Evaluation of Anterior Quadratus Lumborum Block for Postoperative Analgesia in Hip Arthroscopy: A Double-Blinded Randomized Controlled Trial

FUNDER: Department of Anesthesiology

PROTOCOL NO.: 2018-0647

VERSION & DATE: 4/23/2019

TABLE OF CONTENTS

PROTOCOL SYNOPSIS

Protocol Title:	Intraoperative Acupuncture for Low-Dose Opioid Total Knee Replacement: An Observational Prospective Cohort Study
Protocol Number:	2019-1193
Protocol Date:	04/23/2019
Sponsor:	Department of Anesthesiology
Principal Investigator:	Stephen Haskins, MD
Objective:	The purpose of this trial is to compare the change of the NRS pain scores from the baseline pre-operative pain score at rest and with movement to the NRS scores over the first 24 hours after PACU arrival between patients receiving quadratus lumborum block (QLB) vs. no block for hip arthroscopy
Study Design:	Prospective Cohort Study
Enrollment:	96
Subject Criteria:	1. ASA of 1-3 2. Age 18-80 3. Undergoing a planned ambulatory hip arthroscopy 4. English speaking 5. Ability to follow study protocol
Data Collection:	**Sources:** EPIC, Medical Records, Nurse Staff, Patient Report. **Variables**: Name, DOB, Race, Gender, NRS Pain scores at Rest/with Movement, Opioid Consumption, ORSDS, Blinding Assessment, Patient Satisfaction, Induction Time, Block success/failure, Total Pump Fluid/Avg & Max/Pump Pressure in Surgery/Traction Time, Time to Meet D/C Criteria, Time PACU D/C, Antiemetic Usage, Falls/Knee Buckling Incidence, QoR40, Leeds Assessment of Neuropathic Symptoms & Signs Pain Scale.
Statistical Analysis:	• Regression based on GEE approach • Alpha level: 0.05/2 outcomes = 0.025 (two-sided) • Beta or power level: 80%

1.0 INTRODUCTION

Hip Arthroscopy is associated with moderate to severe pain (1). The lumbar plexus block for postoperative analgesia was previously studied by YaDeau et al., which concluded statistically significant reductions in PACU resting pain, but no change in most secondary outcomes including PACU analgesic usage, PACU pain with movement, and patient satisfaction (2). Additionally, the resulting quadriceps weakness was attributed to two inpatient falls in the bathroom without injury. The Quadratus Lumborum Block (QLB) is a well-studied block for supplemental analgesia following abdominal and pelvic surgery that has been lauded as easy to perform, well-tolerated by patients, and avoids side effects such as hypotension, urinary retention, or the quadriceps weakness associated with lumbar plexus blockade - all of which promote early ambulation and discharge (3). Additionally, the QLB has been shown to be an effective analgesic for hip fracture and total hip arthroplasty (4,5).

Depending on the approach (e.g., anterior, lateral, posterior, or intramuscular), the QLB can result in local anesthetic spread generating analgesia ranging from T6 to L4 (6). With the anterior QLB (also known as QLB 3 or the transmuscular QLB), the local anesthetic is injected between the psoas muscle (PM) and the quadratus lumborum (QL) muscle. Given that branches of the lumbar plexus travel between the PM and the QL, the anterior QLB appears to be the preferred approach to provide analgesia to both the lower extremities and the trunk as it consistently provides spread of local anesthesia to the L1-3 nerve roots (7). Hip innervation is largely derived from the lumbar plexus (L1–L4); therefore, ensuring coverage of the lumbar nerve roots is crucial for optimizing analgesia (8) with the potential of avoiding quadriceps weakness. In addition to the surgical pain caused by hip arthroscopy, intra-abdominal fluid extravasation (IAFE) is a well-established complication that can be readily identified by point-of-care ultrasound sonography (POCUS) and has been associated with increased pain (9,10). In a prior study, Haskins et al found that the incidence of IAFE was approximately 16% with 13/16 of the patients demonstrating fluid in the pelvis, and there was a greater increase in pain scores in the postoperative period for patients with IAFE (10). Given that the QLB can provide analgesia to both the hip as well as the pelvis, the QLB may prove to be an appropriate option for postoperative analgesia in hip arthroscopy patients, including those of whom have IAFE (11). Despite this potential benefit, the QLB has not been exclusively studied in this patient population.

