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Comparing postoperative pain scores and opioid consumption in patients receiving Lumbar Plexus block versus Fascia Iliaca block after undergoing hip arthroplasty

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Doctor of Nursing Practice Final Project Report

Comparing postoperative pain scores and opioid consumption in patients receiving Lumbar Plexus block versus Fascia Iliaca block after undergoing hip arthroplasty

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Abstract

Background and Review of Literature*:* Lumbar plexus block and fascia iliaca block are two commonly used anesthesia modalities for patients underdoing hip arthroplasty at Union Hospital in Terre Haute, Indiana. Currently, there are not any studies that demonstrate which block is more effective at reducing postoperative pain and opioid consumption after hip arthroplasty. Review of literature demonstrates that both blocks have their advantages and disadvantages for providing postoperative pain relief.

Purpose*:* To determine which block is more effective at reducing postoperative pain, opioid consumption, and length of stay in hospital after hip arthroplasty procedures. These findings will then be presented to anesthesia staff at Union Hospital.

Methods: A retrospective chart review will be conducted on 25 patients that received a lumbar plexus block and 25 that received facia iliaca block. Pain scores and opioids consumed will be calculated for each patient in each group to determine which block provides superior pain relief. Overall length of stay will be calculated for each block group as well. Microsoft Excel and SigmaXL were utilized to analyze the data. ClinCalc opioid equivalent calculator was utilized to convert all opioids administered into intravenous morphine milliequivalents

Conclusion: This project demonstrated that the fascia iliaca block was superior at reducing postoperative pain ($P = 0.045$) in PACU as well as reducing overall opioid consumption ($P = 0.0056$) when compared to the lumbar plexus block. However, length of stay in hospital and pain score at 24 hours were similar. Difficulty of block and anesthesia provider experience must also be considered.

Keywords: Fascia iliaca block, Lumbar plexus block, Hip arthroplasty

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Introduction

This project was submitted to the faculty of Marian University Leighton School of Nursing as partial fulfillment of degree requirements for the Doctor of Nursing Practice, Nurse Anesthesia track. Every year, thousands of Americans undergo hip arthroplasty for a variety of reasons. Hip arthroplasty procedures are performed to replace all or part of the hip joint and are usually conducted to treat hip fractures or pain related to arthritis of the joint. There are multiple anesthesia modalities available for patients undergoing hip arthroplasty, but two prominent anesthetic modalities to relieve postoperative pain for this procedure include the lumbar plexus block (LPB) and the fascia iliaca block (FIB). Although, it is not clear which is superior at relieving postoperative pain and reducing postoperative opioid consumption after hip arthroplasty. These two blocks are commonly used at Union Hospital in Terre Haute, Indiana. Anesthesia staff at Union hospital requested further inquiry as to which block is more effective at reducing postoperative pain for hip arthroplasty. Determining which block is more effective will improve quality of care by reducing postoperative pain scores, reducing postoperative opioid consumption, and potentially decreasing overall length of stay in hospital.

Background

The mortality related to hip fractures has increased over the past several years (Hong & Ma, 2019). Although, evidence shows that early pain relief from surgery can reduce the

mortality related to postoperative complications (Hong & Ma, 2019). Managing perioperative and postoperative pain can be challenging for both the surgeon and the anesthesia provider. Anesthesia providers are faced with choosing which anesthetic modality will best serve their patient. There are currently multiple anesthesia modalities for patients undergoing hip arthroplasty; two of the most common modalities used at Union Hospital are the LPB and the FIB. Both nerve blocks are typically used in conjunction with general anesthesia while patients undergo hip arthroplasty. Currently, there is a lack of research and evidence that demonstrates which block is more effective at reducing postoperative pain and postoperative opioid consumption in patients undergoing hip arthroplasty.

Research thus far has been limited to comparing the effectiveness of LPB and FIB strictly for hip arthroscopic procedures as opposed to hip arthroplasty procedures. According to the literature on hip arthroscopic procedures, there are benefits of each of these blocks. The LPB is beneficial at reducing postoperative pain but tends to be a difficult block to administer and usually takes an experienced provider (Badiola et al., 2018). The FIB tends to be easier to administer but may not be as effective at relieving postoperative pain when compared to the LPB (Badiola et al., 2018). Other variables that will affect postoperative pain relief include when the block was administered in relation to the surgery, which local anesthetic was used, and if an experienced anesthesia provider administered the block.

