and sensory blockade, and duration of	Randomized Clinical Trial (RCT) Level 1	Experimental study used subjects and interventions according to the aim of focus. The authors ensured the quality of the research by conducting a double blind randomized clinical trial study eliminating any bias or preferential involvement. They examined the effects of DEX added to	The study consisted for 37 subjects who were all ASA status I-II and were scheduled for elective forearm and hand surgery with the use of ultrasound guided axillary brachial plexus block. The subjects were randomly divided into two main groups. Subjects	The results of the study were that subjects in group RD experienced a prolonged duration of sensory block (U-value =35, $p < .001$), Prolonged motor blockage ($p = .001$), longer duration of analgesia ($p < .0010$) compared to the subjects in group R.	The concluding result of the study revealed significant differences between the two groups. Group RD containing the patients receiving an axillary brachial plexus block with the use of both Ropivacaine and dexmedetomidine displayed an increase in the duration of the sensory, motor, and duration of

	analgesia when administering an ultrasound guided axillary brachial plexus block. ¹²		Ropivacaine (ROPI) on the onset, duration of motor and sensory blockade, and duration of analgesia when administering an ultrasound guided axillary brachial plexus block. ¹²	in Group RD ($n = 19$) received ultrasound guided axillary brachial plexus block with 15 mL of 0.5% ropivacaine and 1mL of 100 mcg of DEX. Patients in group R ($n = 18$), received ultrasound guided axillary brachial plexus block with 15 mL of 0.5% ropivacaine and 1 mL of Normal Saline. ¹²		analgesia when compared to participants in group R. ⁶ The results also demonstrated a shortened onset of sensory block in group RD, with no significant difference in the onset of motor blockade.
Liu et al, ⁹ 2018	The goal of this randomized controlled study explored the analgesic effect of Ropivacaine in combination with dexmedetomidine in contrast to Ropivacaine alone on brachial plexus block to provide substitute anesthetic means for upper limb trauma surgery. ⁹	Randomized Clinical Trial (RCT) Level 1	Experimental study used subjects and interventions according to the aim of focus. The authors ensured the quality of the research by conducting a double blind randomized clinical trial study eliminating any bias or preferential involvement. They examined the analgesic effect of Ropivacaine in combination with dexmedetomidine in contrast to Ropivacaine alone on brachial plexus block to provide substitute anesthetic means for upper limb trauma surgery. The blocking effect on sensory and motor neurons, visual analog scale (VAS) score, heart rate (HR), mean arterial pressure (MAP),	The study included a total of 117 patients receiving upper limb surgeries under brachial plexus block anesthesia. The patients were randomized into a control group receiving Ropivacaine alone and a combination group receiving Ropivacaine combined with dexmedetomidine.	The study results demonstrated that onset time for both sensory and motor blockage was significantly faster in the combination group (8.9 min vs. 12.4 min for sensation blockade; 7.5 min vs. 12.8 min for motor blockade, $P < 0.05$ for both comparisons). ⁹ The duration of the blockade in the combination group was also significantly prolonged (590.2 min vs. 532.1 min, $P < 0.05$). ⁹ There difference in VAS scores between the two groups immediately and 4 h after surgery was non-significant. There was a difference in VAS scores between the two groups in, 8, 12 and 24 h after surgery, demonstrated to have significantly lower VAS scores in the combination group than the control group (2.4 vs. 3.0 for 8 h; 2.2 vs. 4.2 for 12 h, and 2.1 vs. 5.4 for 24	The study concluded that the participants who received both Ropivacaine and dexmedetomidine presented with a faster onset of analgesic effects and longer duration of both sensory and motor nerve blockade. ⁷ The study also identified a decrease in both HR and MAP and an increase in SPO ₂ intraoperatively, which the authors stated to be a favorable outcome. ⁹

			peripheral capillary oxygen saturation (SPO ₂) and adverse reactions were compared between the two groups. ⁹		h, respectively, P < 0.05 for all comparisons). There was a statistical difference in HR, MAP and SPO ₂ between the two groups after anesthesia, the MAP and HR were significantly lower, and the SPO ₂ was significantly higher in the combination group than the control group.	
Vorobeichik et al, ³ 2017	This meta-analysis was published in 2017, and it intended to reevaluate their previous meta-analysis where it was not recommended to use dexmedetomidine as an adjunct agent for brachial plexus blocks. The authors structured their research to evaluate the duration of sensory and motor blockade, time of onset, analgesia duration, consumption of supplemental analgesic agents, the severity of pain,	Systematic review and meta-analysis of randomized clinical trials Level II	The authors pursued and identified relevant studies from electronic databases including the US National Library of Medicine database, MEDLINE; the Excerpta Medica database, EMBASE; the Cochrane Databases of systematic reviews; the Cochrane central register of controlled clinical trials; Cumulative Index of Nursing and Allied Health Literature (CINAHL); Scopus; Web of Science; MEDLINE In-Process; and other non-indexed citations.	Data was collected from a total of 2007 patients, that included 1026 in the dexmedetomidine group and 981 in the Control group for analysis. ³	To conclude the meta-analysis, Vorobeichik et al. ³ findings suggested that the addition of dexmedetomidine to brachial plexus blocks prolonged the duration of sensory block by 46%, shortened motor block onset time by 39%, prolonged analgesic effects by 60%, reduced analgesic consumption in the postoperative period by 10.2mg, reduced pain on the VAS scores, and improved patient satisfaction. ³ The study also reported that patients receiving dexmedetomidine displayed a higher instance of perioperative bradycardia and hypotension, as well as excessive undesired sedation. ³	According to the evidence listed in the meta-analysis, it is indicated that perineural dexmedetomidine significantly shortens the onset, increases the quality, and prolongs the analgesia of brachial plexus blocks. Data also demonstrates that the benefits are associated with increased risks of motor block prolongation and transient bradycardia and hypotension.

	patient satisfaction, and the associated side effects with the use of dexmedetomidine. ³					
El-Boghdadly et al, ¹⁴ 2017	El-Boghdadly et al ¹⁴ conducted a systematic review and meta-analysis to target the clinical inconsistencies regarding the efficacy of perineural dexmedetomidine in comparison to the efficacy of perineural clonidine.	Systematic review and meta-analysis of randomized clinical trials Level II	The two authors pursued and identified relevant studies from electronic databases including US National Library of Medicine database, MEDLINE; the Excerpta Medica database, EMBASE; the Cochrane Databases of systematic reviews; the Cochrane central register of controlled clinical trials; Cumulative Index of Nursing and Allied Health Literature (CINAHL); Scopus; Web of Science; MEDLINE In-Process; and other non-indexed citations.	The final appraisal consisted of 14 clinical studies, totaling 868 patients. ¹⁴ The total sample size was equal with a total of 419 patients receiving perineural clonidine and 419 patients receiving dexmedetomidine as an adjunct to local anesthetics. The study included patients who received various types of local anesthetics including 8 studies with bupivacaine, 4 studies received Ropivacaine, and 2 studies received levobupivacaine. The dose of dexmedetomidine and clonidine were equal in all trials except for 2 studies. One of the studies used a set 50mcg of both dexmedetomidine and clonidine while the other trial administered 150mcgs of dexmedetomidine and only 100mcgs of clonidine.	The results of the systematic review were listed in a concise report, displaying the findings of the study. In the 14 studies evaluated, all the studies demonstrated dexmedetomidine to be superior in the sensory block duration. The sensory block was prolonged by an estimate of 1.2 compared to the administration of perineural clonidine. Similarly, the study displayed that dexmedetomidine also prolonged the effects of motor blockade by 1.2, compared to clonidine. On the topic of onset of action, El-Boghdadly et al. ¹⁴ reported that dexmedetomidine hastened the onset of action of both the sensory and motor block with a ratio of 0.9, in contrast to clonidine. In evaluating the analgesic outcomes, analgesia was appraised by various modalities including dynamic pain scores, analgesic consumption, and overall patient satisfaction. Dexmedetomidine ranked superior in prolonging the analgesic effects of the block. All the studies gauged in the meta-analysis reported successful	According to the evidence listed in the meta-analysis, it is indicated that perineural dexmedetomidine significantly shortens the onset, increases the quality, and prolongs the analgesia of brachial plexus blocks in comparison with clonidine. Data also demonstrates that the benefits are associated with increased risks of excessive sedation and transient bradycardia.

