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An Educational Module Explaining the Use of The IPACK Block and The Adductor Canal Block to Relieve Pain After Total Knee Arthroplasty: A Quality Improvement Project

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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Abstract

Background. Orthopedic arthroplasty surgeries are one of the most performed surgical procedures in the United States, with over 840,000 total knee replacement patient admissions in 2017.[1] The quality improvement display will exhibit that the utilization of the IPACK block should be regularly applied to improve postoperative knee pain in combination with the ACB to enhance pain relief, increase mobility, decrease hospital stay, and reduce opioid consumption along with opioid side effects such as nausea and vomiting.

Methods. The databases utilized for the search included The Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Google Scholar. library, with full-text availability. Exclusion criteria included the studies that were published more than 10 years ago, comparison with other peripheral nerve blocks such as sciatic or femoral, abstract only, inaccessible, or third-party accessible articles. Other terms utilized during the search was peripheral nerve block and TKA. The Boolean phrases were utilized and produced 116 articles. Ten articles were chosen for review based on the inclusion and exclusion criteria, and 8 were utilized.

***Conclusion and Discussion*.** All TKA patients should receive the ACB and IPACK block perioperatively to decrease opioid consumption, side effects of pain, pain scores, and hospital stay and increase mobility. The IPACK block is a technique that relieves pain on the posterior portion on the knee, which is vulnerable to pain when utilizing the ACB alone.[2] The ACB provides a sensory block solely to the anterior and lateral portions of the knee.[2] By utilizing both blocks for TKA patients, all areas of the knee are receiving an adequate sensory blockade. The IPACK should be routinely utilized in all TKA surgical patients to provide better patient outcomes.

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INTRODUCTION

Background

Orthopedic arthroplasty surgeries are one of the most performed surgical procedures in the United States, with over 840,000 total knee replacement patient admissions in 2017.[1] Historically, knee replacement surgeries are performed under general anesthesia, with opioids to relive pain with an adjunct peripheral nerve blockade such as the adductor canal block (ACB).[2] The ACB provides a sensory block solely to the anterior and lateral area of the knee, attenuating pain for total knee arthroplasty (TKA) patients, while allowing for patient mobility.[2] However, the ACB does not produce pain relief to the posterior aspect of the knee; a common patient complaint postoperatively.[2] Pain is a common fear in patients postoperatively. Patients experience and express pain in different ways, and the physiological effect of pain negatively contributes to myocardial oxygen consumption by increasing the cardiac contractility, pulse rate, and blood pressure.[3] Along with the increase in myocardial consumption, pain is also responsible for the prolongation of post anesthesia care unit (PACU) time.[3,4]

Pain is a patient perception and a subjective symptom; nonetheless, patient pain should be attended to and lessened. Typically, pain is treated with opioids. Opioids have strong pain-relieving properties that are unfortunately associated with postoperative nausea and vomiting (PONV), urinary retention, urticaria, and constipation.[5] Opioids also decrease respiratory drive and cause sedative effects and hyperalgesia, necessitating larger doses to accomplish pain relief.[5] Inadequate management of pain after a TKA leads to a decrease in mobility, which impedes recovery and rehabilitation.[2] The hinderance of rehabilitation lengthens the hospital stay and further increase the financial burden upon the healthcare system.[2] The quality improvement

display will exhibit that the utilization of the IPACK block should be regularly applied to improve postoperative knee pain in combination with the ACB to enhance pain relief, increase mobility, decrease hospital stay, and reduce opioid consumption and opioid side effects such as nausea and vomiting. [5,6]

Scope of the Problem

Although pain is a subjective vital sign, or occasionally called the fifth vital sign, it also has physiologic presentations. Pain stimulates the sympathetic nervous system, which promotes an increase in pulse, blood pressure, and cardiac contractility, which negatively contributes to an increase in myocardial oxygen demand.[4] Pain can be treated with multimodal approaches, but for severe pain, opioids are utilized. Opioids cause negative side effects such as a decrease in respiratory drive, sedative effects, hyperalgesia, and tolerance. Opioids can advance to tolerance and dependence that will necessitate an increase in dosage to accomplish the exact same pain relief with the lower dose.[5]

The pain that is associated with TKAs can be attenuated by utilizing peripheral nerve blocks. The traditionally utilized ACB, along with the newly introduced IAPCK block has been proven to combat the negative effects of pain and reduce opioid usage.[7] The utilization of peripheral nerve blockade to block all innervation to the knee (saphenous and sciatic nerve) has shown magnificent pain relief after a TKA, which reduces opioid consumption, hospital stay, and the occurrence of nausea and vomiting.[5]

Consequences of the Problem

Insufficient control of pain after a TKA, in combination with a decrease in mobility related to pain, hinders recovery and rehabilitation, which in turn prolongs the hospital stay and further increases the monetary load upon the health care system.[2] Additionally, a lack of pain control intensifies the dependance on opioids, which contributes to nausea, vomiting, and decreased peristalsis, possibly delaying the discharge process.[2] TKA patients are twice as likely to require a refill on their opioid prescriptions and are postoperatively prescribed more morphine, an opioid, for a longer period of time.[5] The more pain a patient feels, the more compelling providers are to relieve the pain with opioids. Without the IPACK block, patients are vulnerable to posterior knee pain necessitating aggressive pain control.

The aforementioned consequences can be mitigated by the utilization of both the ACB and IPACK block for all TKA surgical candidates. There is a clinically substantial reduction in overall opioid use postoperatively after a TKA with the adjunct therapy of the IPACK block to the ACB compared to patients who did not obtain the IPACK block.[7] Anesthesia providers are capable of participating in the reduction of side effects related to proper regional anesthesia techniques for TKA.