Problem Statement

This doctoral quality improvement project will consist of a retrospective patient chart examination to review postoperative pain scores in the post-anesthesia care unit, overall opioid consumption in the first 24 hours, as well as pain scores 24 hours after receiving a LPB or FIB

following hip arthroplasty. This quality improvement project will also compare length of stay for patients that received either the FIB or LPB.

Organizational Gap Analysis of Project Site

This organizational gap was identified by chief physician anesthesiologist Dr. James Griggs at Union Hospital. Anesthesia faculty at Union hospital manage anesthetic care for hundreds of arthroplasty hip procedures each year. Knowing which block is more effective at reducing postoperative pain scores and postoperative opioid consumption for patients undergoing hip arthroplasty would improve care and patient satisfaction for hundreds of patients. At the time that this review of literature was conducted, there were not any studies that directly compared the LPB and FIB in patients undergoing hip arthroplasty.

Review of the Literature

Review of literature began with searching through multiple electronic data bases with keywords including: MEDLINE-Ebsco, MEDLINE-Ovid, Pubmed, and Google Scholar. Search terms included*: fascia iliaca block, fascia iliaca block for hip surgery, fascia iliaca block for hip arthroplasty, lumbar plexus block, lumbar plexus block for hip surgery, lumbar plexus block for hip arthroplasty, fascia iliaca block versus lumbar plexus block hip surgery, fascia iliaca block versus lumbar plexus block hip arthroplasty.* Inclusion criteria consisted of utilizing studies completed within five years of start of this project, studies directly pertaining to either FIB, LPB, and these blocks in relation to hip arthroplasty. Exclusion criteria consisted of excluding studies completed greater than five years before the beginning of this project unless the studies were

considered landmark. Ultimately, five studies related to FIB, LPB, and hip arthroplasty were utilized for this project.

Over the past decade, as regional anesthesia continues to become a first line anesthetic choice in orthopedic procedures, multiple studies have showed the effectiveness of the FIB and LPB at reducing both intraoperative and postoperative pain for hip procedures. A systematic review conducted by Steenberg and Moller (2018) concluded that patients who had fractured hips that received FIB prior to hip surgery had lower postoperative pain scores when compared to patients who only received opioids and nonsteroidal anti-inflammatory drugs (NSAIDS). Steenberg and Moller (2018) also concluded that FIB success rates were high, and complications related to the FIB were low. A meta-analysis conducted by Hong and Ma (2019) measured postoperative pain scores at various time intervals post hip surgery after receiving a FIB. Results showed that pain scores and opioid consumption were lower in the FIB groups when compared to the non-FIB control groups at every time interval postoperatively. Overall morphine consumption was lower in the FIB when compared to the control groups as well (Hong & Ma, 2019). Amiri, Zamani, and Safari (2014) conducted a study that demonstrated the LPB is a safe and efficient alternative to general anesthesia in patients undergoing hip surgeries. Amiri et al. (2019) demonstrated that no supplemental intraoperative opioid administration was required for the patients that received a LPB and that hemodynamic stability was superior when compared to the general anesthetic patient group. The three previously mentioned studies show that pain scores and opioid consumption are reduced with both the LPB and FIB, but does not demonstrate which is more effective of the two.

At the time that this review of literature was conducted, there were not any studies that directly compared the effectiveness of the LPB and FIB at reducing postoperative pain scores and opioid consumption for patients undergoing hip arthroplasty. However, two studies were identified that directly compared the two blocks for hip arthroscopy. As hip arthroplasty and hip arthroscopy are comparable procedures with similar nerve innervation, these two studies will be the corner stone of this literature review.

Wolf et al. (2016) conducted a retrospective study titled *Pre-operative lumbar plexus block provides superior postoperative analgesia when compared with fascia iliaca block or general anesthesia alone in hip arthroscopy.* Wolf et al. (2016) evaluated postoperative pain scores and secondary variables on each patient on arrival to post anesthesia care unit (PACU) and then every 30 minutes for two hours. Results demonstrated that the LPB group had lower mean postoperative pain scores than that of patients that received a FIB, which the authors noted to be statistically significant (Wolff et al., 2016). However, both groups required similar opioid administration in PACU (Wolff et al., 2016). Secondary variable results between the groups such as time to discharge, nausea, vomiting, paresthesia, and weakness were uniform across both groups as well (Wolff et al., 2016). Wolff et al. (2016) reported that one patient that received a LPB did exhibit a seizure that lasted ten seconds but did not exhibit and medium- or long-term complications while the FIB group did not have any complications related to block administration. Of note, Both blocks were placed preoperatively with the assistance of ultrasound guidance (Wolff et al., 2016).