					completion of the surgical procedure. The research also exposed a higher incidence of excessive sedation and transient bradycardia in the Dexmedetomidine group.	
Bharti et al, ² 2015	This study was designed to assess the effects of dexmedetomidine on the onset and duration of block and postoperative analgesia during supraclavicular brachial plexus block in patients undergoing upper limb surgeries.	Randomized Clinical Trial (RCT) Level 1	Experimental study used subjects and interventions according to the aim of focus. The authors ensured the quality of the research by conducting a blind randomized clinical trial study eliminating any bias or preferential involvement. They examined the effects of DEX added to Ropivacaine (ROPI) and lidocaine with epinephrine on the onset, duration of motor and sensory blockade, duration of analgesia, and post-operative pain control when administering an ultrasound guided supraclavicular brachial plexus block. ²	The patients were equally divided into two groups. The control group consisted of 27 patients who received a supraclavicular brachial plexus block with the inclusion of equal volumes of 0.75% ropivacaine and 2% lidocaine with epinephrine [1:200,000]. The dexmedetomidine group consisted of 27 patients who received the same block and included equal volumes of 0.75% ropivacaine and 2% lidocaine with epinephrine [1:200,000], as well as the addition of 1mcg/kg dexmedetomidine. ² The block modality of both groups was performed in the same manner using the guidance of ultrasound. The study listed a maximal volume of 40ml. The author's aimed to evaluate the hemodynamic stability,	Bharti et al. ² successfully completed the research study and reported the findings in a concise report, including the statistical and numerical results. The patients in the dexmedetomidine group experienced more favorable results in all fields evaluated. ² The onset of the block was significantly shortened, and the duration of both sensory and motor blockade was extended in the dexmedetomidine to those from the control group. The analgesic duration in the dexmedetomidine group was prolonged in comparison to the control group. ² Patients who received the perineural dexmedetomidine as an adjunct to local anesthetics experienced analgesia for an average of 17 hours, whereas the control group's analgesic coverage was 12 hours. The analgesic effects were also quantified by the administration of supplemental pain medication and VAS scores. The patients in the dexmedetomidine group had decreased supplemental pain medication administration, as well as	The study concluded that the participants who received dexmedetomidine as an adjunct to local anesthetics presented with a faster onset of both sensory and motor blockade, longer duration of blockade and analgesia, decreased consumption of pharmacological interventions in the post anesthesia care unit, and decreased VAS scores. ² The study also identified a decrease in both HR and blood pressure perioperatively, but did not identify hypotension or bradycardia in either groups. ²

				onset and duration of both sensory and motor blockade, post-operative pain, and overall adverse side effects. ²	lower VAS scores. ² When evaluating adverse effects, the dexmedetomidine group displayed lower levels of blood pressure and lower heart rates from baseline than the control group. The decrease in heart rate and blood pressure did not result in hypotension, nor bradycardia. The authors concluded that the administration of 1mcg/kg dexmedetomidine prolongs block duration, speeds the onset, and provides longer analgesia, when compared to patients receiving local anesthetics alone. ²	
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Discussion

Summary of the Evidence

The anesthesia profession continues to evolve as new treatment modalities arise and relevant research data displays more efficacious standards of care. The 4 articles appraised in this literature review, 3 RCTs and 1 meta-analysis, all aimed their research efforts to evaluate the effectiveness of perineural dexmedetomidine in combination with Ropivacaine when administering brachial plexus blocks for surgeries involving the upper extremity.^{3,9,12-14} The research articles assessed a variety of standardized factors to quantify the findings in the studies and meta-analysis. Vigorous protocols, inclusion, and exclusion criteria were followed to ensure the data's integrity and eliminate factors that might hinder the results, such as clinical bias and the possibility of human alteration.¹⁴ The authors of each study reported both positive and negative outcomes associated with their research, allowing practitioners and future researchers to evaluate the data as a whole and conclude new methods of clinical practice.

The content of the research obtained in this literature review confirms the clinical benefits of adding dexmedetomidine to Ropivacaine when administering brachial plexus blocks. The consensus of the findings demonstrates that perineural dexmedetomidine expedites the block's onset of action, prolongs both motor and sensory blockade, elongates the analgesic effects, decreases the requirement for supplemental analgesics in the postoperative period, reduces the VAS scores, and increases the patient's overall satisfaction with correlating increase in SAT scores.^{3,9,12,13} The study established by Koraki et al. used the same dose of 1mL 100mcg dexmedetomidine in all the participants; this dose indicated undesirable effects in a total of 5 participants who exhibited hypotension and bradycardia in the perioperative period.^{12,14} This finding is important because it recognizes a possible dose-dependent negative outcome, and

further studies should be implemented to identify the ideal dose range. The author further detailed that a weight-dependent dose of 1mcg per kg could be a safer alternative and possibly eliminate the adverse outcomes associated with the administration of perineural dexmedetomidine.¹² In weighing the outcomes and possible side effects, the published authors favored and recommended the use of dexmedetomidine, regardless of the study's specific negative findings.

Conclusion

Undoubtedly, the wide use of ultrasound-guided peripheral nerve blocks for surgical anesthesia and pain management has significantly increased throughout the years.⁶ Brachial plexus blocks are considered for various surgical procedures involving the upper extremity and for diagnostic and pain control.⁶ Compared to general anesthesia, brachial plexus blocks stop the transmission of nerve signals, thus significantly minimizing the systemic effects of surgical stimulation and the body's pain response.⁶ The reality of the situation is that current studies have identified significant opportunities in administering brachial plexus blocks.

The review of the literature discussed in this appraisal consists of the latest evidence-based studies that focus on identifying methods of improving the efficacy of brachial plexus blocks for upper extremity surgeries. The findings are overwhelmingly favorable in supporting the use of dexmedetomidine as an adjunct agent to Ropivacaine when administering ultrasound-guided brachial plexus blocks. Each study contained randomized subjects in both the variable and the control group, vigorous protocols were followed to eliminate the chances of bias or human influence, and special attention was placed on identifying possible study limitations. The accord of all the studies listed determined that a change in current practice is warranted. The use

of perineural dexmedetomidine accelerates the onset of the blockade, extends the motor and sensory block duration, lengthens the effects of analgesia, minimizes the necessity for auxiliary analgesic pharmacological agents perioperatively, improves experienced postoperative pain as seen in the decreased VAS scores, and enhances the patient's hospital satisfaction as shown by higher SAT scores.^{3,9,12,13} Clinicians now have the support of evidence to implement a new practice modality that enhances patient outcomes, provides optimal quality of care, decreases hospital expenses and utilization of resources, and allows for improved overall patient experience. It is recommended that organizations generate informative material on the subject and provide educational courses to display the advantages of perineural dexmedetomidine as a method to generate practice improvement.