Knowledge Gaps

The IPACK block is a newer block, and not every anesthesia provider is aware of the benefits or the block itself. Also, the IPACK block was introduced with the facilitation of ultrasound guidance. Some providers utilize anatomic landmarks to perform regional blocks, and they may find discomfort with a new skill (ultrasound) and a new block. The IPACK block

utilizes ultrasound guidance for precision due to the closeness of the popliteal artery. Accidental injection of local anesthetic into an artery can produce local anesthtic systemic toxicity (LAST). LAST is a rare but life-threatening side effect of local anesthetic injection from any route.[8] If a provider is not familiar with the ultrasound guidance of peripheral nerve blocks, there could be hesitance regarding performing a new technique with an unmastered skill.

Proposal Solution

To alleviate total knee pain, the utilization of peripheral nerve blocks in combination with an assortment of anesthetics has decreased postoperative pain in comparison to later methods.[6] Particularly, the ACB and IPACK blocks have emerged progressively in relation to their analgesic effectiveness and muscle sparing qualities.[6] The standard of care for TKA should incorporate both peripheral nerve blocks to block all innervation to the knee. Dr. Sanjay Sinha, an anesthesiologist from Connecticut, developed the block to facilitate improvements in posterior knee pain.[9] Anesthesia providers need to receive the training and education regarding the technique of the block to properly perform and contribute to the reduction of pain for this surgical procedure. After surgery, TKA patients have the highest risk for chronic opioid use.[9] Uncontrolled postoperative TKA pain related to the lack of posterior knee sensory blockade causes an increase in opioid consumption. By standardizing both blocks to be performed routinely for all TKA patients, the negative effects of pain are reduced, and the need for opioids are simultaneously decreased.[6]

PICO Question or Purpose

Population (P): Surgical patients undergoing total knee replacement

Intervention (I): Addition of the infiltration between the popliteal artery and capsule of

the knee block (IPACK) block to the adductor canal block (ACB)

Comparison (C): None

Outcomes (O): Improved negative pain related patient outcomes with a decrease in opioid usage

LITERATURE REVIEW

This literature review intended to provide evidence that the IPACK and ACB administered together is a superior option for patients compared to the sole administration of the ACB. The literature review demonstrated the superiority by displaying an increase in pain relief and a decrease in opioid consumption among TKA patients.[6,7] The literature review also provided evidence regarding the addition of the IPACK block has shown to decrease hospital stay and increase patient mobility to decrease hospital cost.[6,7,8]

Search Strategy

Articles for this literature review were assessed based on the inclusion and exclusion requirements to enhance the objectives. Inclusion conditions consisted of only studies published within the past 5 years, included the comparison of the IPACK block & ACB, with full-text availability. Exclusion criteria included studies that were published more than 10 years ago, comparison with other peripheral nerve blocks such as sciatic or femoral, abstract only, inaccessible or third-party accessible articles. The databases were accessed via the FIU online A-Z library. Boolean and search terms included: IPACK, ACB, pain, opioids, peripheral nerve block, and TKA. The databases facilitating the literature review consisted of the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Google Scholar. The Boolean

phrases were utilized and produced 116 articles. Ten articles were chosen for review based on the inclusion and exclusion criteria, and a total of 4 articles were selected for the literature review.

VanderWielen et al.[7]

In the article by VanderWielen et al.,[7] the purpose of the study was to compare postoperative opioid consumption described as morphine milligram equivalents (MME) by patients undergoing a TKA before and after the introduction of the IPACK block to the ACB. The researchers compared a group of patients who received the ACB, without the IPACK block and another group that included both the IPACK block and the ACB. The healthcare records of these patients were obtained, and a few factors were evaluated.

First, the researchers investigated the MME between both patient groups. The mean MME was drastically decreased in the IPACK group. Also, the patients in the IPACK group requested their first narcotic dose longer than the patients in the ACB group (9.02 ± 3.79 vs 7.59 ± 5.08). Secondly, another outcome that was associated with the IPACK group was a decrease in hospital stay (29.57 ± 7.97 vs 36.89 ± 12.20, $p = 0.02$).

Both groups of patients in the study received a spinal anesthetic along with a PAI (periarticular injection) placed by the surgeon intraoperatively. The only difference was the addition of the IPACK block. VanderWielen et al.'s[7] findings discovered a clinically substantial decrease in total postoperative opioid utilization by MME after a TKA with the adjunct IPACK block in combination with the ACB.

Kandarian et al. [6]

The research by Kandarian et al.[6] was an 8-month retrospective cohort study that consisted of reviewing TKA surgical candidates' postoperative pain before and after implementation of the IPACK block on POD (postoperative day) 0. All TKA patients in this study received an ACB and perioperative multimodal analgesia (MMA). The study cohort consisted of 80 patients (n = 32 for non-IPACK group and n = 48 for IPACK group). Information that is usually collected during the postoperative time in relation to pain, such as medication administration, and rehabilitation therapies were incorporated and retrospectively reviewed. Pain measurements were recorded from patients using a 0-10 scale. A pain rating of 0 translated to the patient not feeling any pain. A pain rating of 10 translated to the patient feeling the worst possible pain.

