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Does Periarticular Injection reduce pain after knee arthroplasty among patients receiving peripheral nerve blocks?

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Introduction

Periarticular injection (PAI) of local anesthetic performed by the surgeon is a widely-utilized analgesic intervention for total knee arthroplasty (TKA) patients. The injection often includes additives such as morphine and methylprednisone. Peripheral nerve blocks are also commonly used to provide analgesia after TKA. Addition of adductor canal (ACB) and Infiltration between the Popliteal Artery and Capsule of the Knee (IPACK) blocks to PAI improves analgesic outcomes (reduced pain with ambulation and reduced opioid consumption) (Kim et al (2019). However, it is not clear if the PAI component is necessary given the theoretically largely complete analgesic effects of ACB/IPACK. Anecdotal evidence indicates that some surgeons routinely use the PAI and some do not, without obvious large differences in analgesic outcomes. While there may be a 'belt and suspenders' advantage to using PAI in addition to ACB/IPACK, it is not desirable to perform unnecessary procedures. In this study, we seek to compare the efficacy of ACB/IPACK with and without PAI. We hypothesized that TKA patients with ACB/IPACK will have pain scores with ambulation on the day after surgery that are non-inferior to that of patients with PAI + ACB/IPACK.

Materials and Methods

This single-center, triple blinded randomized controlled trial was approved by the IRB at Hospital for Special Surgery and registered on clinicaltrials.gov (NCT04749615). Written informed consent was obtained from all study participants.
94 patients undergoing primary TKA were enrolled. Subjects were randomly assigned to receive either an active PAI or saline placebo in addition to peripheral nerve blocks. The PAI consisted of a deep injection of bupivacaine 0.25% with 1:200,000 epinephrine, 30 mL; morphine, 8 mg; methylprednisolone, 40 mg; cefazolin, 500 ; with normal saline to bring total volume to 64 mL. A superficial injection of 20 mL bupivacaine, 0.25%, was also administered. The control consisted of normal saline injected with the same injection technique and volumes as for the active intervention. The standardized multimodal protocol included intraoperative sedation with midazolam and propofol, a mepivacaine spinal (60mg), adductor canal block (15mL bupivacaine, 0.25% with 1 mg preservative free dexamethasone); IPACK block (25mL bupivacaine, 0.25%, with 2mg preservative free dexamethasone).

Patients received intraoperative ketamine (50mg) and ketorolac (15mg). Post-operative analgesia was provided with IV ketorolac followed by oral meloxicam, acetaminophen (IV then oral), oral duloxetine 60 mg daily and oral oxycodone 5-10 mg PO q 4 hr PRN. Opioids were adjusted as needed. IV hydromorphone was available in the recovery room for breakthrough pain.
Data were collected through review of medical records and through patient interviews on the day of surgery. The primary outcome was the Numeric Rating Scale (NRS, 0-10) for pain with movement on POD1. Secondary data included cumulative opioid consumption, expressed as oral morphine equivalents.

Inclusion criteria consisted of age 25-80, English speaking, planned use of regional anesthesia and osteoarthritis diagnosis. Exclusion criteria included ASA of IV or higher, renal insufficiency, major prior ipsilateral open knee surgery, chronic gabapentin/pregabalin use, chronic opioid use and diabetes.

Power Calculation: A previous study found TKA patients with an ACB/IPACK/PAI block to have a mean ± standard deviation NRS pain with ambulation at POD1 of 1.7 ± 1.4. (Kim 2019). Using the standard deviation of 1.4 for both groups, 90% power, an alpha level of 0.025, a one-sided two-sample t-test with a non-inferiority margin of 1.0 and 10% attrition required a sample size of 94 patients.
Primary outcome statistics: A one-sided two-sample t-test compared NRS pain with movement at POD1 between the two treatment groups with a non-inferiority margin of 1.0 points (alpha = 0.025).
Secondary outcome statistics: A two-sided two-sample t-test compared cumulative opioid consumption from PACU to POD2 between the two treatment groups (alpha = 0.05).

Demographics statistics: Standardized differences with the threshold of 0.4 were used to assess balance among demographics between the treatment groups.
All individuals involved in the study report no relevant conflicts of interest.

Results/Case Report

Ninety-four patients (47 per group) were randomized to receive either PAI or placebo. Patient characteristics were well balanced between the two groups (Table 1). There was no significant difference between groups in NRS pain score with ambulation. NRS pain with movement at POD1 (Table 2) in the ACB/IPACK/No PAI group was noninferior to that of the ACB/IPACK/PAI group (Difference = -0.3, 95% CI = [-1.5, 0.9], p = 0.0155). There was no significant difference in cumulative opioid consumption from PACU to POD2 between groups.

Discussion

This triple blinded, placebo controlled, randomized clinical trial demonstrated that addition of a PAI to adductor canal blocks and IPACK blocks did not reduce pain with ambulation after TKA, in the context of a multimodal analgesic protocol. Similarly, addition of PAI did not reduce cumulative opioid consumption. This study suggests that PAI may not provide apparent benefit among these patients. These results may not be generalizable for different surgeries or for patients with different baseline characteristics or different underlying conditions.

References

Kim DH, Beathe JC, Lin Y, YaDeau JT, Malouf DB, Goytizolo E, Garnett C, Ranawat AS, Su EP, Mayman DE, Memtsoudis SG. Addition of infiltration between the popliteal artery and the capsule of the posterior knee and adductor canal block to periarticular injection enhances postoperative pain control in total knee arthroplasty: A randomized controlled trial. Anesth Analg 2019;129:526-535.

Disclosures

No

Tables / Images

Table 1 Patient Demographics

	No PAI +ACB/IPACK	PAI +ACB/PAI	Standardized Difference
Total Count, n	47	47	
Age, years [median (IQR)]	67 (62, 72)	67 (63, 71)	0.10
Gender, n (%)			
Female/Male	22 (47)/25 (53)	21 (45)/26 (55)	0.04
Body Mass Index, kg/m^2 (mean ± SD)	30 ± 4	31 ± 4	-0.26
Race, n (%)			0.26
White / Non-White	42 (89)/5 (11)	39 (83)/8 (17)	
Ethnicity, n (%)			0.36
Hispanic/Non-Hispanic	7 (15)/39 (83)	3 (6)/44 (94)	

SD = Standard Deviation
IQR = Interquartile Range

Table 2 Primary and Secondary Outcomes

	No PAI + ACB/IPACK	PAI + ACB/PAI	Effect Size*	P-value (non-inferiority)	P-value (inequality)
NRS Pain with Movement at POD 1 (mean ± SD) and (median [IQR]*	4±3 4 [2,7]	5±3 5 [2,7]	-0.3 (-1.5, 0.9)	0.0155	N/A
Cumulative Opioid Consumption (mean ± SD)	73±52	88±40	-15.9 (-35, 3.1)	N/A	0.1000
***Median and IQR presented to account for the primary outcome's non-normal distribution.**					