III. PURPOSE/ PICO CLINICAL QUESTIONS/OBJECTIVES

Primary DNP Project Goal

The widespread use of ultrasound-guided peripheral nerve blocks for surgical anesthesia and pain management has progressively amplified.⁶ Brachial plexus blocks are implemented for a variety of procedures that involve the upper extremity as well as for pain control.⁶ It is a substitute or supplementation to the use of general anesthesia and a method of decreasing opioid use in the post-anesthesia period.⁵ Anesthesia providers must evaluate patient-specific conditions to assess the technique in the anesthetic plan. That evaluation includes the patient's coexisting medical needs, comfort level, pain tolerance, body habitus, and the location of the injury or surgical site.⁶ In contrast to general anesthesia, brachial plexus blocks impede the transmission of nerve signals, thus significantly diminishing the systemic effects of surgical stimulation and the physiological response to pain.⁶

The local anesthetics used in brachial plexus blocks (BPB) provide adequate procedural anesthesia, analgesia, and some degree of postoperative pain coverage, depending on the anesthesia provider administering the block.⁶ The onset and duration of the block have been closely monitored and recorded. According to research studies, the onset is not ideal, and the block duration is not enough to make a lasting impact on patients in the postoperative period.¹ Patient has encountered undesirable pain-related effects, such as nausea, vomiting, and sleep disturbance.⁸ These adverse outcomes related to pain and the impact of general anesthesia have prompted the use of adjunct pharmacological interventions in the postoperative period. This use of pain medications such as oral and intravenous opioids has often been accompanied by multiple adverse outcomes such as prolonged post-anesthesia care unit times, respiratory depression, and delayed discharge.⁸ Current practice modalities of patients undergoing upper extremity surgeries with ultrasound-guided brachial plexus block have been deficient in adequately satisfying the pain management needs in the postoperative surgical period.¹

The success of BPB is measured by various elements that include the speed of onset, duration of sensory blockade, duration of analgesia, and overall patient outcome and satisfaction.² These blocks have failed to sufficiently deliver postoperative pain control and moderate the associated harmful effects of pain stress in patients. The use of local anesthetics alone, such as Ropivacaine, bupivacaine, levobupivacaine, and lidocaine, lacks the duration of sensory block needed for optimal pain coverage in the first 24 hours of the postoperative period.⁶ Patients have described severe pain levels ranging from 4-5 on the pain scale, malaise, and delayed post-anesthesia care unit (PACU) times succeeding surgery with the administration of a peripheral nerve block.⁸ The patients receiving supplemental pharmacological interventions with

opioids have reported nausea, vomiting, respiratory depression, prolonged PACU times, and delayed discharge times.⁸

The implementation of perineural dexmedetomidine is relatively a new practice that is still being widely researched. Dexmedetomidine is a highly selective α_2 adrenergic agonist used in clinical practice to produce analgesia and engender sedation.⁶ Recent studies have aimed to evaluate the use of dexmedetomidine as an adjunct to local anesthetics when administering peripheral nerve blocks. Substantial evidence has identified that adding dexmedetomidine, about 1mcg per kg, has significantly shortened the onset of action and prolonged the duration of the sensory block, thus reducing pain in the postoperative time frame.^{2,6} This practice modification eliminates or at least lessens the adverse outcomes in the postoperative period.

As more research is conducted, standards of practice guidelines evolve to promote the highest quality of care. The main goal for anesthesia providers is to administer safe and efficacious anesthesia for patients undergoing surgical procedures with minimal adverse effects during the entire perioperative period. Current practice guidelines on peripheral nerve blocks should be reformed to achieve the best patient outcomes and improve the quality of care. This change can be facilitated by educating anesthesia providers with the most recent evidence on dexmedetomidine as an adjunct to the local anesthetics used in brachial plexus blocks. Clinicians and hospital organizations must employ a quality improvement protocol that evaluates and enhances patient outcomes while decreasing adverse effects during the hospital stay. Clear and concise display of evidence ranging from improved outcomes, reduced hospitalization cost, and overall enhanced patient experience are topics of coverage in hospital-wide training that may generate an impact and lead to systematic procedural change.¹¹

Objectives

As more research is conducted, standard practice guidelines evolve to provide the utmost quality of care. This change can be facilitated by educating anesthesia providers with the most recent evidence on dexmedetomidine as an adjunct to the local anesthetics used in a brachial plexus block. Clinicians and hospital organizations must improve patient outcomes and minimize adverse effects during hospital stay. Clear and concise displays of evidence ranging from improved outcomes, decreased hospitalization cost, and overall enhanced patient experience are all methods that may generate an impact and lead to systematic procedural change.

IV. DEFINITION OF TERMS

Dexmedetomidine

Selective α_2 -adrenoreceptor agonist with anesthetic and sedative properties due to activation of G-proteins by Alpha_{2a} - adrenoreceptor in the brainstem, inhibiting norepinephrine release.¹²

General Anesthesia

A reversible state of unconsciousness is induced artificially to perform procedures or surgery. It is apportioned into induction, maintenance, and emergence stages.¹⁵

Regional Anesthesia

The use of local anesthetics to block sensations of pain and proprioception from an area of the body, such as an arm or leg, or the abdomen. Regional anesthesia allows a procedure to be performed on a region of the body without your need for complete loss of consciousness.¹⁵

Peripheral Nerve Block (PNB):

The injection of local anesthetic near a specific nerve or bundle of nerves to block pain sensations from the area of the body supplied by the nerve. Nerve blocks are most used for surgery involving the arms and hands, legs and feet, groin, or face. Peripheral nerve blocks (PNBs) are used for both surgical anesthesia and as a pain management modality.

V. CONCEPTUAL UNDERPINNING AND THEORETICAL FRAMEWORK OF THE PROJECT**Theoretical Framework**

The project aspires to evaluate, educate, and determine what is needed at a professional level to introduce a more productive approach to current practice and ultimately improve patient outcomes. The Donabedian model provides the theoretical framework most consistent with the project's goals and ambitions. The Donabedian model grants a simple framework for evaluating care delivery outcomes and consists of three primary concepts: structure, process, and results.¹⁶ This theoretical framework allows for evaluating effects by examining the organizational structure, including available finances, resources, and participants. The administrative process aspect reviews the current utilization of care and the complete care timeline.¹⁶ Conclusively, it provides an elegant framework for evaluating outcomes and a robust project configuration.

Program Structure

Implementing dexmedetomidine as an adjunct to local anesthetics when conducting an ultrasound-guided brachial plexus block for upper extremity surgeries will require the involvement of key stakeholders to allow the passage of modified practice protocols to achieve improved patient outcomes. The initial phase of the program structure is to conduct a comprehensive evaluation of current practice modalities and identify protocol opportunities of

high importance to the stakeholders involved.¹⁷ The strength, weakness, opportunities, and threats (SWOT) analysis tool will be employed to appraise the internal and external characteristics and threats to the implementation development.

The project's primary goal was to evaluate, educate, and determine what is needed at a professional level to commence the implementation of perineural dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block for upper extremity surgeries. The initial step was to identify the key stakeholders in the matter and acquire their involvement to guide the development of a concise educational proposal. The project participants' level of knowledge was determined by using a questionnaire developed to quantify their specific knowledge base on the administration of brachial plexus blocks, including the time of onset, blockade duration, patient outcomes, and PACU pain coverage, discharge times, and overall patient satisfaction. The participants then were provided with educational material illustrating the most current evidence-based research on the use of perineural dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block. The supplemental educational courses would be conveyed through an academic module. Following the educational intervention, the participants were asked to complete a questionnaire to determine the knowledge variations before and after the intervention.

Strengths

The administration of brachial plexus blocks has already been implemented for various surgical procedures involving the upper extremities. These blocks have been shown to provide surgical anesthesia adequately. Still, they fail to sufficiently deliver postoperative pain control and minimize the associated adverse effects of pain stress in patients following upper extremity

procedure.⁶ One of the strengths of implementing perineural dexmedetomidine as an adjunct to brachial plexus blocks for upper extremity procedures would be in line with protocols and practice modalities already established. This change would modify a regional anesthesia technique already used in current practice. The material dispersed would allow only a focus on disclosing current research data, statistical analysis results, and reported patient outcome advantages. Training on the process, protocol, complications, and patient qualifies for administering brachial plexus blocks are not subject to change and will remain constant.

Another strength of the project was the alignment with the anesthesia provider's oath to provide compassionate patient care with seamless coordination and advancing medicine through unrivaled education, research, and outreach. Unrivaled education signifies providing anesthesia professionals with the latest quality research and creating a system where education on new modalities is readily available to all who seek improvement. Therefore, the project's goal was to allow the CRNA to act on its mission statement and to provide practice modalities that will deliver high-quality patient care and the best possible outcomes.