On POD 0, Kandarian et al.[6] reported that the IPACK group had the lowest pain scores compared to the non-IPACK group (0 [0–4.3] vs. 2.5 [0–7]; p = 0.003). The aforementioned results also translated to this group consuming less opioids postoperatively in MME. Kandarian et al.[6] concluded their study with evidence that the addition of IPACK block produced the lowest pain scores on POD 0. Kandarian et al.[6] also stated that the IPACK block may be a technique utilized for new opioid-sparing analgesic practices.

Sankineani et al.[8]

Sankineani et al.[8] constructed a prospective control trial to determine if the combination of the ACB and IPACK block will provide better pain relief and improve knee function in the immediate postoperative period compared to ACB alone. Group 1 consisted of patients who

received an IPACK block along with an ACB, while Group 2 received the ACB alone. The study would determine the efficacy of the IPACK block on the VAS (visual analog score). The VAS is a subjective measure for pain. The study sample size consisted of 120 TKA participants. Sixty patients received the ACB and IPACK (Group 1, $n = 60$), and the other group, which also consisted of 60 patients, received the ACB alone (Group 2, $n = 60$). All the patients in the study, despite their group, received the same preoperative medications and the same postoperative analgesic treatment. The one important difference between the groups were the utilization of the IPACK block.

The VAS score was measured every 8 hours while patients were at rest, which showed that on postoperative day 1 and day 2 a substantially significant ($p < 0.005$) value in the ACB and IPACK group compared to the ACB group. Another finding in the Sankineani et al.[8] study was that the average range of motion (ROM) of the knee on POD 2 was 71.8 degrees in the ACB and IPACK group, which was significantly better ($p < 0.05$) than the ACB group (ROM = 62.2 degrees). Comparably, the ambulation distance was better in the ACB and IPACK group compared to the ACB group. Not only did the study provide that the IPACK block has better values in the VAS, but the block also provides better patient mobilization and ROM.

Wang et al.[9]

In this level III, meta-analysis study by Wang et al.,[9] the purpose was to authenticate the effectiveness of combining the IPACK block to the ACB in the process of a multimodal pain setting after TKA. Wang et al.[9] evaluated 8 studies ($N = 1,056$) that demonstrated a comparison between the effectiveness of the IPACK block and ACB to the ACB alone. After assessing the 8 different studies, primary outcomes consisted of VAS score at rest or during activity at different

time points. Secondary outcomes consisted of opioid consumption, walking distance, and hospital LOS.

Wang et al.[9] discovered through the studies that the addition of the IPACK block to ACB in a multimodal pain setting can successfully reduce opioid consumption in the early postoperative time. Opioid consumption at POD 1 was found to be lower in the IPACK and ACB groups. Also, VAS scores at rest on the day of surgery were lower in the iPACK block and ACB groups.

Author(s)	Purpose	Methodology/ Research Design	Intervention(s)/ Measures	Sampling/Setting	Primary Results	Relevant Conclusions
Vander Wielen et al., 2018	To compare postoperative opioid consumption described as morphine milligram equivalents (MME) by patients undergoing a TKA before	Retrospective review	The researchers compared a group of patients who received the ACB, without the IPACK block and another group that included both the IPACK block and the ACB.	The health records of 75 patients that underwent a TKA under spinal anesthesia were reviewed: 38 patients received an ACB and PAI without an IPACK block from 3/2017-9/2018, and 37 patients received	Discovering a clinically substantial decrease in total postoperative opioid utilization by MME after a TKA with the adjunct IPACK block in combination with the ACB	The patients in the IPACK group requested their first narcotic dose longer than the patients in the ACB group (9.02 ± 3.79 vs 7.59 ± 5.08). Secondly, another outcome that was associated with the IPACK group was a decrease in hospital

	and after the introduction of the IPACK block			the IPACK, ACB and PAI from 10/2018-10/2019		stay (29.57 ± 7.97 vs 36.89 ± 12.20, p = 0.02).
Kandarian et al., 2019	To compare the outcomes of postsurgical patient pain in TKA candidates before and after implementing ng the IPACK block on post op day 0	Retrospective cohort study	Administering the IPACK block to one group of patients to evaluate pain measures on a scale from 0-10.	The study cohort consisted of 80 patients (n = 32 for non-IPACK group and n = 48 for IPACK group)	On POD 0, the lowest pain score was significantly lower for the IPACK group compared to the non-IPACK group (0 [0–4.3] vs. 2.5 [0–7]; p = 0.003).	The total postoperative opioid consumption in MME was lower in the IPACK group.

Sankineani et al, 2018	To determine if the combination of the ACB and IPACK block will provide better pain relief and improve knee function in the immediate postoperative period compared to	Prospective control trial	1 group of patients received an IPACK block along with an ACB, while another group received the ACB alone to determine the efficacy of the IPACK block on the VAS.	60 patients received ACB and IPACK (Group 1, $n = 60$), and the other group with 60 patients received ACB alone (Group 2, $n = 60$).	VAS score at rest after 8 hours postoperatively, on day 1 and day 2 showed significantly ($p < 0.005$) better values in ACB and IPACK group compared to the ACB group.	The average ROM of the knee on POD 2 was 71.8 degrees in the ACB and IPACK group, which was significantly better ($p < 0.05$) than the ACB group (ROM = 62.2 degrees). Comparably, the ambulation distance was better in the ACB and IPACK group compared to the ACB group.

