The Utility of iPACK Block in Anterior Cruciate Reconstruction Surgery: A Retrospective Study

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Abstract

The primary aim of this retrospective study was to evaluate the effect of iPACK block in ACL reconstruction surgery. Adults who received a femoral nerve block were compared to those who received femoral block plus iPACK. Opioid requirements, PACU pain scores, and recovery time (a combination of PACU and phase II recovery time) were compared. A total of 184 patients were included. There were no difference in PACU pain scores, or opioid doses in PACU. However, the iPACK group had lower intraoperative propofol dose and total intraoperative OME requirements, as well as a shorter postoperative stay by 40 minutes.

Key words: Anterior Cruciate; Reconstruction; Peripheral Nerve Block; iPACK Block; Analgesia.

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Introduction

The optimum role of peripheral nerve blocks in anterior cruciate ligament reconstruction (ACLR) continues to be debated as a component of multimodal analgesia (1,2). For those choosing to utilize peripheral nerve block for ACLR, there has been variability in addressing pain in the posterior aspect of the joint, usually either by a sciatic nerve block or with local infiltration. However, in keeping with motor preservation, the former is not desirable, and there is less opportunity for directed surgeon infiltration in ACLR, which is primarily conducted with arthroscopy. One possible solution to this dilemma is a relatively new block, Injection between the Popliteal Artery and the Capsule of the Knee (iPACK), which has been effective in providing posterior analgesia for total knee arthroplasty (1-3). However, data is limited regarding the utility of this block in ambulatory ACLR. We evaluated our experience with iPACK block in this retrospective study of ACLR patients. Our hypothesis was that pain levels experienced by patients in the post-anesthesia care unit (PACU) would be significantly lower for patients who received iPACK block in concert with femoral block, as opposed to femoral nerve block alone.

Methods:

This retrospective review was approved by our Institution Review Board of the University of Pittsburgh (PRO20060152). We included patients with ASA physical status classes 1-2, presenting for ambulatory ACLR, between September 1, 2019 and October 31, 2020, who received either femoral nerve block (n=73) or femoral block in combination with an iPACK block (n=111). There was no discrimination for inclusion based upon graft type. Patients who did not receive the described blocks were excluded.

After informed consent was obtained in the preoperative holding area, patients underwent femoral block under ultrasound guidance with a 6-13 MHz linear transducer (Sonosite Export, Bothell WA), utilizing 20 ml 0.25% bupivacaine or ropivacaine injected through a 5 cm, 22 gauge echogenic needle (Sonoplex II, Pajunk USA, Alpharetta, GA). Patients who consented for iPACK block were subsequently asked to externally rotate, the leg at the hip and provide partial flexion of the knee. A curvilinear, 2-5 MHz transducer (Sonosite Export) was applied at the level of the base of the patella, to image the medial aspect of the distal thigh. The region between the popliteal vessels and the posterior portion of the femoral cortex was targeted, and an 8 cm, 21 gauge echogenic needle (Pajunk Sonoplex) was advanced into this space. After assuring negative aspiration, 20 ml of 0.25% bupivacaine or ropivacaine was injected in aliquots of 2-5 ml, ensuring spread between the bone and vessels.

All patients received multimodal analgesia including preoperative acetaminophen, and intraoperative decadron and ketamine. Some patients received intraoperative opioids as well, based upon vital sign responses to surgical interventions. All cases were conducted with general anesthesia, utilizing either laryngeal mask airway or endotracheal tube. Muscle relaxation was not generally employed after airway management was carried out.

Patient demographics, PACU pain scores, recovery time, and opioid requirements after surgery were collected. The primary outcome measure was PACU NRS score on arrival from the OR. Secondary outcomes included pain scores at other points during recovery, opioid doses in the OR and in PACU, time to discharge from the hospital, and the incidence of postoperative nausea and vomiting.

Incidences of perioperative outcomes are reported as simple statistics. Comparisons for outcome variables between the two groups were assessed by Chi-square test or by T-test, and Wilcoxon test. The Bonferroni correction was used to account for multiple comparisons. An alpha level of 0.05 was considered statistically significant. A difference in numeric pain rating score, NPRS, of two units between groups was considered clinically significant.

Results

There were no differences in demographics or operative times (Table 1).

We also found no significant differences between groups for pain scores in PACU. (Table 2). Intraoperative anesthetic requirements including total dose of propofol, and opioid drugs were significantly lower for the iPACK group. In addition, the iPACK group had a significantly shorter postoperative stay (191.1 +/- 80 minutes vs 152.6 +/- 65.9 minutes, $p < 0.02$). Opioid and antiemetic requirements in the PACU were similar in both groups.

Discussion

In this retrospective analysis, we found that patients undergoing ACLR who had received FNB plus iPACK had similar pain scores

Table 1 Baseline Characteristics.