Weakness

The project's weaknesses are considered to include any internal traits that can harm the development and execution of the projected plan.¹⁷ These internal barriers can encompass critical holders such as part-time, full-time, and per-diem certified registered nurse anesthetists. Specific professional weaknesses identified at an individual practitioner level include variations in preference of regional anesthesia modality among anesthesia providers, variations in surgeon preference, perineural dexmedetomidine knowledge deficits among anesthesia providers, unestablished assigned block personnel schedule, and block time limitation due to fast turnover expectations.

Opportunities

The project's professional participation would require the involvement of nurse anesthesiologists that have direct to adjunct multidisciplinary staff such as anesthesia technicians, pre-operative registered nurses, operating room registered nurses, and post-anesthesia care unit registered nurses and would aid in the project objectives. For the proposed plan to succeed, all CRNAs sampled should be educated about the changes in practice and the identification of specific symptoms associated with dexmedetomidine. The scholarly project has the potential to have a substantial reach in various states and organizational systems. FIU's nurse anesthesiology program chair facilitated the alumni list with detailed contact information and board credentials.

Threats

The most present threat to the success of the plan to use dexmedetomidine as an adjunct to brachial plexus blocks for upper extremity procedures would be denial from critical stakeholders responsible for the project's approval. Another significant threat was provider refusal or non-compliance with the expectations of the project. The project had the difficult task of attempting to change personal practice methodology and encourage experienced anesthesia providers to modify protocols they have followed during their careers. Change implementation could generate momentous resistance and thus can lead to an abrupt termination of the project.

Organizational Factors

The plan required the support and alignment of various components, including the stakeholders, FIU's nurse anesthesiology program chair personnel, and the providers' willingness. The initial segment in the process would be to determine the steps needed to generate a perineural dexmedetomidine protocol and usage guidelines. The planning phase also

encompassed selecting the data that would be included in the educational modules and verifying the quality and validity of the data being dispersed. During the evaluation phase, anesthesia providers were interviewed, and feedback on the project's overall effectiveness was obtained. This process led to the gain of raw data that was later further analyzed and converted into clear and concise points of value. The analysis included a project narrative, interventions employed, mission statement, data collection methods, data categorization including modality, analytical tools used, concise summary of the results, expected and unexpected outcomes, flaws in project design, and program improvement suggestions.

Goals and Outcomes

The goal of this project was to evaluate current practice protocols, recognize knowledge gaps, identify personal areas of opportunity, and provide educational material, statistical data, monetary incentives, and detailed training on the advantages of implementing dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block.

Specific

This educational intervention took place remotely and sample various FIU alumni nurse anesthesiology providers. Florida International University Alumni Certified Registered Nurse Anesthetists (CRNA) have direct involvement with the anesthesia management, administration, and modality selection of ultrasound-guided brachial plexus blocks for upper extremity surgeries. The sample size indicated the total full-time, part-time, and per-diem CRNAs. The subjects were chosen from an extensive list of FIU alumni CRNAs provided by FIU's Nurse Anesthesiology program chair. The sample size included male and female providers of various ages, levels of education, and ethnic groups.

Measurable

Evaluation of current knowledge regarding the use of dexmedetomidine for brachial plexus blocks was obtained before educational intervention. Reassessment was conducted after completing a concise training module that included educational material, statistical data, hospital monetary incentives, and detailed training on the advantages of implementing dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block. Outcomes were measured by identifying variations in clinician knowledge on the advantages and disadvantages of using dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block. The reports were generated and analyzed using Qualtrics[®], a standardized survey software.

Achievable

FIU's nurse anesthesiology program chair and part-time, per-diem, and full-time CRNAs were involved in developing an attainable educational modality.

Realistic

Certified registered nurse anesthetists (CRNAs) in a part-time, full-time, or per-diem role were evaluated and educated on the most evidence-based research and statistical data available. Each participant was expected to generate a structured protocol for dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block in their practice.

Timely

The assessment of current knowledge, clinician education, and protocol establishment would have a projected accomplishment timeframe of 10 months. The outcome of this initiative was as follows: Within 10 months, anesthesia providers were evaluated and educated on the use

of dexmedetomidine as an adjunct to local anesthetics when administering an ultrasound-guided brachial plexus block, and a personal process was implemented where the clinicians can have access to patient qualifiers, dosages, and contraindications.

VI. METHODOLOGY

Setting and Participants

This educational intervention took place remotely and sample various nurse anesthesiology providers. The provider samples were Certified Registered Nurse Anesthetists (CRNAs) alumni of Florida International University's Nurse Anesthesia Program. The nurse anesthesiology program chair supplied the Provider list.

Description of Approach and Project Procedures

The educational project intervention commenced by inviting FIU alumni Certified Registered Nurse Anesthetists to participate in the scholarly project. A pretest/posttest was issued to measure the providers' knowledge of administering brachial plexus blocks and perineural dexmedetomidine. The data prior to the educational intervention included demographic information, training level, years of practice, and exposure to regional anesthesia. During the educational intervention, providers were educated on the project findings and the patient outcomes when administering brachial plexus block using dexmedetomidine as an adjunct agent to Ropivacaine. The educational intervention was expected to have a duration of approximately 15 minutes. Once the interventional education was completed, the participants were asked to complete a posttest. The findings were then analyzed and quantified.

Protection of Human Subjects

The faculty participants were invited to participate via email notification. Should the Institutional Review Board (IRB) determine that this study poses more than minimal risk,

participants consented via Qualtrics, a HIPAA-compliant online survey platform. The participants completed the scholarly project requirements independently and possessed the option to opt out. The participant involvement benefits include the reflection of current knowledge, exposure to the latest evidence-based practice, enhancement of their current practice, and enforcement of expertise to which they might have already been exposed. The data retrieved was only accessed by the individuals involved in the scholarly project and was password protected.

Data Collection

Demographic data was collected, including gender, race, ethnicity, and education. Also, participants were asked to provide the years they have been practicing and whether they have previously received training on the subject. Previous training on the subject required submission of the type and length of training. The educational intervention included basic regional anesthesia questions such as procedural knowledge of brachial plexus blocks, mechanism of action of local anesthetics including speed of onset and duration of action, mechanism of action of dexmedetomidine, including speed of onset and course of action. The data was collected via a HIPAA-compliant online survey platform, Qualtrics.

Data Management and Analysis Plan

The data acquired was stored and analyzed electronically, and only the primary investigator and participants directly involved in the scholarly project had access to the data. The identifiers were removed from postings of the finding results; thus, results were anonymous.

Discussion of the Results with Implications for Advanced Nursing Practice

The scholarly project consists of a relatively short educational intervention allowing a broad reach of FIU alumni CRNAs. The results would provide various positive implications to

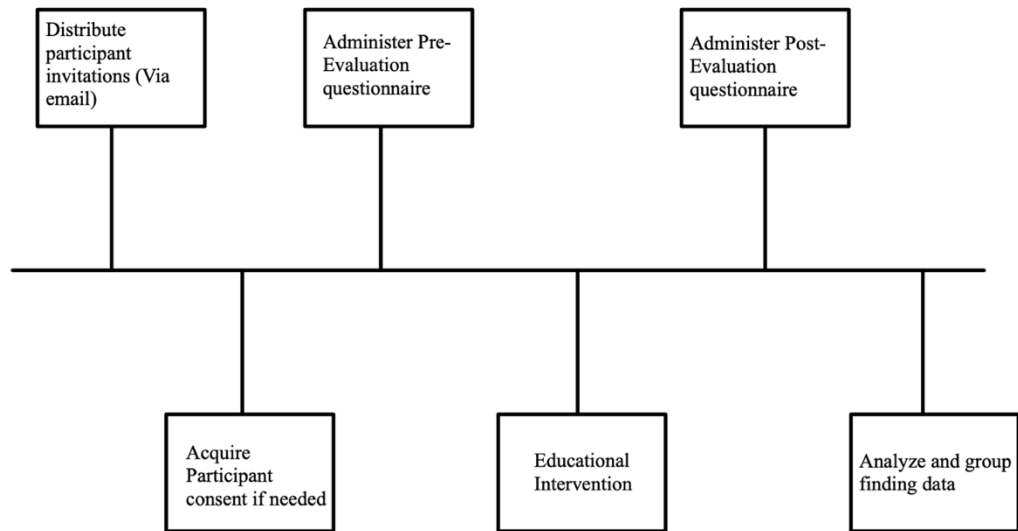
the participants, their organization's current standards of care, and ultimately the patient outcomes and satisfaction rates. Changes to current practice from the intervention allowed providers to be educated with the most recent research on brachial plexus blocks using dexmedetomidine as an adjunct agent to Ropivacaine. It also allowed a chance for the facility to generate a more efficacious protocol. The intervention has the potential to decrease the patient's length of stay in the facility, shorten the time in the post-anesthesia care unit, improve post-operative pain control, decrease the amount of supplemental pharmacological administered, reduce the cost of personnel, medications, and additional interventions, enhance patient outcomes, and improve the patient's overall satisfaction.