	ACB alone					
Wang et al., 2021	To validate the efficacy of combining the IPACK block to the ACB in the process of a multimodal pain management procedure after TKA	Level III, meta-analysis study	Evaluating 8 studies ($N = 1{,}056$) that demonstrated a comparison between the effectiveness of the IPACK block and ACB and the ACB alone.	From 8 different studies, primary outcomes consisted of VAS score at rest or during activity at various time points. Secondary outcomes consisted of opioid consumption, walking distance, and length of hospital stay (LOS).	The addition of the IPACK block to ACB in a multimodal pain management setting can successfully reduce opioid consumption in the early postoperative time. Opioids consumption at POD 1 was lower in the IPACK and ACB group	VAS scores at rest on the day of surgery were lower in the IPACK block and ACB group.

Summary of the Evidence & Conclusion

The 4 articles that were utilized for the literature review consisted of retrospective studies, a prospective study, and a meta-analysis study. Overall, the studies demonstrated the benefits of utilizing the IPACK block in conjunction with the ACB to produce an overall improved patient outcome. VanderWielen et al.[7] and Kandarian et al.[6] both provided information regarding opioid consumption. Both articles revealed that the addition of the IPACK block to the ACB produced a decrease in opioid consumption by measuring the MME. Patients were utilizing less opioids in the IPACK group in both studies. VanderWielen et al.[7] was the only study that revealed the IPACK decreased the hospital length of stay.

Kandarian et al.[6] Wang et al.[9], and Sankineani et al.[8] demonstrated a decrease in pain scores using a subjective metric to determine the experience of pain. The VAS was deceased along with the 0-10 pain scale rating in the aforementioned studies in groups that utilized the IPACK block. Sankineani et al.[8] was the only study that exhibited a significant improvement in patient mobility by measuring the degree of the knee, which was shown to be significantly improved in the IPACK group. The same study also demonstrated that the ambulation distance was longer in the IPACK group, further providing better outcomes for patients.

The literature review has revealed the efficacy of combining the IPACK block with ACB for TKA. Patients experiencing little to no pain by the result of adding the IPACK to the ACB would theoretically display lower heart rates and blood pressure because pain causes an increase in myocardial consumption.[3] By consuming less opioids due to the pain-relieving effects of the IPACK block, there is a decrease in opioid related side effects such as PONV, urinary retention, urticaria, and constipation.[5] Inadequate management of pain after a TKA leads to a decrease in mobility, which impedes recovery and rehabilitation.[2] By utilizing the IPACK block in

conjunction with the ACB, patients displayed an increase in ROM, and ambulation distance.[8] The hinderance of rehabilitation lengthens the hospital stay, which is shortened by adding the IPACK block to the ACB.[7]

In summation, the literature review has provided adequate information by utilizing a variable number of studies to display the efficacy of the IPACK block in conjunction with the ACB. The ACB alone is inferior to the IPACK block and ACB combined, regarding subjective pain scores, opioid consumption, hospital length of stay, and patient mobility.[5,6,7,8] The IPACK block is a technique that relieves pain on the posterior portion on the knee, which is vulnerable to pain when utilizing the ACB alone.[2] The ACB provides a sensory block solely to the anterior and lateral portions of the knee.[2] By utilizing both blocks for TKA patients, all areas of the knee are receiving an adequate sensory blockade. The IPACK should be routinely utilized in all TKA surgical patients to provide better patient outcomes.

Primary DNP Project Goal

Total knee replacement surgeries are one of the most common orthopedic arthroplasty surgeries performed, with 840,000 inpatient admissions in 2017.[1] Pain is a common fear in patients postoperatively. To alleviate the pain in patients undergoing a total knee arthroplasty (TKA), general anesthesia has been historically utilized in combination with opioids and a peripheral nerve blockade such as the adductor canal block (ACB). The ACB delivers a sensory block solely to the anterior and lateral area of the knee while allowing for patient mobility.[2] However, the ACB does not produce pain relief to the posterior area of the knee, a common patient complaint postoperatively.[2] The primary goal is to introduce the IPACK block as a

standardized and routine peripheral block in conjunction with the traditional ACB for TKA patients to allow for overall better outcomes.

The posterior sensory nerves in the knee do not receive a blockade from the ACB, which renders the TKA patient vulnerable to pain in that area.[2] Pain negatively contributes to myocardial oxygen consumption by increasing the cardiac contractility, heart rate, and blood pressure.[3] Along with the increase in myocardial consumption, pain is also responsible for the prolongation of post anesthesia care unit (PACU) time.[3,4] Opioids have strong pain-relieving properties that are frequently utilized postoperatively in TKA patients. Opioid consumption is unfortunately associated with postoperative nausea and vomiting (PONV), urinary retention, hives, and constipation.[5] Opioids also decrease respiratory drive and cause sedative effects and hyperalgesia, necessitating larger doses to accomplish pain relief.[5] Insufficient postoperative pain management of TKA patients leads to a decrease in mobility, which hinders recovery and rehabilitation.[2] The hinderance of rehabilitation lengthens the hospital stay of TKA patients.[5] The IPACK block is a peripheral nerve block that should be standardized and routinely utilized in conjunction with the ACB to relieve posterior knee pain. The addition of the IPACK block to the ACB block has been shown to decrease opioid consumption, hospital length of stay, and pain scores, while increasing patient mobility.[3,4,5] Utilizing both the IPACK block and ACB for TKA patients can produce an overall better patient outcome compared to the sole use of the ACB.

Goals and Outcomes (SMART)

Specific

All TKA patients received an ACB and IPACK block perioperatively to decrease opioid consumption, pain scores, and hospital stay and increase mobility compared to previous patients who only received the ACB block.