A second study titled *A comparison of the fascia iliaca block to the lumbar plexus block in providing analgesia following arthroscopic hip surgery: A randomized controlled clinical trial*

by Badiola et al. (2018) also directly compares LPB and FIB. Pain scores were recorded every 15 minutes for two hours in PACU after completion of the hip arthroscopy (Badiola et al., 2018). While opioid consumption was lower postoperatively in the LPB group, mean postoperative pain scores were the same between both groups (Badiola et al., 2018). The authors of this study note that these findings of similar postoperative pain scores between the groups contradicts the findings of Wolf et al.. Badiola et al. (2018) contribute this discrepancy to the fact that Wolff et al. administered the FIBs prior to the hip arthroscopy surgery (as opposed to after the completion of the surgery as Badiola et al. did) which can lead to "washing out" of the local anesthetic during the surgery which would reduce the effectiveness of the facia iliaca block at controlling postoperative pain. Badiola et. (2018), felt that this "washing-out" could have skewed the results as to which block is most effective. Badiola et al. (2018) found the FIB to be more effective when placed postoperatively. Badiola et al. (2018) also discussed the advantages and disadvantages of performing each of these blocks. The FIB is considered easier to complete and can be administered by anesthesia providers with limited regional anesthesia experience (Badiola et al., 2018). The LPB is technically more difficult to administer and typically requires an anesthesia provider with more regional anesthesia experience to complete the block (Badiola et., 2018). The LPB also has more adverse side effects linked to its administration such as epidural spread that can lead to prolonged hospital length of stay (Badiola et., 2018). One such patient in this study did experience epidural spread related to administration of the LPB and required an overnight stay but did not have any long-term negative effects (Badiola et., 2018).

These studies conclude that both the LPB and FIB are appropriate analgesic techniques to reduce postoperative pain. Although, it is not obviously clear which block is superior. Wolff et

al. (2016) ultimately found that LPB postoperative scores were lower but overall opioid consumption was similar between the two groups. Badiola et al. (2018) concluded that the postoperative pain scores were the same amongst the two groups while LPB group required less opioids postoperatively. As previously mentioned, Badiola et al. (2018) questioned Wolff et al. (2016) results as the local anesthetic may have been "washed out" of the FIB group. Between the two studies, the LPB groups either had lower postoperative pain scores or lower postoperative opioid consumption, but also had two different adverse reactions after administration of LPB. The LPB block also typically requires an advanced regional anesthesia provider while the FIB tends to be easier to administer (Badiola et al., 2018).

Theoretical Framework or Conceptual Model or Evidence Based Practice Model

The Johns Hopkins Nursing Evidence-Based Practice Model is a clinical decision-making tool that is utilized to ensure the latest evidence-based practice is translated into clinical practice (Johns Hopkins Medicine, 2017). According to Dang and Dearholt (2019), this model ensures research and findings are quickly and appropriately incorporated into patient care. This evidence-based practice model uses a three-step process called PET: Practice question, evidence, and translation (Dang & Dearholt, 2019). This three-step process leads to best practices and practice improvement (Dang & Dearholt, 2019). The goal of this model is to ultimately lead to further inquiry that will restart the three-step process that will lead to further evidence-based practice changes (Dang & Dearholt, 2019). This model will be applicable to the clinical question to determine which block is more effective at reducing postoperative pain scores, opioid consumption, as well as decreasing length of stay in hospital. After a retrospective chart review is completed and results are reviewed, the findings will help determine which block is more

effective. Results will then be translated into clinical practice at Union Hospital to help improve patient care. See appendix A for graphic of the Johns Hopkins Nursing Evidence-Based Practice Model (John Hopkins Medicine, 2017).

