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Femoral Catheter Marginally Improves CPM Compliance but Significantly Lowers Opioid Use vs Adductor Canal Catheter with ACL Repair

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Introduction

Many patients undergoing an Anterior Cruciate Ligament (ACL) reconstruction receive a nerve block for pain relief [1]. A femoral nerve block (FNB) has been the standard location for the block for many years, but recently, the adductor canal block (ACB) has been used to provide analgesia after knee surgery [2].

Comparisons of the two techniques have focused on single injection techniques. One study suggested that FNB provides better analgesia for knee pain than ACB under movement [3]. Another study comparing the two approaches showed non-inferior analgesia with ACB compared to FNB [4]. Although we recognize that ACB has the proposed benefit of retaining quadriceps muscle strength and improving mobility, particularly following total knee arthroplasty compared to FNB, it is worth noting that ACL repair patients are instructed to avoid immediately putting weight on the affected leg, which reduces the significance of conserving the quadriceps after surgery. Thus, we hypothesize that a continuous femoral block will be superior to a continuous adductor canal block after ACL reconstruction for pain control without negatively affecting the quality of recovery from potential transient quadriceps weakness.

Materials and Methods

Institutional Review Board approval and patient consent were obtained for this single-institution, randomized, double-blinded study. The study was registered with ClinicalTrials.gov (NCT03208478).

Baseline characteristics were collected from all patients in the pre-operative area before block placement. All patients received a standard ultrasound-guided femoral or adductor canal block catheter with a loading dose of 20mL 0.5% ropivacaine in the pre-operative bay before surgery. All surgeries were completed under general anesthesia. Upon arrival to the recovery room, catheters were connected to a portable infusion pump delivering a continuous infusion of 0.2% ropivacaine at 5mL/hr, with 5mL demand bolus and 30-minute lockout.

Before discharge home, pain scores and opioid use were recorded in the recovery room. Patients were then discharged home per standard of care.

A Quality of Recovery questionnaire (QoR15) was conducted twice by phone at 24 hours and 48 hours after

discharge from the recovery room. Pain scores, opioid usage, catheter demand bolus dosage, and use of continuous passive motion (CPM) device were recorded. Relevant demographics and observational data from patients' charts were recorded, including intra-operative and recovery room opioid usage.

Two patients in the femoral block group and one patient in the adductor canal block group withdrew from the study due to catheter placement and removal errors. They were excluded from the analysis, leaving 28 patients in the FNB group and 29 patients in the ACB group.

Both patients and research personnel measuring study outcomes were blinded.

After testing for normality using the Shapiro-Wilk test, a Mann-Whitney U test and Fisher's exact test were used as indicated to analyze non-parametric variables. Parametric variables were analyzed using a t-test. Significance was defined as p value less than 0.05.

Results/Case Report

Sixty adult patients undergoing elective anterior cruciate ligament reconstruction were consented, enrolled, and analyzed. Exclusion criteria included pregnancy, BMI >35, opioid use >15 mg MME/Day, chronic pain, pre-existing neuropathy, and any contraindication to nerve block placement. Enrolled patients were randomized to receive either a continuous FNB or a continuous ACB before surgery.

There were no significant differences in demographics between the two groups when considering age, height, weight, BMI, and gender.

Opioid Consumption:
A strong association ($p<0.001$) exists between the FNB group and low opioid consumption, while the ACB group is strongly associated with high opioid usage ($p<0.001$). Within the FNB group, there were no patients, 0% (0/28), who had a high opioid consumption level of more than 50 MME/Day. Moreover, there were 79% (22/28) patients who had a low opioid usage level of less than 10 MME/Day. In contrast, the ACB group included 17% (5/29) patients with high opioid usage and only 59% (17/29) patients with low opioid usage. (Table 1)

CPM compliance:
At both 24 and 48 hours after surgery, the FNB group was associated with better CPM compliance than the ACB group ($p<0.001$). (Table 2)

There were no differences between FNB and ACB catheters for pain scores and Quality of Recovery (QoR-15) score.

Discussion

The ACB was introduced in 2011 as an alternative to FNB, providing knee analgesia while sparing motor branches to the quadriceps. After ACL repair, the two techniques showed similar analgesia, with ACB providing better quadriceps muscle preservation [5]. Since those studies used single injection blocks, their full potential value on CPM compliance and outcome was limited beyond the duration of the block. As ACL repair is non-weight-bearing after surgery, we decided to conduct this randomized study using continuous infusion and additionally measure CPM compliance after surgery.

While the overall analgesic impact of ACB appears to be non-inferior to FNB, their analgesic characteristics differ. This study demonstrates that although overall pain score ratings and quality of recovery were similar, the FNB catheter exhibits a superior analgesic profile compared to the ACB

catheter. This is evidenced by a lower incidence of excessive opioid consumption and a higher occurrence of CPM usage, indicating active engagement in rehabilitation. Although ACL repair patients are non-weight-bearing, which minimizes the importance of quadriceps preservation after surgery, further research is required to confirm the long-term effectiveness of FNB on this surgical population.

References

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4. Abdallah FW, Whelan DB, Chan VW et al. Adductor canal block provides noninferior analgesia and superior quadriceps strength compared with femoral nerve block in anterior cruciate ligament reconstruction. Anesthesiology 2016;124:1053-64.
5. Jaeger P, Zaric D, Fomsgaard JS et al. Adductor canal block versus femoral nerve block for analgesia after total knee arthroplasty: A randomized, double-blind study. Reg Anesth Pain Med 2013;38:526-32.