VII. TIMELINE

Project Timeline

Project Tasks

1. Develop the education intervention.
2. Request FIU Faculty approval.
3. Request FIU's CRNA alumni list.
4. Create and send study invitation.
5. Administer pretest questionnaires.
6. Perform educational intervention.
7. Administer posttest.
8. Analyze the data.

Figure 2. Project Timeline

VIII. RESULTS

Participant Demographics

Participant demographics are shown in Table 1, and Table 2 displays the participant's experience.

Table 1. Demographics

Demographics	N (%)
Total participants	8 (100%)
Gender	
Male	3 (37.5%)
Female	5 (62.5%)
Ethnicity	
African American	1 (12.5 %)
Caucasian	4 (50 %)
Hispanic	3 (37.5 %)
Medical Profession	
DNP	8 (100%)

Table 2. Experience

Experience	
Less than one year	0
1 to 2 years	5
2 to 5 years	1
20+ years	2

The sample size of this survey included a total of 8 participants. A total of 62.5% ($n = 5$) of the participants were females and 37.5% ($n = 3$) were males. The participants in this study were from assorted ethnic backgrounds, such as African Americans (12.5%), Caucasians (50%), and Hispanics (37.5%). All participants are CRNAs with Doctoral degrees in Nursing Practice. The participants were asked about their length of time practicing, which was: those 1 to 2 years ($n = 5$, 62.5%), 2 to 5 years ($n = 1$, 12.5%), and 10 or more years ($n = 2$, 25%).

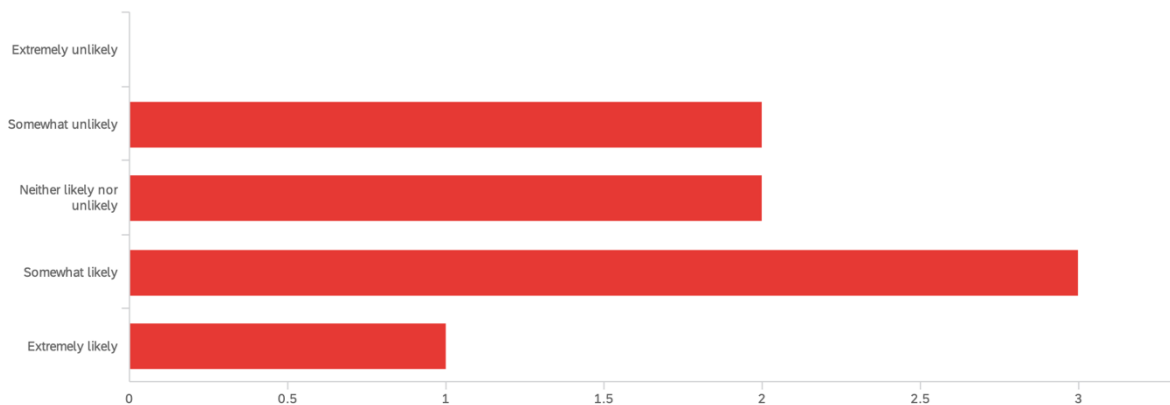
Pretest: Assessment of Baseline Knowledge

The pretest was established to determine the clinician's baseline knowledge. The pretest was delivered before the educational module and the posttest was delivered after the education. The pretest and posttest consisted of multiple-choice questions and were identical to one another. The pretest results varied question by question, however none of the participants were able to achieve perfect scores. Two (25%) participants had the highest scores by answering 90% of the questions correctly. Overall, the participants scored an average of 71.25% in selecting the correct response. Results for pretest questions are listed below in Table 3, and outcomes for pretest question 11 are seen in Figure 3 below.

Regarding the eleventh question on the Pretest, 2 (25%) answered "somewhat unlikely," 2 (25%) answered "neither likely nor unlikely," 3 (37.5%) answered "Somewhat likely," and 1 (12.5%) answered "Extremely likely." Results for pretest question eleven are seen in figure 3 below.

Figure 3. Pretest Question 11

Pre_Q11 - How likely are you to consider perineural dexmedetomidine as an adjunct agent to ropivacaine when administering a single shot brachial plexus block?



Pretest results are displayed below in Table 3.

Table 3. Pretest Results

Participant Number (#)	Correct Answers	Score
#1	8/10	80%
#2	8/10	80%
#3	8/10	80%
#4	9/10	90%
#5	8/10	80%
#6	3/10	30%
#7	9/10	90%
#8	4/10	40%

Posttest: Assessment of Learning

The posttest was presented after the educational module. It was implemented to evaluate learning and the probability of clinicians incorporating perineural dexmedetomidine as an adjunct agent to Ropivacaine when administering brachial plexus blocks. Four (50%) participants demonstrated improved knowledge on the posttest evaluation and scored perfect scores. Two (25%) participants scored the same on the Pretest and posttest. Lastly, 2 (25%) participants displayed a decrease in posttest scores compared to pretest scores. Furthermore, 3 (37.5%) CRNAs claimed that they would be "somewhat likely" to consider implementing incorporating perineural dexmedetomidine as an adjunct agent to Ropivacaine when administering brachial plexus blocks, and 5 (62.5%) CRNAs would be "extremely likely" to do so. Results for posttest questions are listed below in Table 5, and outcomes for posttest question 11 are seen in Figure 4 below.

Posttest results are displayed below in Table 4.

Table 4. Posttest Results

Participant Number (#)	Correct Answers	Score
#1	10/10	100%
#2	10/10	100%
#3	10/10	100%
#4	9/10	90%
#5	10/10	100%
#6	3/10	30%
#7	8/10	80%
#8	3/10	30%

Figure 4. Posttest Question 11

Post_Q11 - How likely are you to consider perineural dexmedetomidine as an adjunct agent to ropivacaine when administering a single shot brachial plexus block?