Goals, Objectives, and Expected Outcomes

The goal of this project is to gain evidence as to which block is more effective at reducing postoperative pain scores and postoperative opioid consumption in the first 24 hours postoperatively as well as overall length of stay between block groups. In order to reach this goal, a retrospective patient chart review was be conducted on patients that underwent hip arthroplasty that either received a LPB or FIB. Further chart examination will then be conducted to review pain scores and opioid consumption postoperatively. Once evidence is gathered and synthesized as to which block is more effective, data will then be presented to anesthesia staff at Union hospital to help guide anesthetic block choices

Project Design/Methods

This DNP project will include process improvements and will lead to practice interventions. This project will consist of conducting a retrospective non-randomized patient chart review comparing postoperative pain scores and postoperative opioid consumption on patients receiving a LPB or FIB for hip arthroplasty. 25 LPB and 25 FIB patient charts were reviewed and included in this project. Postoperative pain scores listed in the quantitative numeric 0-10 grading scale will be evaluated and averaged for each patient while in PACU and then pain scores will be recorded 24 hours postoperatively. Postoperative opioid consumption will be recorded for each patient for the first 24 hours postoperatively. These opioids will then be converted to quantitative intravenous (IV) morphine milliequivalents (MMEs) to create

standardization across patient populations that received multiple types of opioids. Total MMEs will be calculated for patients during their time in PACU as well as their first 24 hours postoperatively. Length of stay in hospital will be documented and averaged for each group.

Project Site and Population

This DNP project chart review will evaluate patients from Union Hospital in Terre Haute, Indiana in conjunction with Dr. Griggs' guidance. The nerve blocks were conducted by the employees of Unified Anesthesia Services staff of Union Hospital. This anesthesia staff included physician anesthesiologists and certified registered nurse anesthetists (CRNAs). Patient chart review will consist of patients that underwent LPB or FIB prior to hip arthroplasty at Union Hospital. Patient inclusion criteria will consist of patients that are ASA 1-3, had ultrasound guided LPB or FIB, and non-revisional hip arthroplasty surgeries. Chart review will be conducted through Cerner electronic medical record (EMR) via remote access on personal computer.

Ethical Considerations and Protection of Human Subjects

Prior to initiation of this project, documentation of this project was submitted to the Institutional Review Board at Marian University. After evaluation by the Institutional Review Board, a determination of exempt status was made for this project (IRB #B20.154). See appendix B for IRB form. Patient privacy and anonymity will be protected through all facets of this project. Any data that will be extracted from patient charts will be carefully protected and will be stored without any identifying patient information. All electronic files containing patient information were password protected to prevent access by unauthorized users and only the project coordinator had access to the passwords.

Measurement Instruments

In order to measure the outcomes of this DNP Project, Microsoft Excel and SigmaXL statistical software were utilized. The combination of these two programs allowed for storing and statistical analysis of the data. After each patient's data was analyzed and pain scores, opioids consumed, and LOS were then totaled and averaged for each group. ClinCalc opioid equivalent calculator (ClinCalc, LLC, 2017) was used to convert all opioids into IV MMEs for each patient. The groups were then compared using the Mann-Whitney U test via SigmaXL to determine statistical significance across multiple variables. These variables include: average PACU pain score, pain score 24 hours after surgery, average total MMEs through the first 24 hours postoperatively, and average length of stay in hospital postoperatively.

Data Collection Procedures

Data collection began with accessing Union Hospital's Citrix EMR. Starting in January of 2019, all patients that underwent hip arthroplasty and met inclusion criteria were evaluated and included in the chart review. These patients were then divided into two groups depending on which block they received. Average PACU pain scores and 24-hour pain scores were then documented and calculated for patient. Each opioid and amount administered were then documented for each patient. ClinCalc opioid equivalent calculator (ClinCalc, LLC, 2017) was then used to convert each opioid drug and dose to intravenous (IV) morphine milliequivalents (MMEs) to allow for standardization across each patient and each group. After averages were calculated, SigmaXL was then used to determine statistical significance between variables of

each group via Mann-Whitney U test. It is worth noting that each patient received their nerve block prior to their hip arthroplasty surgery.

Data Analysis and Results

A total of 50 patients were included in this data analysis, 25 from each block group. The average PACU pain score for the FIB group using the quantitative numeric 0-10 grading scale was 2.31 while the LPB groups score was 3.7. Two sample Mann-Whitney U test showed a statistical difference (P=0.045) between the two groups in favor of the FIB having lower PACU pain scores (see appendix C). 24-hour postoperative pain scores for the FIB and LPB groups were 2.84 and 3.72, respectively. Two sample Mann-Whitney U testing did not yield any statistically significant difference (P=0.86) between the two groups when comparing 24-hour post-operative pain (see appendix D). Average IV MME for the FIB group was 20.96 milligrams while the LPB group was 33.24 milligrams. Two sample Mann-Whitney U testing yielded a significant statistical difference (P=0.005) in favor of FIB group receiving less opioids(see appendix E). Average length of stay in hospital postoperatively for the FIB group was 2.73 days while the LPB group was 2.27 days. Two sample Mann-Whitney U testing did not reveal any significant statistical difference (P=0.87) between the two groups (see appendix F).