Disclosures

No

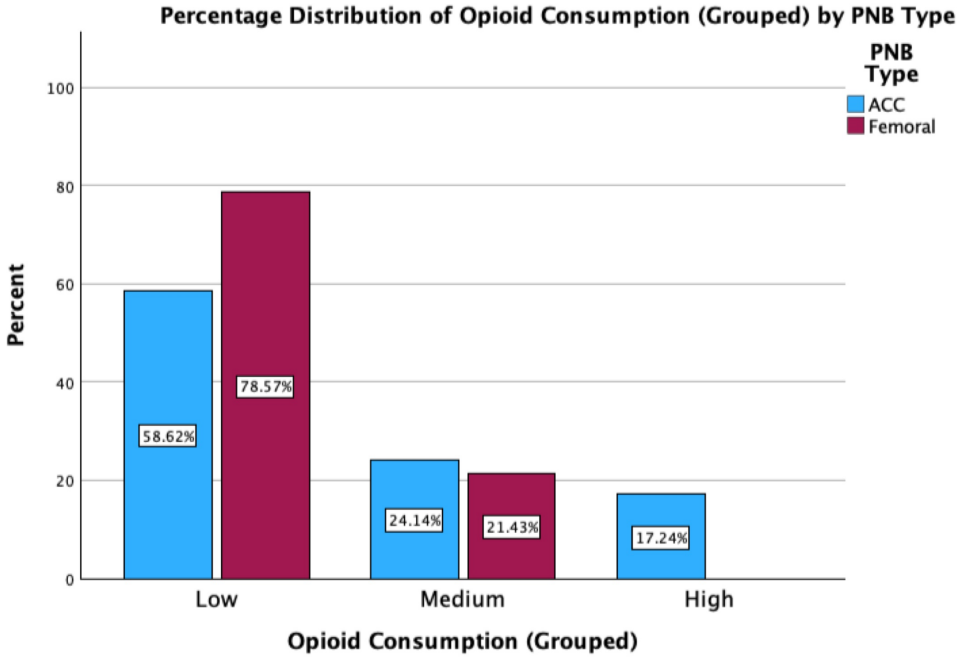
Tables / Images

Table 1

PNB Type * Opioid Consumption (Grouped) Crosstabulation

Count

		Opioid Consumption (Grouped)			
		Low	Medium	High	Total
PNB Type	ACC	17	7	5	29
	Femoral	22	6	0	28
Total		39	13	5	57

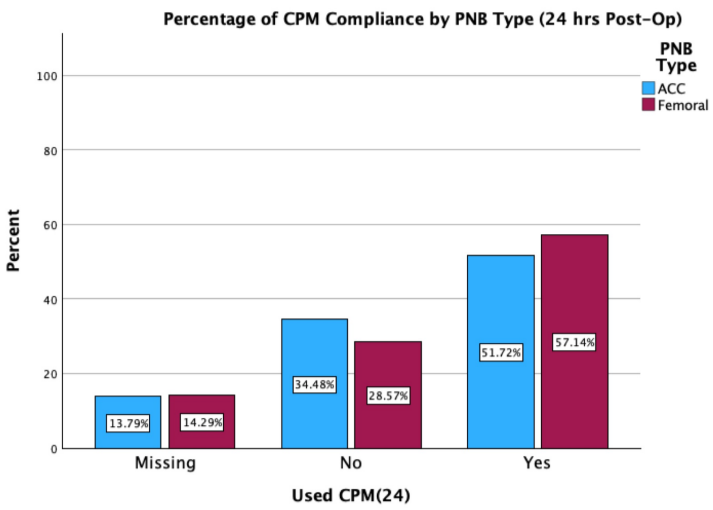


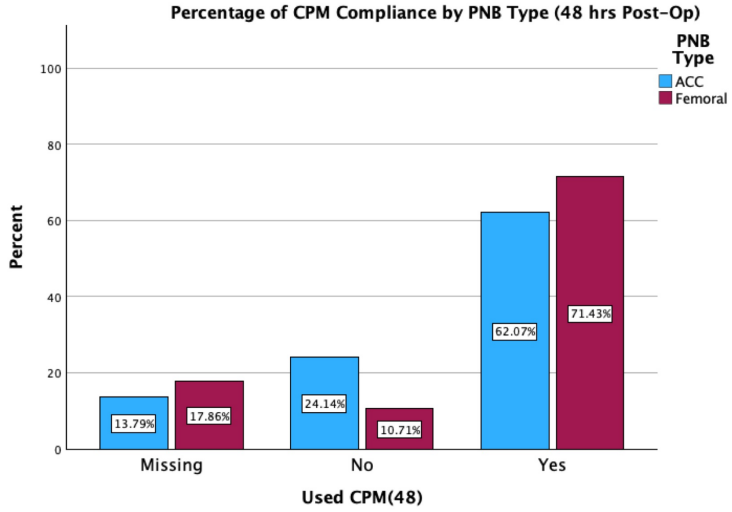
Opioid Consumption: High(H) is defined as >50 MME per day, Medium(M) is defined as between 10 and 50 MME per day, Low(L) is defined as <10 MME per day ($p<0.001$).

Table 2

		Used CPM(24)			
		Missing	No	Yes	Total
PNB Type	ACC	4	10	15	29
	Femoral	4	8	16	28
Total		8	18	31	57

		Used CPM(48)			
		Missing	No	Yes	Total
PNB Type	ACC	4	7	18	29
	Femoral	5	3	20	28
Total		9	10	38	57





CPM compliance after 24 hours (Left) and after 48 hours (Right) ($p<0.001$)