	Femoral Nerve Block (n=73)	Femoral + iPACK Block (n=111)	p-valuea,b
Demographics			
Female, n (%)	32 (44)	57 (51)	0.3
Mean age in years (SD)	26.8 +/- 10.0	26.6 +/- 10.7	0.2
BMI (SD)	26.5 +/- 5.4	26.2 +/- 5.75	0.7
ASA classification, n (%)			
I	51 (69.9)	73 (65.6)	0.63
II	20 (27.4)	32 (28.9)	0.86
III	2 (2.7)	6 (5.5)	0.48
ACL side, n (%)			
Right	43 (58.9)	54 (48.7)	0.17
Left	30 (41.1)	57 (51.3)	
ACL repair type, n (%)			
Quadriceps	42 (57.5)	46 (41.4)	0.04
Patellar	14 (19.1)	23 (20.7)	0.85
Allograft	13 (17.9)	38 (34.3)	0.02
Hamstring	4 (5.5)	4 (3.6)	0.71

Abbreviations: SD, standard deviation; ASA, American Society of Anesthesiologists; BMI, Body mass index;
a: p-value compares femoral nerve block vs femoral nerve block + iPACK block
b: chi-squared test used to compare categorical data and t-test to compare means

Table 2 : Outcomes.

	Femoral Nerve Block (n=73)	Femoral + iPACK Block (n=111)	p-valuea,b
Total OR time in minutes (SD)	203.6 (40)	194.6 (39)	0.1
Intraoperative total propofol dose in mg (SD)	1409.0 (778)	1188.3 (713)	0.04
Intra-Op OMEs			
No opioid use intra op, n (%)	19 (26.0)	24 (21.6)	0.59
Average OME for those who utilized opioids intra-op	20.4 +/- 13.6	16.2 +/- 10.5	0.02
Average NPRS PACU Score (SD)	3.93 (2.0)	3.73 (2.57)	0.57
PACU OMEs			
No opioid use in PACU, n (%)	15 (20.5)	32 (28.8)	0.23
Average OME for those who used opioids in PACU	(n=58) 19.9 (13.8)	(n=79) 21.8 (15)	0.38
Time in minutes to first opioid in the recovery room (SD)	37.1 (36.8)	33 (34)	0.43
Total recovery time in minutes (SD)	191.1 (80)	152.6 (65.9)	0.0004
Rescue antiemetic in PACU, n (%)	8 (10.9)	13 (11.7%)	1.0

Abbreviations: SD, standard deviation; OMEs, oral morphine equivalents; NPRS, numeric pain rating scale;
a: p-value compares femoral nerve block vs femoral nerve block + iPACK block
b: chi-squared test used to compare categorical data and t-test to compare means

in PACU compared to those who received FNB only and did not differ in postoperative opioid requirements. However, they required less intraoperative opioids and lower doses of propofol. These likely contributed to the significantly shorter recovery time in this population, an important variable in ambulatory anesthesia.

A paucity of evidence has accrued regarding blocks specifically targeting the posterior portion of the knee in ACLR, particularly in outpatients, in whom such a block might impact time required for recovery and facilitate earlier discharge. Two studies of inpatients reported a reduction in opioid requirements after surgery. Amer et al, in a randomized trial comparing adductor canal block with iPACK to adductor canal block plus surgeon-applied local infiltration in ACLR patients, reported lower pain scores and reduced opioid consumption in the iPACK group (4). When iPACK was compared to LIA in addition to femoral triangle block in a group of surgical inpatients undergoing ACLR, the authors noted that 24 hour morphine consumption was significantly reduced, with no effect on reported pain levels or functional outcomes (3).

However, like Vichainarong et al, who studied outcomes with iPACK block in total knee arthroplasty, we were unable to demonstrate a reduction in postoperative opioids in iPACK patients, though this group did require fewer opioids during the surgery (5). Further, we did not identify differences in pain scores when the iPACK block was added to femoral block, though

this may be explained by the increased dose of opioids that were provided in the OR to the group with femoral block only

Limitations of this study include relatively limited numbers of patients in the two groups, as well as the retrospective design, which allows for bias that may not be apparent during data analysis. In addition, there was a higher proportion of allografts, and lower proportion of quadriceps tendon autografts, in the Femoral-iPACK group. However, this was not associated with differences in PACU pain reported by patients.

In conclusion, addition of an iPACK block to a femoral block did not reduce reported pain levels in PACU, but did provide other benefits for ambulatory ACL reconstruction patients, including shorter length of stay, and lower intraoperative propofol and opioid requirements, when compared to those receiving only a femoral nerve block. Future prospective studies will permit greater elucidation of the benefits of iPACK in this setting.

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