These results demonstrate that the FIB group was superior at reducing immediate postoperative pain in the PACU. Intravenous MME administration was also substantially lower in the FIB group. These findings contrast with Wolf et al. (2016) conclusions which found the LPB group to have lower postoperative pain scores and equal amounts of opioids administered between the two block groups. Badiola et al. (2018) findings are also in contrast to the findings of this project. Badiola et al. (2018) found that the LPB group required less opioids but still had

similar pain scores to the FIB group. The discrepancies across these studies highlights the need for further research on the topic. Ultimately, LOS and 24-hour pain scores were similar between the two groups.

Limitations

There were multiple limitations to this study. To begin, this was a retrospective chart review study which led to a lack of standardization of documentation postoperatively. The amount of time spent in PACU as well as how many pain scores recorded varied from patient to patient. This led to some patients having more pain scores recorded than others. Also, despite duration of time in PACU, some patients did not have many pain scores recorded in general. Comorbidities such as chronic pain and history of opioid abuse or tolerance were not accounted for when recording patient information. There was also variation amongst the PACU nursing staff as to what pain score triggered the need for opioid administration. Intraoperative opioid administration was not accounted for in consideration to postoperative pain.

Conclusion

As regional anesthesia continues to become a viable and effective anesthesia modality for orthopedic procedures, conclusive evidence needs to be gathered to guide which regional anesthetic block is the best choice for a given procedure. Finding an anesthetic technique that offers analgesia while decreasing opioid consumption is paramount in our modern healthcare system (Badiola et al., 2018) The goal of this project was to determine which regional anesthetic technique is superior at reducing postoperative pain scores and opioid consumption for patients undergoing hip arthroplasty. Wolff et al. (2016) surmised that the LPB was superior to the FIB at reducing postoperative pain scores while Badiola et al. (2018) concluded that the FIB was not

inferior to the LPB during hip arthroscopy. This project demonstrated that the FIB was superior at reducing postoperative pain in PACU as well as reducing overall opioid administration in the first 24 hours postoperatively. However, the discrepancies across these studies highlights the need for further research on the topic

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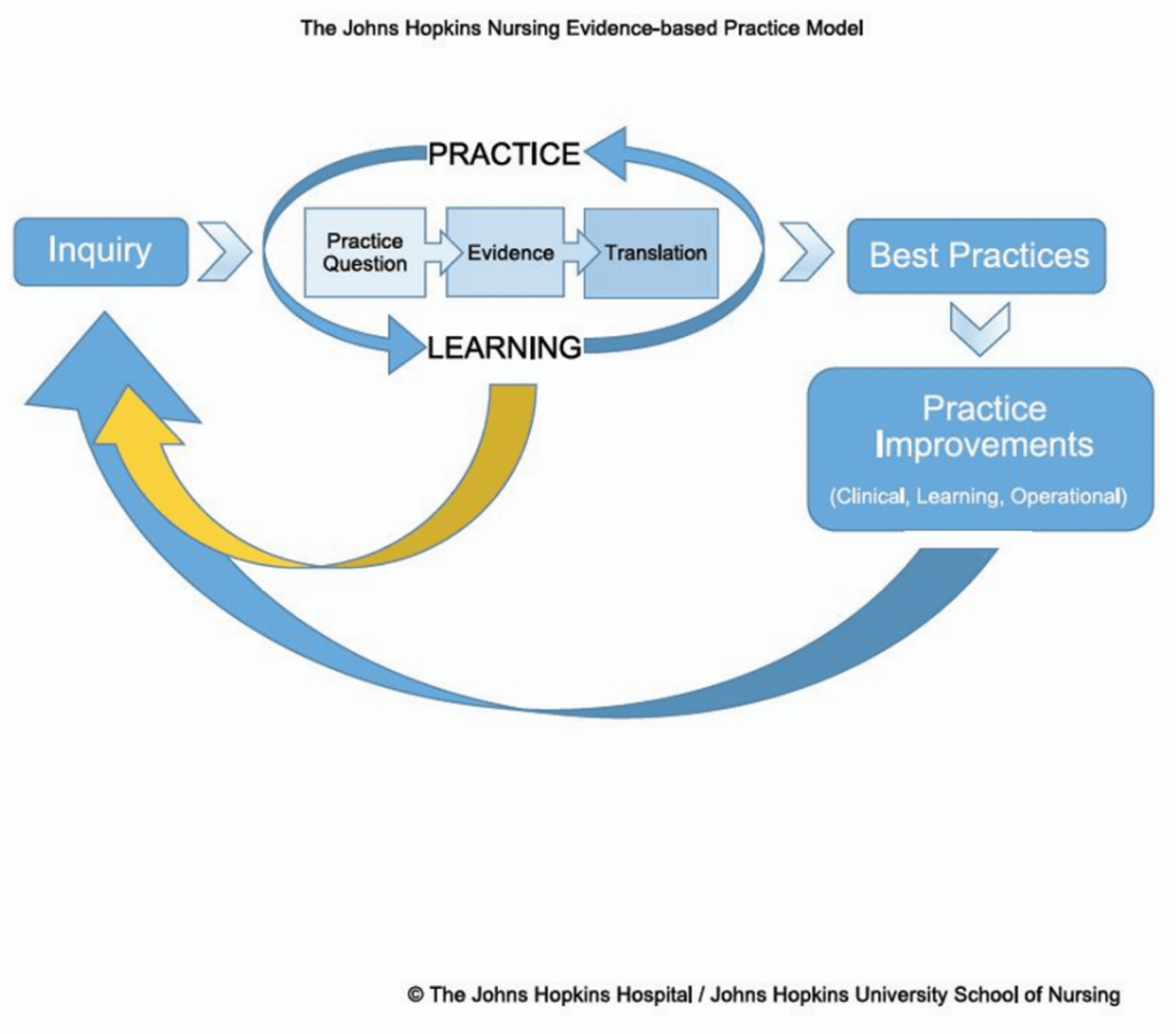
Appendix A: Johns Hopkins Nursing Evidence-Based Practice Model