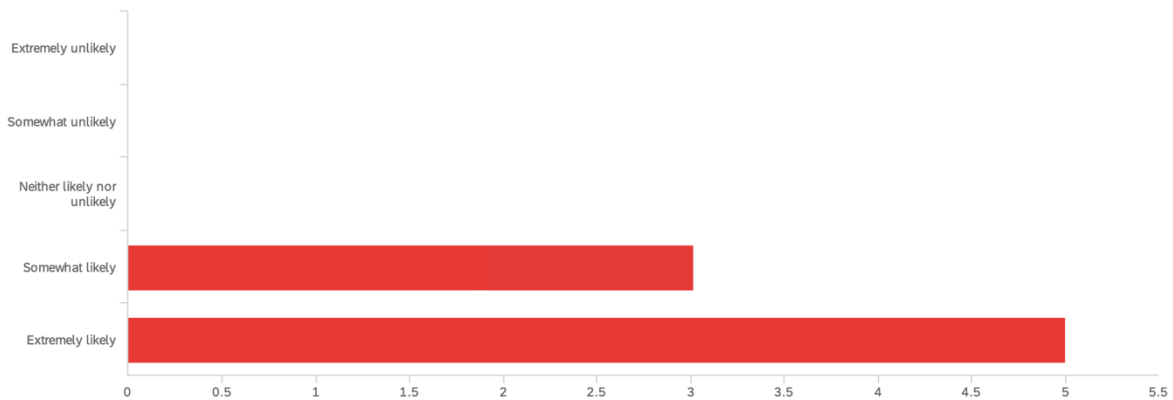


Table 5. Pretest vs. Posttest Scores

Participant Number (#)	Pretest Score	Posttest Score	Difference
#1	80%	100%	+20%
#2	80%	100%	+20%
#3	80%	100%	+20%
#4	90%	90%	No % Change
#5	80%	100%	+20%
#6	30%	30%	No % Change
#7	90%	80%	-10%
#8	40%	30%	-10%

IX. DISCUSSION

The virtual educational project produced mixed results when evaluating the knowledge gained after the educational module and significantly positive results when evaluating the likelihood of considering perineural dexmedetomidine as an adjunct agent to Ropivacaine when administering brachial plexus blocks. After completing the academic module, 50% of the participants demonstrated knowledge of perineural dexmedetomidine, 25% of participants did not have any improvement, and 25% exhibited decreased ability after the educational module. When evaluating the likelihood of CRNAs to consider perineural dexmedetomidine improved

significantly with 37.5% CRNAs claiming that they would be "somewhat likely" to consider perineural dexmedetomidine and 5 (62.5%) CRNAs would be "extremely likely" to do so.

Limitations

The most noticeable limitation of the educational project was the small sample size. Although email invitations were distributed to 88 FIU alumni, 4 of those emails were returned, unable to be delivered, and only 8 participated in the survey. Several of the emails provided by the FIU anesthesia department's chair were FIU emails of graduates that may no longer have access to the university's email account. Another limitation was the virtual aspect of the project. Cybernetic communication can be unreliable and challenging for CRNA without many computers or phone literacy. Email invitations have the potential to be overlooked, and there is limited control over the participant initiating or even completing the survey.

X. IMPLICATIONS OF ADVANCED PRACTICE NURSING

Future Implications for Practice and Career Development

The extensive literature review has identified that the conjunction of perineural dexmedetomidine with Ropivacaine when administering brachial plexus blocks results in favorable outcomes with minimal side effects.^{1-6,8-10,13} However, implementation in practice has been restricted due to practitioner limitations and inadequate substantial evidence-based research.

The educational project implemented by the author of this scholarly paper validated that anesthesia providers are willing to incorporate new approaches to already established practices. It also demonstrated that with the proper education, they are likely to modify their clinical training in pursuit of the most up-to-date, evidence-based practices that lead to the best possible patient outcomes. It is advisable to continue the research on adding perineural dexmedetomidine

to Ropivacaine when administering a brachial plexus block. New practice guidelines can lead to improved outcomes, decreased hospitalization costs, and enhanced patient's surgical experience.

XI. CONCLUSION

Amongst the total number of participants in this educational intervention ($n = 8$), 50% ($n = 4$) demonstrated gained knowledge of perineural dexmedetomidine, 25% ($n = 2$) showed no change, and 25% ($n = 2$) exhibited a decrease in understanding. The results are neither favorable nor unfavorable. All the participants ($n = 8$) were willing to consider implementing perineural dexmedetomidine as an adjunct agent to Ropivacaine when administering brachial plexus blocks. Considering the ambiguity of the results, it is recommended that further research is developed to educate, train, and possibly alter current practice standards.

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XIII. APPENDIX

Appendix A



Office of Research Integrity
Research Compliance, MARC 414

Dr. Yasmine Campbell

File

Handwritten initials, possibly "CJC", in black ink.

March 25, 2022

Improving Clinical Knowledge on the Efficacy of Brachial Plexus Blocks
with Perineural Dexmedetomidine as an Adjunct Agent to Ropivacaine
Compared to Brachial Plexus Blocks with Ropivacaine as a Sole Agent: An
Educational Module

IRB-22-0106
111505

03/25/22

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.

discontinued.

or

Special Conditions: N/A

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

Appendix B



CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT

"Improving Clinical Knowledge on the Efficacy of Brachial Plexus Blocks with perineural dexmedetomidine as an adjunct agent to ropivacaine compared to brachial plexus blocks with ropivacaine as a sole agent: An Educational Module"

SUMMARY INFORMATION

Things you should know about this study:

- Purpose:** Educational module to improve knowledge in utilizing perineural dexmedetomidine as an adjunct agent to ropivacaine for brachial plexus blocks.
- Procedures:** If you choose to participate, you will be asked to complete a pre test watch a voice PowerPoint and then a post test
- Duration:** This will take about a total of 20 minutes total.
- Risks:** 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 have included mild emotional stress or mild physical discomfort from sitting on a chair for an extended period of time, for instance.
- Benefits:** The main benefit to you from this research is increase the participants knowledge in utilizing perineural dexmedetomidine as an adjunct agent to ropivacaine for brachial plexus blocks.
- Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- Participation:** Taking part in this research project is voluntary.

Please carefully read the entire document before agreeing to participate.

PURPOSE OF THE PROJECT

You are being asked to be in a quality improvement project. The goal of this project is to improve health care provider knowledge on the use of perineural dexmedetomidine as an adjunct agent to ropivacaine for brachial plexus blocks.

NUMBER OF STUDY PARTICIPANTS: If you decide to be in this study, you will be one of approximately 10 people in this research study.

DURATION OF THE PROJECT

Your participation will require about 20 minutes of your time. If you decide to participate you will be 1 of 10 participants.

PROCEDURES

If you agree to be in the project, we will ask you to do the following things:

If you agree to be in the study, we 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 10 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 have included mild emotional stress or mild physical discomfort from sitting on a chair for an extended period of time, for instance.

BENEFITS

The following benefits may be associated with your participation in this project: An increased understanding on perineural dexmedetomidine as an adjunct agent to ropivacaine for brachial plexus blocks.

The overall objective of the program is to increase the quality of healthcare delivery and improve healthcare outcomes for our patients.

ALTERNATIVES

There are no known alternatives available to you other than not taking part in this project. However, if you would like to receive the educational material given to the participants in this project, it will be provided to you 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, we might publish, we will not include any information that will make it possible to identify you as a participant. Records will be stored securely, and only the project team will have access to the records.

PARTICIPATION: Taking part in this research project is voluntary.

COMPENSATION & COSTS

There is no cost or payment to you for receiving the health education and/or for participating in this project.

RIGHT TO DECLINE OR WITHDRAW

Your participation in this project is voluntary. You are free to participate in the project or withdraw your consent at any time during the project. Your withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove you without your consent at such time that they feel it is in the 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 Pedro Pena at 305-833-9130/ ppena025@fiu.edu and Dr. Yasmine Campbell at 305-348-9894/ ycampbell@fiu.edu

IRB CONTACT INFORMATION

If you would like to talk with someone about your rights pertaining to being a subject in this project or about ethical issues with this project, you 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



Nicole Wertheim College of Nursing & Health Sciences

Improving Clinical Knowledge on the Efficacy of Brachial Plexus Blocks with perineural dexmedetomidine as an adjunct agent to ropivacaine compared to brachial plexus blocks with ropivacaine as a sole agent: An Educational Module

Dear FIU Alumni, Anesthesia Provider:

My name is Pedro Pena, and I am a student from the Anesthesiology Nursing Program Department of Nurse Anesthetist Practice at Florida International University. I am writing to invite you to participate in my quality improvement project. The goal of this project is to improve health care provider knowledge on the use of perineural dexmedetomidine as an adjunct agent to ropivacaine when administering a brachial plexus block. You are eligible to take part in this project because you are an alumni CRNA FIU's DNAP program.