Measurable

The effectiveness of the ACB and IPACK was measured by evaluating pain scores on a scale from 0-10, reporting the number of opioids consumed, measuring the length of stay and the lengths patients have walked after the TKA.

Achievable

Nurses, anesthesia personnel, physical therapists, internal medicine, and nursing informatics collaborated to report on the postoperative aforementioned measurables.

Realistic

TKA patients will have a decrease in pain scores, opioid consumption, and hospital length of stay after receiving the IPACK block and ACB.

Timely

The ACB and IPACK block intervention for TKA took place over 4 months to provide an adequate amount of time to report outcomes.

Program Structure (SWOT)

The implementation of both the ACB and IPACK block necessitates the cooperation of anesthesia providers and their willingness to perform *both* peripheral nerve blocks perioperatively for patients undergoing a TKA. The collaboration with the postoperative team members to adequately report pain scores, and proper documentation regarding opioid consumption was an important detail in determining the efficacy of the implementation. Another aspect that provided success is the correct length that patients have walked post-TKA by physical therapists, along with recording of hospital length of stay.

Strengths

Strengths of the ACB and IPACK block are significant for the patient. There have been studies that displayed patients having an increase in ROM, and ambulation distance with the addition of the IPACK block to the ACB.[7] Both blocks used in conjunction for postoperative knee pain decreased opioid consumption and pain scores along with a decrease in hospital stay.[5,8] By decreasing opioid consumption, there is also a decrease in side effects such as nausea, vomiting, and decreased peristalsis, which can possibly delay the discharge process.[2]

Weakness

Although the ACB and IPACK block implementation contains strengths, there are also weaknesses that are evident. The two blocks are being utilized to provide a sensory block for the entire aspect of the knee to anatomically reach nerves that will be blocked. Unfortunately for the patient, they are subjected to two different uncomfortable injections. Peripheral nerve blockades are performed sterilely, and there is a risk of infection. The risk of infection can be doubled by receiving two separate injections.

Another weakness is the knowledge deficit that providers may have regarding the IPACK technique and or regional peripheral blockades. Staffing problems and the lack of anesthesia personnel available to perform a blockade can hinder the process of implementation. The IPACK block is performed on the posterior aspect of the knee and requires ultrasound.[6] The nerves that are targeted in the IPACK block are situated in close proximity to the popliteal artery which puts the patient at risk for intravascular injection and local anesthetic systemic toxicity (LAST).[6,9] LAST is a rare but life-threatening side effect of local anesthetic injection from any route.[9]

Opportunities

The implementation of a routine ACB and IPACK block for TKA patients provides opportunities of awareness and expectations of the postsurgical patient. The new standard of TKA pain management can provide opportunities of education to anesthesia providers to learn a new technique and become versed in IPACK block delivery. Due to the collaborative methods from different healthcare departments such as anesthesia, nursing, and physical therapy, the constant communication regarding TKA patients can develop a healthy interpersonal relationship within healthcare departments.

Threats

Factors that may potentially harm the process or interfere with the ability to deliver the IPACK block along with the ACB is provider pushback. Surgeons or anesthesiologists who deem the double block as time-consuming may discourage the utilization of the block. Risks to the standardization of the IPACK block are surgeons preferring to use the periarticular injection instead of the IPACK block intraoperatively.[8] Unwilling healthcare team members to perform the block and patient refusal are realistic threats to the standardization of the IPACK block. Another possible threat is uncooperative post-surgical team members such as nurses or physical therapists deeming the reporting of the patient status to be too much of a task on top of the other responsibilities that are being completed. Without postoperative feedback, it is difficult to measure if the intervention is successful.

DEFINITION OF TERMS

Opioids – Any natural or synthetic substance that binds to several opioid receptors and produces some morphine-like pain-relieving effects.[5]

Peripheral nerve block – A type of regional anesthesia where a local anesthetic is injected near a specific nerve or bunch of nerves to block perceptions of pain.[7]

METHODOLOGY

Setting and Participants

The setting took place in a hospital in the perioperative areas. The participants were all anesthesia providers (CRNAs and anesthesiologists) employed at a medical treatment facility in South Florida, in all perioperative areas where an IPACK block would be performed.

Description of Approach and Project Procedures

The project approach started by inviting the anesthesia providers at BHMC via e-mail to take part in the educational module. After consenting to participate and answering general demographic questions, the anesthesia providers participated in a pre-assessment to evaluate their current knowledge on the IPACK block and adductor canal block. Next, there was an educational module in the form of a video that the anesthesia providers watched. The video consisted of teachings regarding the IPACK block, pain side effects, and the patient outcomes. After the completion of the video, the anesthesia providers should be equipped with the knowledge to answer the post-assessment questions.

Protection of Human Subjects

All the anesthesia providers from BHMC were instructed that the educational module and their participation is voluntary. The anesthesia providers consented to participate before the actual survey begins. Qualtrics was utilized for the distribution of the educational module and pre/post assessments. The providers could exercise their right to withdraw their consent at any time and not participate in the module. The advantage of agreeing to the educational module

includes providing anesthesia personnel with education regarding the utilization of the IPACK in conjunction with the adductor canal block to improve patient outcomes. No identifiable information was be collected during this study that linked the specific answers to a specific person. The information collected was kept in a password-protected online database (Qualtrics) that was only be accessible by the primary investigator.

Data Collection

General demographic data was collected prior to the start of the pretest and included gender, age, and race/ethnicity. Other questions were asked regarding education level, number of years practicing anesthesia, and job title. The data was collected electronically through Qualtrics.