References:

1) Lee EM, Murphy KP, Ben-David B. Postoperative analgesia for hip arthroscopy: combined L1 and L2 paravertebral blocks. J Clin Anesth 2008;20:462–5
2) YaDeau JT, Tedore T, Goytizolo EA, et al. Lumbar plexus blockade reduces pain after hip arthroscopy: a prospective randomized controlled trial. Anesth Analg. 2012;115:968–972.
3) Murouchi T, Iwasaki S, Yamakage M. Quadratus lumborum block: analgesic effects and chronological ropivacaine concentrations after laparoscopic surgery. Reg Anesth Pain Med. 2016;41:146–150
4) La Colla L, Ben-David B, Merman R. Quadratus lumborum block as an

alternative to lumbar plexus block for hip surgery: a report of 2 cases. A A Case Rep. 2017;8:4–6. TDNet
5) La Colla L, Uskova A, Ben-David B. Single-shot quadratus lumborum block for postoperative analgesia after minimally invasive hip arthroplasty: a new alternative to continuous lumbar plexus block? Reg Anesth Pain Med. 2017;42:125–126.
6) Ueshima H, Otake H, Lin Jui-An. Ultrasound-Guided Quadratus Lumborum Block: An Updated Review of Anatomy and Techniques. Biomed Res Int. 2017; 2017: 2752876.
7) L. Carline, G. A. McLeod, C. Lamb, and L. Colvin, “A cadaver study comparing spread of dye and nerve involvement after three different quadratus lumborum blocks,” British Journal of Anaesthesia, vol. 117, no. 3, pp. 387–394, 2016.
8) Halaszynski T and A. Uskova. Regional Anesthesia for Hip Surgery. Minimally Invasive Surgery in Orthopedics. 30 July 2016.
9) Kocher MS, Kelly BT et al. Intra-abdominal fluid extravasation during hip arthroscopy: a survey of the MAHORN group. Arthroscopy. 2012 Nov;28(11):1654-1660
10) Haskins SC, Desai NA, et al. Diagnosis of Intraabdominal Fluid Extravasation After Hip Arthroscopy with Point-o-Care Ultrasonography Can Identify Patients at an Increased Risk for Postoperative Pain. Anesthesia & Analgesia. 2017 Mar;124(3): 791-799.
11) Ben-David B and L La Colla. Extravasated Fluid in Hip Arthroscopy and Pain: Is Quadratus Lumborum Block the Answer? Anesthesia & Analgesia. 2017;125(1):364-365.

2.0 OBJECTIVE(S) OF CLINICAL STUDY

Hip arthroscopy is performed frequently and the postoperative course often involves moderate to severe pain. There remains no definitive perioperative pain regimen that has been proven to be effective and safe for this ambulatory procedure. Some institutions perform peripheral nerve blocks either preoperatively or postoperatively as a rescue block. The types of PNBs range from lumbar plexus blocks, femoral nerve blocks, and fascia iliaca blocks. All of these PNBs lead to quadriceps weakness which may impede earlier mobilization and physical therapy and possibly delay PACU discharge. While some case reports exist, there have not been any studies evaluating the QLB for hip arthroscopy patients. As previously mentioned, the technique is easy to perform, well-tolerated by patients, and avoids side effects such as hypotension, urinary retention, or the quadriceps weakness associated with lumbar plexus blockade.

The purpose of this trial is to compare the change of the NRS pain scores from the baseline pre-operative pain score at rest and with movement to the NRS scores over the first 24 hours after PACU arrival between patients receiving quadratus lumborum block (QLB) vs. no block for hip arthroscopy.

1. Does QLB provide improved analgesia (at rest and with movement) in the post-operative period for Hip arthroscopy when compared to no QLB? This will be measured by looking at NRS scores, post-operative opioid consumption and patient satisfaction.
2. Does QLB avoid side effects associated with other PNBs such as Quadriceps weakness? What is the incidence of post-operative neuropathic symptoms.
3. Does QLB improve secondary outcomes such as post-operative nausea/vomiting, antiemetic use, and time to discharge.
4. Will there be a difference in the analgesia of patients with Intra-Abdominal Fluid Extravasation (IAFE) between groups and does it have an impact of post-operative pain scores?

Our primary outcome will be NRS pain scores at rest and with movement at 30min, 1hr, 2hr, 3hr & 24hrs after arrival into PACU

Secondary aims of the study are as follows:

1. Presence of IAFE following surgery (immediately Post-Op in OR)
2. Opioid Use (PACU stay and POD1)
3. Nausea/vomiting (PACU stay and POD1)
4. Antiemetic Use (PACU stay and POD1)
5. Incidence of hospital admission (Post-op)
6. Time to discharge from PACU

7. Patient satisfaction with pain management (PACU either once cleared for stage II or in stage II/24hr follow-up)
8. Quality of Recovery 40 physical comfort composite (PACU either once cleared for stage II or in stage II/24hr follow-up)
9. Short Form 8 Health Survey (Pre-op)
10. Leeds Assessment of Neuropathic Symptoms and Signs Pain Scale (6 months)
11. Quadriceps Weakness (Pre-op and PACU)
12. Urinary Retention (PACU)
13. Incidence of Hypotension (PACU)

3.0 STUDY HYPOTHESES

Analgesia Hypotheses

1. There will be a difference in the trajectory of pain at rest or with movement over the first 24 hours after PACU arrival between patients who receive quadratus lumborum block vs. no block for hip arthroscopy.
2. There will be a difference in postoperative opioid consumption between groups.
3. There will be a difference in the analgesia in the QLB arm despite the presence of IAFE.