If you decide to participate in this project, you will be asked to complete and sign a consent form for participation. Next, you will complete a pre-test questionnaire, which is expected to take approximately 5 minutes. You will then be asked to view an approximately 15 minute long educational presentation online. After watching the video, you will be asked to complete the post-test questionnaire, which is expected to take approximately 5 minutes. No compensation will be provided.

Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate or have any questions about the study, please email or contact me at ppena025@fiu.edu or 305-833.9130

Thank you very much.

Sincerely,

Pedro Pena, SRNA, BSN, CCRN

Appendix D



Name: Pedro Pena

Date: February 5, 2022

Pretest and Posttest Questionnaire:

Improving clinical knowledge on the efficacy of brachial plexus blocks with perineural dexmedetomidine as an adjunct agent to ropivacaine compared to brachial plexus blocks with ropivacaine as a sole agent: An Educational Module

INTRODUCTION

The primary aim of this QI project is to educate anesthesia providers on the latest evidenced research regarding the addition of perineural dexmedetomidine to ropivacaine when administering brachial plexus blocks for upper extremity surgeries.

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 the use of perineural dexmedetomidine as an adjunct agent to ropivacaine for brachial plexus blocks.

PERSONAL INFORMATION

1. **Gender:** Male Female Other_____
2. **Age:** _____
3. **Ethnicity:**
 Hispanic Caucasian African American Asian Other_____
4. **Position/Title:** _____
5. **Level of Education:** Certificate Bachelors Masters Doctorate Other _____
6. How many years have you been an anesthesia provide?
 Over 10 5-10 years 2-5 years 1-2 years

QUESTIONNAIRE

- 1. In contrast to a single shot brachial plexus block using ropivacaine as the sole agent, a single shot brachial plexus block with perineural dexmedetomidine as an adjunct agent to ropivacaine is associated with of the following laboratory findings:**
 - a. Significantly lower mean plasma cortisol levels 6hrs post-operatively
 - b. Significantly lower mean plasma substance P levels 1hr post-operatively
 - c. Significantly lower mean plasma IL-6 level at 1, 6, 12, and 48 h postoperatively
 - d. All the above

- 2. Recent data states that the median duration of analgesia of an ultrasound guided brachial plexus block with the use of 0.5% ropivacaine is:**
 - a. 5 Hours
 - b. 3.6 Hours
 - c. 14 Hours
 - d. 8 Hours

- 3. [Select Four]. Poorly managed acute post-operative pain can result which negative outcomes?**
 - a. Prolonged recovery periods
 - b. Acholuria
 - c. Impaired immune function
 - d. Hypoventilation
 - e. Delayed discharge
 - f. Sleep Disturbances

g. Xerostomia

4. Select the correct mechanism of action of Dexmedetomidine?

- a. Potent μ -receptor agonist
- b. N-Methyl-D-aspartate receptor antagonist
- c. Highly selective α_2 adrenergic agonist
- d. Inhibition of alpha 2 delta subunit of voltage gated calcium channels

5. What recommended dose of perineural dexmedetomidine results in optimal efficacy while minimizing the risk of adverse side effects?

- a. 100mcg-200mcg
- b. 25mcg -50mcg
- c. 1mcg/kg
- d. 4-5mcg/kg

6. According to the latest evidenced based research on perineural Dexmedetomidine, all the following are expected outcomes, except?

- a. Shortened time of onset
- b. Prolonged sensory blockade
- c. Prolonged motor blockade
- d. Prolonged analgesia
- e. Shortened motor blockade

7. Upon reviewing the latest evidenced based research on single shot brachial plexus blocks with 0.5% ropivacaine and 1mcg/kg perineural Dexmedetomidine, the anesthesia provider displays adequate understanding by selecting which three potential side effects?

- a. Transient bradycardia
- b. Increased MAP
- c. Hypertension
- d. Hypothermia
- e. Hypotension
- f. Excessive sedation
- g. Transient tachycardia

8. Post-operative pain that requires supplemental pharmacological intervention with opioids can result in which of the following undesired outcomes?

- a. Increased risk to develop PONV
- b. Respiratory depression
- c. Constipation
- d. Prolonged hospitalization
- e. Extended post anesthesia care unit (PACU) time
- f. All the above

9. True or False. According to current research, patients receiving a brachial plexus block with both ropivacaine and perineural dexmedetomidine, displayed lower levels of plasma IL-6 and IL-8 in the first 48h of surgery as well as the delayed presence of rebound pain.

- a. True
- b. False

10. Which perineural dose of dexmedetomidine is associated with an increased risk of intraoperative hemodynamic instability?

- a. 1mcg/kg
- b. 25mcg -50mcg
- c. 100mcg-150mcg
- d. Perineural dexmedetomidine is not associated with any dose dependent hemodynamic changes

11. How likely are you to consider perineural dexmedetomidine as an adjunct agent to ropivacaine when administering a single shot brachial plexus block?

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

Appendix E

6/7/22

FIU

Improving Clinical Knowledge On The Efficacy Of Brachial Plexus Blocks With Perineural Dexmedetomidine As An Adjunct Agent To Ropivacaine Compared To Brachial Plexus Blocks With Ropivacaine As A Sole Agent: An Educational Module

Nicole Wertheim College of Nursing & Health Sciences, Florida International University
 Pedro O. Peña BSN, RN, CCRN
 Yasmine Campbell BNP, CRNA, AFRN

FLORIDA INTERNATIONAL UNIVERSITY

1

FIU

LEARNING GOALS:

From this quality improvement module, you will:

- Discuss brachial plexus blocks
- Discuss dexmedetomidine
- Understand the effects of postoperative pain on patient outcomes

FLORIDA INTERNATIONAL UNIVERSITY

2

BACKGROUND:

FIU

Brachial plexus block with ropivacaine alone provides analgesia for a mean duration of 8hrs

Brachial plexus block with ropivacaine and perineural dexmedetomidine provides analgesia for a mean duration of 12hrs

The use of O2 agonists with local anesthetics has proven to reduce their overall dosage and thereby reduce the risk of local anesthetic toxicity

FLORIDA INTERNATIONAL UNIVERSITY

3

Effects of inadequate post-operative pain control

FIU

- PONV
- Sleep Disturbance
- Prolonged PACU time / Delayed Discharge
- Impairs immune function
- Lower Patient satisfaction (SAT scale) / Increased VAS
- Increased need for supplemental pharmacological intervention

4

Effects of post-operative Opioid administration

FIU

- Opioid induced nausea & vomiting
- Respiratory depression
- Prolonged PACU time
- Supplemental O2 requirements
- Delayed hospital discharge
- Risk for constipation/ ileus

5

Education: What is Dexmedetomidine?

FIU

Dexmedetomidine

- Dexmedetomidine is a highly selective alpha2 adrenergic agonist used in clinical practice to alleviate pain and induce sedation

Evidence in research

- Ideal perineural dose: 1-2mcg/kg (Dosages above 100mcg have been shown to cause hemodynamic instability)
- Significantly lower mean plasma cortisol levels 6hrs post-operatively
- Significantly lower mean plasma substance P levels 1hr post-operatively
- Lower levels of plasma IL-6 and IL-8 in the first 48h of surgery as well as the delayed presence of rebound pain

6

Education: How Will Dexmedetomidine Impact Patient Outcomes?