Data Management and Analysis Plan

The information collected from the anesthesia providers was stored in an electronic database, Qualtrics. Only the primary investigator had the password to this database. No exclusive identifiable data was collected in this investigation. Questionnaires were based off of the amount of pretest/posttest questions that were answered correctly.

Discussion of the Results with Implications to Advanced Nursing Practice

The hope of this project is to provide patients with the utmost quality care and beneficial experience. By educating anesthesia providers on utilizing both the ACB and IPACK block for TKA patients, the desire is to reduce pain scores and opioid consumption, which will then decrease the negative side effects of pain, and opioid use, such as constipation, urinary retention, urticaria, PONV, and opioid tolerance.[4,5] When TKA patients receive better pain relief with the dual blocks, their ambulation distances are further, which also correlate with a shorter hospital stay.[8] Advanced nursing practice can participate in active change for the benefit of the patient while also gaining skills and education.

RESULT

Table 1. Demographics

Demographics	n (%)
Total Participants pretest	11(100%)
Gender	
Male	4(36%)
Female	7(63%)
Ethnicity	
White	4(36%)
Hispanic/Latin	3(27%)
African American Black	3(27%)
Other	1(9%)
Education	
Associates	0
Bachelor's	1(9%)
Master's	5(45%)
Doctorate	5(45%)
Position/Title	
CRNA	11(100%)
Years of Anesthesia Experience	
Less than a year	1(9%)
1-2 years	2(18%)

2-4 years	1(9%)
5+ years	7(63.6%)

Eleven participants completed the pretest. Only 9 participants participated in the post-test. All participants were CRNAs (*n* = 11, 100%). The ethnicities of the participants included White (*n* = 4, 36%), Hispanic/Latin (*n* = 3, 27%), African American/Black (*n* = 3, 27%), and other (*n* = 1, 9%). The education level for participants resulted in doctorate (*n* = 5, 45%) bachelors (*n* = 1, 9%), and master's degrees (*n* = 5, 45%). The participants' anesthesia experience was questioned, and the responses ranged from less than 1 year (*n* = 1, 9%), 1-2 years (*n* = 2, 18%), 2-4 years (*n* = 1, 9%), and 5+ years (*n* = 7, 63%). A majority of the CRNAs have over 5 years of anesthesia experience. There were 7 (*n* = 7, 63%) female CRNAs and 4 (*n* = 4, 36%) male CRNAs who participated in the survey.

Pretest Knowledge Based Questions

Before the participants received the educational module, they were asked an array of questions to assemble a baseline assessment on their current knowledge of the IPACK block. About 55% (*n* = 6) of participants were able to recognize the area of the knee that the IPACK block targets. Eighty-one percent (*n* = 9) of participants were able to identify side effects of opioids, side effects of untreated pain, and the artery identified for the block. Sixty-three percent (*n* = 7) of participants in the pretest were able to label the area of the knee that the IPACK blocks. Ninety percent (*n* = 10) of participants were aware that the IPACK was an adjunct to the ACB, pain increases hospital LOS, the IPACK block preserves motor function, urinary retention is a sign of opioid consumption, and that ultrasound is needed to perform the block.

Posttest Knowledge Based Questions

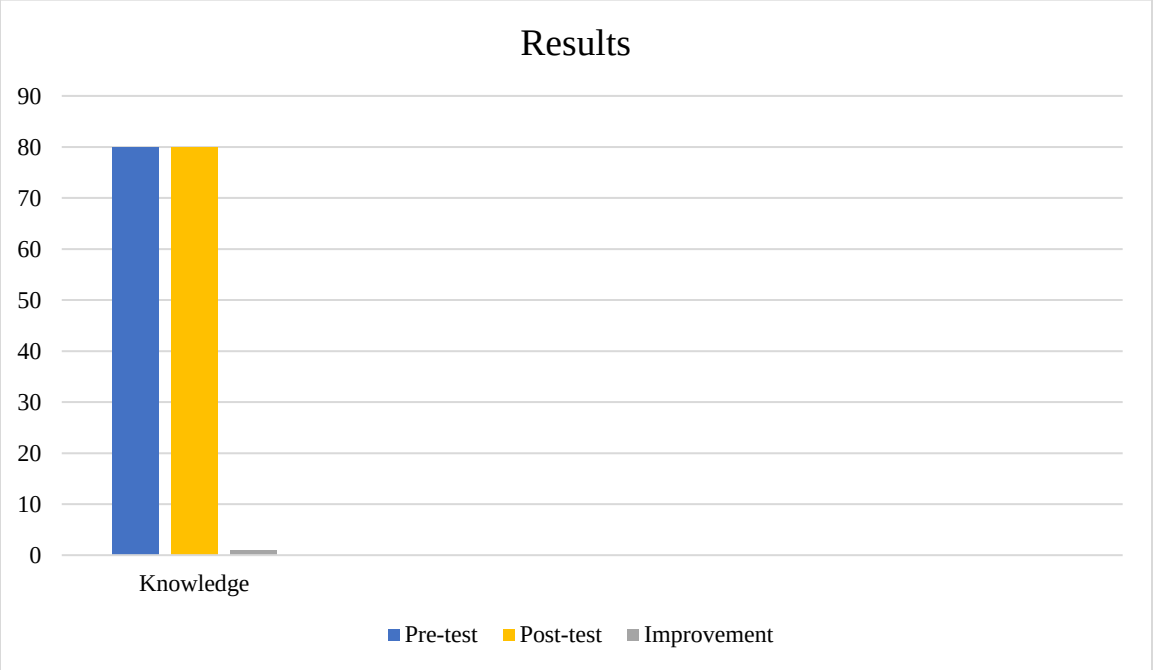
The posttest questions included the same questions from the pretest to gauge if knowledge was gained from the educational module. Only 9 out of the 11 participants from the pretest completed the posttest.