The Johns Hopkins Nursing Evidence-based Practice Model
PRACTICE
Inquiry
Practice Question
Evidence
Translation
Best Practices
LEARNING
Practice Improvements
(Clinical, Learning, Operational)
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Appendix B: IRB Approval

MARIAN UNIVERSITY
Indianapolis ®

Institutional Review Board

DATE:	02-24-2020
TO:	Mark Ritter
FROM:	Institutional Review Board
RE:	IRB #B20.154
TITLE:	Comparing post-operative pain scores in patients receiving Lumbar Plexus block versus Fascia Iliaca block after undergoing hip arthroplasty
SUBMISSION TYPE:	New Project
ACTION:	Determination of Exempt Status
DECISION DATE:	02-24-2020

The Institutional Review Board at Marian University has reviewed your protocol and has determined the procedures proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol and you are cleared to proceed with your project. The protocol will remain on file with the Marian University IRB as a matter of record. Please be mindful of the importance of reporting only de-identified, HIPAA-compliant information about the patient in any exhibit or publication.

Although researchers for exempt studies are not required to complete online CITI training for research involving human subjects, the IRB **recommends** that they do so, particularly as a learning exercise in the case of student researchers. Information on CITI training can be found on the IRB's website: http://www.marian.edu/academics/institutional-review-board.

It is the responsibility of the PI (and, if applicable, the faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project. Please contact me if you are unsure whether your proposed modification requires review. Proposed modifications should be addressed in writing to the IRB. **Please reference the above IRB protocol number in any communication to the IRB regarding this project.**

Bryan Larsen, Ph.D.

Appendix C: PACU Pain Scores

Pain During PACU

Block	FIB	LPB
Count	25	25
Median	1.500	4.140

Mann-Whitney Statistic	534.00
P-Value (2-sided, adjusted for ties)	0.0454

Appendix D: 24 Hour Pain Scores

24 Hour Pain Scores

Block	1	2
Count	25	25
Median	3	3

Mann-Whitney Statistic	562.50
P-Value (2-sided, adjusted for ties)	0.1416

Appendix E: Total MMEs

Total MMEs

Block	1	2
Count	25	25
Median	20	29

Mann-Whitney Statistic	494.50
P-Value (2-sided, adjusted for ties)	0.0056

Appendix F: Length of Stay

Length of Stay

Block	1	2
Count	25	25
Median	2.300	2.300

Mann-Whitney Statistic	646.50
P-Value (2-sided, adjusted for ties)	0.8683