Block Side Effects Hypotheses

1. There will be no difference in the incidence of Quadriceps weakness post-operatively in the QLB group versus no block.
2. There will be a difference in Leeds Assessment of Neuropathic Symptoms and Signs Pain Scale between groups.

Improvement in Secondary Outcomes Hypotheses

1. There will be a difference in the incidence of nausea between groups.
2. There will be a difference in the incidence of vomiting between groups.
3. There will be a difference in antiemetic use between groups.
4. There will be a difference in the incidence of hospital admission between groups.
5. There will be a difference in time to PACU discharge between groups.

Patient Satisfaction Hypothesis

1. There will be a difference in patient satisfaction with pain management between groups.
2. There will be a difference in Quality of Recovery 40 physical comfort composite score between groups.

4.0 STUDY DESIGN

4.1 Endpoints

4.1.1 Primary Endpoint

- Our primary outcomes are NRS pain at rest and with movement 30min, 1, 2, 3 and 24 hrs after PACU arrival (if at home, obtained by a patient education sheet).

4.1.2 Secondary Endpoints

- Total Presence of IAFE following surgery [Immediately Post-Op in OR]
- Opioid use [PACU stay and POD 1]
- Nausea/vomiting [PACU stay and POD 1]
- Antiemetic use [PACU stay and POD 1]
- Incidence of hospital admission [Post-op]
- Time to discharge from PACU [PACU]
- Patient satisfaction with pain management [PACU either once cleared for stage II or in stage II /24hr follow up]
- Quality of Recovery 40 physical comfort composite [PACU either once cleared for stage II or in stage II /24hr follow up]
- Short Form 8 Health Survey [Pre-Op]
- Leeds Assessment of Neuropathic Symptoms and Signs Pain Scale [6mos]
- Quadriceps Weakness [Pre-op and PACU]
- Urinary Retention [PACU]
- Incidence of Hypotension [PACU]

4.2 Study Sites

This study will take place at the main campus of the Hospital for Special Surgery (HSS).

5.0 STUDY POPULATION

5.1 Number of Subjects

96

5.2 Inclusion Criteria

Subjects of either gender will be included if:

1. Patients scheduled for a planned ambulatory hip arthroscopy
2. Age 18-80
3. ASA 1-3
4. Ability to follow study protocol
5. English speaking (secondary outcomes include questionnaires validated only in English)

5.3 Exclusion Criteria

Subjects will be excluded from the study if:

- Non-English speaking
- Patients with the inability to understand or follow study protocol
- Younger than 18 or older than 80
- Hepatic or renal insufficiency
- Patients with intolerance/contraindication/allergy to one of the study medications
- Chronic gabapentin/pregabalin use (>3 months)
- Chronic opioid use (Daily opioid use >3 months)
- Patients with contraindication to undergo spinal anesthesia
- No Lipogem injections, Revisions, Repair Gluteus Medius

6.0 PROCEDURES

6.1 Intraoperative Protocol

Patients will receive either a spinal (4cc Mepivacaine) or combined spinal epidural anesthetic (dose up 50 5 cc 2% lidocaine) with IV sedation. Intraoperative anti-emetics will consist of IV ondansetron (4mg) and IV dexamethasone (4mg). Intra-operative analgesics will be IV fentanyl (max 100mcg), IV acetaminophen (max 1000mg), IV ketorolac (max 30mg. Up to 2 mg of IV dilaudid can be given at the end of the case at the discretion of the anesthesiologist. At the discretion of the anesthesiologist intra-op protocol may be modified.

Patients will be randomized to either receive a single shot anterior QLB (30cc 0.5% Bupivacaine with 2mg preservative free dexamethasone) or no block. The randomization schedule will be generated using SAS software by a member of the Healthcare Research Institute not otherwise involved in the trial. Group assignment will be indicated on cards within numbered sealed opaque envelopes.

It is recommended that PACU orders will include Oxycodone 5/10 with IV dilaudid 0.5mg q5min for breakthrough pain but can be changed at the discretion of the anesthesiologist and APS. For assessment of IAFE, an anesthesiologist trained in the Focused Assessment with Sonography for Trauma (FAST) exam will evaluate the patient pre-operatively and postoperatively for signs of fluid in the peritoneum. The results will be confirmed by a second anesthesiologist.