Table 2. Pretest and Posttest Responses

Questions & Answers	**Pretest (11 responses)**	**Posttest (9 responses)**
Which area of the knee does the IPACK block pain sensation to? -**Posterior**	6 (54.5%)	7 (77.8%)
Side effects of opioids include all except -**Increase respiratory drive**	9 (81.8%)	7 (77.8%)
Untreated pain can lead to: -**All of the above**	9 (81.8%)	7 (77.8%)
Adductor canal block provides a nerve blockade to all areas of the knee except: **-Posterior**	7 (63.6%)	8 (88.9%)
The IPACK block is a/an **adjunct** to the adductor canal block. Fill in the blank.	10 (90.9%)	7 (77.8%)
Pain increases length of stay and delays discharge from the hospital	9 (81.8%)	9 (100%)

-True		
Motor function with the IPACK block is: **Preserved**	9 (81.8%)	6 (66.7%)
Urinary retention is not a sign of opioid consumption **-False**	9 (81.8%)	7 (77.8%)
Which artery is identified in the IPACK block? **-Popliteal**	9 (81.8%)	6 (66.7%)
Ultrasound is needed for the IPACK block? **True**	10 (90.9%)	8 (88.9%)

Figure 1. Results



CONCLUSION

Identical questions were asked on the pretest and posttest to evaluate if the participants learned any new information after receiving the educational module. Unfortunately, only 9 of the 11 individuals participated in the post test, which changed the results. Figure 1 displays an overall knowledge of 80% on the pretest and surprisingly, 80% on the posttest, resulting in neither an increase nor decrease in knowledge. The knowledge of the participants remained the same, which displays a possible underlying baseline knowledge regarding IPACK blocks.

DISCUSSION

Limitations

Limitations would include a difference between the number of participants in the pre- and posttest. Also, current knowledge of the existing topic could have swayed the answers of the participants. The route of disbursement was via an institution e-mail. Many members of the e-mail recipients do not regularly check their institution email, which I believe led to a lower number of total participants and contributed to a possible limitation.

Implications to Advanced Nursing Practice

Generally, there was not a decrease in learning after the completion of the educational module, which provides a foundation into understanding the main implications of a dual block that incorporates the ACB and IPACK block. As previously reported, the utilization of the IPACK block in adjunct with ACB provides pain relief that results in a decreased use of opioids and hospital stay and increased mobility. By promoting the duality of the utilizing both blocks, the solution is proposed to combat TKA patient’s postoperative pain. Therefore, the educational

module has reinforced anesthesia providers about the negative implications on pain and not utilizing both blocks and the importance to patients' overall postoperative experience.

Quality Improvement

Plan for Sustaining the Practice Change

To sustain the practice change of routinely administering two different peripheral blocks (IPACK and ACB) to TKA patients would take efficient planning. Establishing a healthy time frame and sending out a notice to all healthcare team members involved would be the first step to implement. Proper collaboration with preoperative nurses, anesthesia providers, and surgeons would deem a necessary component of practice change sustainment. Creating a policy that gives a step-by-step instructional to the process and procedural duties to be performed by all healthcare team members would allow a smooth transition into the practice change. Performing the block on a small number of patients in the beginning of the practice change and then gradually transitioning to larger number of patients would hopefully provide a seamless transition for a routine implemented practice change.

Implications for Advanced Practice Nursing

The advanced practice anesthesia provider who is unversed but interested in performing the peripheral nerve blockade will have education provided. Before the advanced practice nurse can safely administer both the ACB and IPACK block, there should be an in-service, practice modules, and supervision on skills before actively being responsible for administering peripheral nerve blockades. Competency should be measured, and only efficient advanced practice nurses should administer the blocks.

The goal for establishing an educational module on utilizing both the ACB and IPACK block was to increase the knowledge on the benefits that both blocks provide patients after a

TKA to anesthesia providers. Furthermore, the educational module helps to encourage an alternative intervention to facilitate the inevitable TKA postoperative pain that will arise. Healthcare providers with an understanding of the physiological and negative effects that pain can have on the body will also understand that effectively treating the pain can yield positive results. The educational module seemed to reinforce the current knowledge that the participants had on the IPACK block. The results of the posttest did not show a decrease in information in comparison to the pretest. The overall purpose of introducing this quality improvement project is for the betterment of the patients and positive outcomes. With the decrease in opioid consumption due to utilizing both blocks, it prevents and lessens the negative side effects associated with opioids such as urticaria, nausea, vomiting, tolerance, dependency, and constipation.[5,6] When patients experience a decrease in pain after a TKA, they have an increase in mobility and a decrease in hospital stay, which, in turn, lessens their hospital costs.[2] Improving the quality of care that patients receive is a major goal in the nursing profession. Healthcare workers are known to practice non-maleficence and beneficence by improving the postoperative pain related to TKA with the IPACK block in conjunction with the ACB, we are fulfilling the standard of care.