According to the latest evidenced based research, the administration of **1mcg/kg of dexmedetomidine** to 0.2% ropivacaine when administering a brachial plexus block results in:

- **Shortens onset time****
- **Extended the duration of motor, sensory, and analgesic blockade****
- **Decreases need for supplemental pharmacological interventions in the PACU****
- **Eliminates the side effects from the administration of opioids****
- **Decreases need for supplemental analgesia (VAS) and increases patient satisfaction (SAT score)****

FIU

7

Study Discussion Points:

Hwang et al ⁶	Kozak et al ⁶	Lu et al ⁶	Voncken et al ⁶
<ul style="list-style-type: none"> • The participants in group #1 receiving ultrasound guided (US) using a mixture of 1 ml (100 mg) of 0.2% and 8 ml of 0.25% ropivacaine demonstrated: • Lower VAS scores, • Higher SAT scores, • Lower pain related symptoms • Delayed rebound pain. 	<ul style="list-style-type: none"> • The concluding result of the study revealed significant differences between the two groups. Group #2 containing the patients receiving an auxiliary brachial plexus block with the use of both ropivacaine and dexmedetomidine displayed: • Increased analgesia, sensory and motor duration • The results also demonstrated a shortened onset of sensory block • No significant difference in the onset of motor blockade. 	<ul style="list-style-type: none"> • The study concluded that the participants who received both ropivacaine and dexmedetomidine presented with: • Faster onset of analgesic effects • Longer duration of both sensory and motor nerve blockade. • Decrease in both HR and MAP and no increase in SpO2 measurements, which are the results related to the auxiliary added to the outcome. ** 	<ul style="list-style-type: none"> • According to the evidence listed in the meta-analysis it is indicated that: • Peripheral Dexmedetomidine significantly: • Shortens the onset • Prolongs the analgesic effects • Increases rate of motor block • Decreases bradycardia and hypotension.

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8

Study Discussion Points cont.

Bharti et al ⁷	El-Bohady et al ⁸
<ul style="list-style-type: none"> • The study concluded that the participants who received dexmedetomidine as an adjunct to local anesthetics presented with: • Faster onset of both sensory and motor blockade • Longer duration of blockade and analgesia. • Decreased consumption of pharmacological interventions in the post anesthesia care unit. • Decreased VAS scores.⁸ • The study also identified a decrease in both HR and blood pressure perioperatively. • No hypotension or bradycardia in either groups.⁸ 	<ul style="list-style-type: none"> • According to the evidence listed in the meta-analysis it is indicated that peripheral dexmedetomidine significantly: • Shortened onset of action • Increased the analgesic quality • Prolongs the of brachial plexus blocks in comparison with clonidine. • Data also demonstrates that the benefits are associated with increased risks of excessive sedation and transient bradycardia.

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9

Take home points

Dexmedetomidine possesses unique properties which render it suitable enhancements of brachial plexus blocks	Dexmedetomidine has decreased the need for supplemental pharmacological interventions in the PACU	Dexmedetomidine is a highly selective potent alpha-2 adrenergic agonist, of anesthetic, analgesic, and emolytic properties, with minimal side effects	Minimal decreases in MAP, transient bradycardia, and excessive sedation have been noted, without significant clinical impact
It has been shown to extend the duration of motor, sensory, and analgesic blockade	It has shortened the speed onset	Enhance patient satisfaction (SAT scores)	Eliminate the side effects from the administration of opioids

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10

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11

Appendix F

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QUESTION	
Population	Adult patients receiving a US guided brachial plexus block for elective surgery.
Intervention	The addition of perineural dexmedetomidine
Comparison	Compared to patients only receiving ropivacaine as a sole agent
Outcome	Analgesic onset, duration, and efficacy of block. (Measured in recovery times, the patient reported pain post-operatively, and usage of additional analgesia)
Time	Intraoperative and postoperative period (1-hour postoperative, 2 hours postoperative, or the entire postoperative period)

7

PROJECT PURPOSE

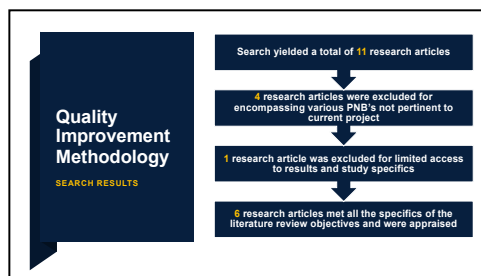
To educate anesthesia providers on the latest evidenced research regarding the addition of perineural dexmedetomidine to ropivacaine when administering brachial plexus blocks for upper extremity surgeries.

To enhance overall patient outcomes and satisfaction by reducing the negative effects associated with limited onset and duration of brachial plexus blocks using ropivacaine as a sole agent.

8

Database:	Exclusion Criteria	Search Terms	Inclusion Criteria
<ul style="list-style-type: none"> CINAHL EBSCO 	<ul style="list-style-type: none"> Studies published prior to 2014 Participants < 18y old ASA > III Procedures for Tx of Cancer Brachial plexus blocks using the coracoid approach 	<ul style="list-style-type: none"> Brachial Plexus Block OR Suprascapular Block OR Interscalene Block OR Infraclavicular Block OR Axillary Block AND Neuraxial OR Perineural AND Dexmedetomidine OR Prorocidex AND Ropivacaine 	<ul style="list-style-type: none"> Printed in English Full text availability Printed 2014 to current year

9



10

Quality Improvement Methodology

- Participants:** A total of 8 CRNAs
- Methods:** Pre-test Survey, Educational Module, Post-test Survey
- Data Collection:** Anonymous, virtual data collection via Qualtrics survey platform
- Data Analysis:** Qualtrics data analytical software to generate survey results

11

Quality Improvement Results

Demographics	N (%)	DEMOGRAPHICS	
		Experience	Yrs
Total participants	8 (100%)	Less than one year	0
		1 to 2 years	5
Gender		2 to 5 years	1
Male	3 (37.5%)	20+ years	2
Female	5 (62.5%)		
Ethnicity			
African American	1 (12.5%)	Medical Profession	
Caucasian	4 (50%)	DNP	8 (100%)
Hispanic	3 (37.5%)		

12

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QUALITY IMPROVEMENT RESULTS

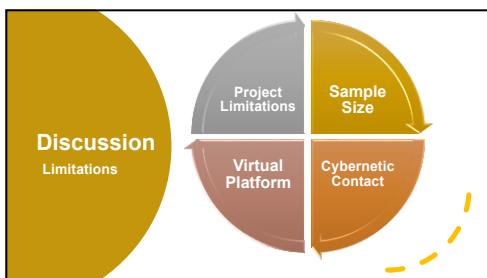
Participant Number (#)	Pretest Score	Posttest Score	Difference
#1	85%	100%	+20%
#2	85%	100%	+20%
#3	85%	100%	+20%
#4	95%	95%	No % Change
#5	85%	100%	+20%
#6	30%	30%	No % Change
#7	95%	80%	-15%
#8	45%	35%	-10%

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13



14



15

Implication of Advanced Practice Nursing

- ✓ The extensive literature review has identified that the conjunction of perineural dexmedetomidine with Ropivacaine when administering brachial plexus blocks results in favorable outcomes with minimal side effects.
- ⚠ However, implementation in practice has been restricted due to practitioner limitations and inadequate substantial evidence-based research.
- 🔬 It is advisable to continue the research on adding perineural dexmedetomidine to Ropivacaine when administering a brachial plexus block.
- 👤 New practice guidelines can lead to improved outcomes, decreased hospitalization cost, and enhanced patient's surgical experience.

16

Conclusion

Review of Literature

According to the latest evidenced-based research, the implementation of **fenofyllol of dexmedetomidine to 0.5% ropivacaine** when administering a brachial plexus block results in:

- Prolongs analgesia duration
- Shortened onset time
- Decreases visual Analog scale (VAS) and Enhances patient satisfaction (GAT scale)
- Extended the duration of motor, sensory, and analgesic blockade
- Decreased the need for supplemental pharmacological interventions in the PACU
- Eliminates the side effects from the administration of opioids

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17


Conclusion

- 🏛️ Amongst the total number of participants in this educational intervention (n=8) 50% (n=4) demonstrated general knowledge of perineural dexmedetomidine. 25% (n=2) showed to change 25% (n=2) exhibited a decrease in understanding.
- ✓ The results are neither favorable nor unfavorable.
- 👤 All the participants (n=8) were willing to consider implementing perineural dexmedetomidine as an adjunct agent to Ropivacaine when administering brachial plexus blocks.
- 👤 Considering the ambiguity of the results, it is recommended that further research is developed to educate, train, and possibly alter current practice standards.

18

10/18/22

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19

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20