Once the spinal has completely resolved (2 hrs following PACU arrival), a blinded research assistant will independently assess each patient for quadriceps weakness. The patient will be placed supine with a cushion underneath their knee, resulting in a 45-degree angle at the knee. Quadriceps strength of both legs will be assessed by placing a dynamometer on the anterior of the ankle, between the malleoli. Patients will be instructed to extend their legs three times each, with a 30- s pause between each attempt. After each attempt, the strength will be recorded and patients will rate their pain using NRS. A blinded anesthesiologist will assess analgesia in the L1-3 dermatomal distribution. Sensory function along the L1-3 dermatomal distribution will be assessed by touch and temperature discrimination using an alcohol swab.

The preferred home medication will be Oxycodone/Percocet (unless contraindicated) and an oral nonsteroidal anti-inflammatory drug. However, this can be changed according to the discretion Anesthesiologist or the PA.

Questionnaires administered by Research staff:

1) DOS: Pre-op- NRS pain scores, SF-8, Quad Strength, Sensory Exam
2) DOS: PACU- NRS pain scores, ORSDS, QoR40, Patient Satisfaction, Quad Strength, Sensory Exam
3) POD 1- NRS Pain scores, QoR40, ORSDS, Patient Satisfaction, blinding assessment
4) 6 months Post -Op - Leeds Assessment of Neuropathic Sx and Signs Pain Scale

6.2 Data Collection

The following data will be collected:

Pre-operative/Baseline

- Basic demographic data (i.e. name, DOB, race, gender, etc.)
- Patient weight & height, BMI
- NRS scores at rest

Surgical procedure (Intra-operative)

- Date of surgery
- Type of surgery
- Induction Time
- Total Pump Fluid (Avg. and Max.)
- Pump Pressure
- Traction Time

PACU (Post-op)

- NRS pain scores at rest
- Opioid consumption
- ORSDS
- Blinding Assessment
- Patient Satisfaction
- Block Success/Failure
- Time to discharge from PACU
- Time to meet discharge criteria
- Antiemetic usage
- Incidence of falls/knee buckling, quadricep weakness
- QoR40

Post-Operative Day 1 (POD 1)

- NRS pain scores at rest
- Opioid consumption
- Patient satisfaction
- ORSDS
- Antiemetic usage
- Incidence of falls/knee buckling, quadricep weakness
- QoR40
- Blinding Assessment

Post-Operative 6 months

- Leeds Assessment of Neuropathic Symptoms and Sign Pain Scale

7.0 STATISTICAL ANALYSIS

- **Proposed analysis**: Regression based on generalized estimating equations (GEE) approach
- **Interim analysis planned**: No
- **Alpha level**: 0.05/2 outcomes = 0.025 (two-sided)
- **Beta or power level**: 80%
- **Primary outcome variable estimate**: Mean ± SD NRS pain score at rest 24 hours post-surgery = 3.3 ± 2.3 (round up SD to 3.0) (YaDeau 2012).
  Mean ± SD NRS pain score at rest 24 hours post-surgery = 5.5 ± 2.4 (round up SD to 3.0) (YaDeau 2012)
- **Number of groups being compared**:2
- **Effect size or change expected between groups**: 1.3 points (Todd 1996)
- **Resulting number per group**: 40
- **Total sample size required**: (40*2) +20% attrition rate= 96

The primary outcomes (NRS pain score at rest and with movement 30 minutes, 1, 2, 3, 4, and 24 hours after PACU arrival) will be compared between the QLB and no block groups using regression based on a generalized estimating equations (GEE) approach with an unstructured correlation structure. Continuous secondary outcomes measured at a single time point will be analyzed using two-sample t-tests or Wilcoxon rank-sum tests, depending upon the distribution of the data. Categorical secondary outcomes measured at a single time point will be compared between groups using $\chi 2$ or Fisher's exact tests, as appropriate. Outcomes measured at multiple time points will be analyzed using regression based on a GEE approach with an identity or logit link.

Balance on demographics and baseline characteristics will be assessed by calculating standardized differences (difference in means or proportions divided by the pooled standard deviation) between groups. Balance will be assessed using two thresholds: (1) 1.96 x (2/48)1/2 = 0.400 and (2) 0.2 (Austin 2009).

The success of blinding in each group will be assessed using the Bang Blinding Index (Bang 2010).

References:

1. Austin PC. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity score matched samples. Stat Med 2009; 28: 3083-107.
2. Bang H, Flaherty SP, Kolahi J, Park J. Blinding assessment in clinical trials: A review of statistical methods and a proposal of blinding assessment protocol. Clin Res Regul Aff 2010; 27:42-51

8.0 ADVERSE EVENT ASSESSMENT

All Adverse Events (AEs) will be reported in the final study report.