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Appendix A

IRB Approval

FIU | FLORIDA INTERNATIONAL UNIVERSITY

Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To: Dr. Valerie Diaz
CC: Aaronique Anthony

From: Maria Melendez-Vargas, MIBA, IRB Coordinator

Date: March 18, 2022

Protocol Title: "An Educational Module Explaining the Use of The IPACK Block and The Adductor Canal Block To Relieve Pain After Total Knee Arthroplasty: A Quality Improvement Project"

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

IRB Protocol Exemption #: IRB-22-0085 **IRB Exemption Date:** 03/18/22
TOPAZ Reference #: 111585

As a requirement of IRB Exemption you are required to:

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

Special Conditions: N/A

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

MMV/em

Appendix B

Letter of Support

ANESCO™
Driving Results in Anesthesia

February 1, 2022

CAPT Valerie Diaz, DNP, CRNA, APRN, NC USN

Clinical Assistant Professor,

Department of Nurse Anesthesiology

Florida International University

Dr. Diaz

Thank you for inviting Broward Health to participate in the Doctor of Nursing Practice (DNP) project conducted by Aronique Anthony entitled "*An Educational Module Explaining the Use of the IPACK Block and the Adductor Canal Block to Relieve Pain After Total Knee Arthroplasty Pain: A Quality Improvement Project* in the Nicole Wertheim College of Nursing and Health Sciences, Department of Nurse Anesthetist Practice at Florida International University. I have granted her permission to conduct the project using our providers.

Evidence-based practice's primary aim is to yield the best outcomes for patients by selecting interventions supported by the evidence. This project intends to evaluate if a structured education targeting providers will increase knowledge on the use of IPACK Block and the Adductor Canal Block to Relieve Pain After Total Knee Arthroplasty Pain.

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

Prior to the implementation of this educational project, the Florida International University Institutional Review Board will evaluate and approve the procedures to conduct this project. Once the Institutional Review Board's approval is achieved, this scholarly project's execution will occur over two weeks. We support the participation of our Anesthesiology providers in this project and look forward to working with you.

February 1, 2022

Edward Punzalan, DNP, CRNA, APRN — Date

Administrative Director of Nurse Anesthesia

Healthcare Performance Anesco

Appendix C

Consent

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CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT
An Educational Module Explaining the Use of The IPACK Block and The Adductor Canal Block To
Relieve Pain After Total Knee Arthroplasty: A Quality Improvement Project

SUMMARY INFORMATION
Things you should know about this study:

- **Purpose:** Educational module explaining the use of the IPACK block and the Adductor canal bock to relieve pain after total knee arthroplasty (TKA) surgery.
- **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 minute total.
- **Risks**: The main risk or discomfort from this research is minimal
- **Benefits:** The main benefit to you from this research is the increase in participants knowledge of IPACK & adductor canal block benefits in TKA.
- **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
The goal of this project is to decrease post operative TKA pain with the utilization of the IPACK & adductor canal block targeting certified registered nurse anesthetists (CRNAs). You are being asked to participate in this quality improvement project

DURATION OF THE PROJECT
Your participation will require about 20 minutes of your time.

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

RISKS AND/OR DISCOMFORTS
There are no foreseeable risks with you for participating in this project.

BENEFITS
The following benefits with your participation in this project: An increase in your knowledge surrounding the anatomy of knee innervation, and the benefits both blocks (IPACK & ACB) decrease pain after a TKA which leads to a reduction in opioid consumption, reduction in pain and a reduction in length of stay.

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 Aaronique Anthony a**t 407-369-1654, aanth016@fiu.edu** or Dr. Valerie Diaz at 954-520-7494, vdiaz@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 Florida International UNiversity 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 consen

Appendix D

Pre- & Posttest Questionnaire

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Pretest and Posttest Questionnaire :

IPACK block in adjunct to ACB block to relieve TKA pain

INTRODUCTION

The primary aim of this QI project is to improve the knowledge of CRNAs pertaining to the IPACK block relieving pain after a TKA surgery in adjunct to the ACB

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 IPACK block

PERSONAL INFORMATION

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

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

QUESTIONNAIRE

1. **Which area of the knee does the IPACK block pain sensation to?**
    a. posterior
    b. anterior
    c. lateral
    d. medial
2. **Side effects of opioids include all except:**
    a. Nausea & vomiting
    b. Urticaria
    c. Increase respiratory drive
    d. Constipation
3. **Untreated pain can lead to:**
    a. Increase heart rate
    b. Increase blood pressure
    c. Increase in myocardial oxygen consumption
    d. All the above
4. **Adductor canal block provides a nerve blockade to all areas of the knee except:**
    a. posterior
    b. anterior
    c. lateral
    d. medial

5. **The IPACK block is a/an _____ to the abductor canal block. Fill in the blank**
    a. replacement
    b. detriment
    c. duplicate
    d. adjunct
6. **Pain increases length of stay and delays discharge from the hospital?**
    a. True b. False
7. **Motor function with the IPACK block is**
    a. Decreased
    b. Preserved
    c. Increased
    d. Abolished
8. **Urinary retention is not a sign of opioid consumption:**
    a. A. true b. false
9. **Which artery is identified in the IPACK block?**
    a. Femoral
    b. Dorsalis Pedis
    c. Inguinal
    d. Popliteal Artery
10. **Ultrasound is needed for the IPACK block?**
    a. True b. false

11. How likely are you to suggest the IPACK block to your attending anesthesiologists?

a. Most likely

b. Somewhat likely

c. Somewhat unlikely

d. Most unlikely

12. How likely are you recommend the IPACK block in addition to the ACB to patients receiving TKA?

a. Most likely

b. Somewhat likely

c. Somewhat unlikely

d. Most unlikely

Appendix E

Education Module