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# Comparison of Continuous Adductor Canal Block with Single Shot Adductor Canal Block and IPACK Block for Postoperative Analgesia in Total Knee Arthroplasty – A Randomized Controlled Trial

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**Conflicts of Interest:** Nil

## Abstract

**Background**: Effective postoperative pain control after total knee arthroplasty (TKA) remains a clinical challenge. Regional anaesthesia techniques, particularly adductor canal block (ACB) and interspace between the popliteal artery and capsule of the knee (IPACK) block, are increasingly being used to provide opioid-sparing analgesia with preserved quadriceps strength. Aim: To compare the efficacy and safety of continuous ACB with single-shot ACB plus IPACK block in patients undergoing unilateral TKA.

**Methods**: Fifty-two ASA I–II patients aged 40–70 years were randomized into two groups (n=26 each). Group A received continuous ACB with 0.5% ropivacaine (20 ml bolus followed by 5 ml/hr infusion for 24 hours). Group B received single-shot ACB (0.5% ropivacaine 20 ml + dexmedetomidine 0.5 mcg/kg) plus IPACK block (0.5% ropivacaine 20 ml + dexmedetomidine 0.5 mcg/kg). Primary outcome was VAS pain scores. Secondary outcomes included opioid consumption, time to first rescue analgesia, ambulation distance, quadriceps strength, and complications.

**Results**: Group A showed significantly lower VAS scores at 6, 12, and 24 hr ($p<0.05$), required less fentanyl (42 ± 8 mcg vs. 62 ± 10 mcg, $p=0.001$), and had longer time to first rescue analgesia (10.5 ± 2.1 hr vs. 6.4 ± 1.8 hr, $p=0.001$). Ambulation at 24 hr was greater in Group A (54.2 ± 9.1 m vs. 44.7 ± 8.6 m, $p=0.02$). Quadriceps strength was preserved in both groups. Complications were minimal.

**Conclusion**: Continuous ACB provides superior analgesia, reduces opioid use, and facilitates early mobilization compared to single-shot ACB with IPACK in TKA.

**Keywords**: Adductor Canal Block, Anaesthetic, Ropivacaine, Total Knee Arthroplasty

## Introduction

Total knee arthroplasty (TKA) is a widely performed orthopaedic procedure designed to alleviate pain and improve functional outcomes in patients with advanced knee osteoarthritis and other degenerative conditions. Although surgical techniques and perioperative care have improved significantly, postoperative pain management remains a vital determinant of patient satisfaction, early mobilization, and overall postoperative recovery [1].

Regional anaesthesia techniques have become increasingly important due to their ability to provide targeted analgesia while reducing opioid consumption and associated adverse effects. Among these modalities, the adductor canal block (ACB) and the interspace between the popliteal artery and the capsule of the knee (IPACK) block are commonly utilized to manage pain following TKA.

The ACB primarily targets the saphenous nerve, offering sensory blockade to the medial and anterior aspects of the knee while sparing quadriceps motor function. Initially introduced as a single-shot block, recent research has explored the use of continuous ACB (CACB) via catheter placement to prolong analgesia [2].

Conversely, the IPACK block provides targeted analgesia to the posterior knee capsule by anesthetizing articular branches of the obturator and sciatic nerves, thereby complementing the anterior analgesia provided by ACB [3].

Although both blocks are widely used, there remains a need to compare their analgesic efficacy, opioid-sparing benefits, functional outcomes, and patient satisfaction. The present study evaluates continuous ACB versus single-shot ACB combined with IPACK to identify the optimal postoperative analgesia technique following TKA [4].

**Technique**

**1. Adductor Canal Block**

Under ultrasound guidance, local anaesthetic (commonly ropivacaine or bupivacaine) is deposited within the canal to achieve sensory blockade while preserving quadriceps motor strength [5]. Both single-shot and continuous catheter-based approaches are used.

**2. IPACK Block**

With the patient supine, ultrasound guidance is used to identify the popliteal artery. Local anaesthetic is injected into the fascial plane between the artery and posterior capsule to provide posterior knee analgesia without affecting motor function [6].

**Materials and Methods**

After obtaining ethics committee approval and informed consent, this prospective comparative study was conducted in adult patients undergoing elective total knee arthroplasty at Jhalawar Medical College and SRG Hospital, Jhalawar. Materials used included an ultrasound machine, PNS needle, nerve stimulator, ropivacaine, and standard emergency equipment [7].

**Study Design**

Total participants: 52

Group A (n=26): Continuous ACB using 0.5% ropivacaine at 5 mL/hr

Group B (n=26): Single-shot ACB (20 mL 0.5% ropivacaine) + single-shot IPACK (20 mL 0.5% ropivacaine)

**Procedure**

**Adductor Canal Block**

Performed under ultrasound guidance with catheter placement for continuous infusion in Group A [5].

**IPACK Block**

Performed using ultrasound to inject anaesthetic between the popliteal artery and knee capsule in Group B [6].

**Observation Parameters**

**Vital Monitoring:** Pulse, blood pressure, and $SpO_2$ were recorded preoperatively, after block, intraoperatively, and hourly for 24 hours.

**Pain Assessment:** VAS 0–10 recorded hourly for 24 hours.

**Rescue analgesia:** fentanyl 1 μg/kg for VAS >3.

**Mobilization**: Distance walked at 24 hours between fixed 10-meter points.

**Complications**: Monitored for infection, hematoma, nerve injury, intravascular injection, myositis, LAST, and quadriceps weakness.

**Statistical Analysis**

t-test, chi-square, and ANOVA applied appropriately.

A p-value <0.05 was considered statistically significant.

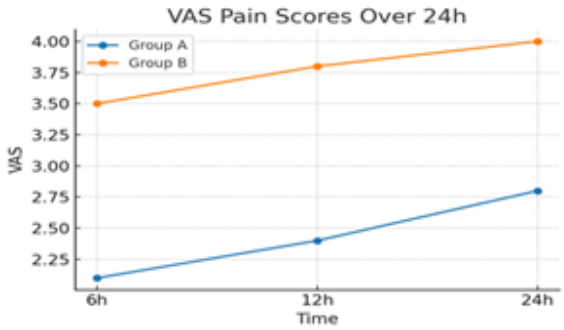
**Results**

All 52 patients completed the study. Baseline demographics were comparable.

Pain scores were significantly lower in Group A at all-time points. Fentanyl consumption was lower in Group A (42 ± 8 mcg) compared to Group B (62 ± 10 mcg). Time to first rescue analgesia was longer in Group A (10.5 hr vs. 6.4 hr). Ambulation distances at 12 and 24 hr were higher in Group A. Quadriceps power was preserved in all patients. Complications were minimal (1 catheter displacement in Group A, 1 mild nausea in Group B).

Table 1: Comparison of Outcomes between Groups

| Parameter | Group A (Continuous ACB) | Group B (Single-shot ACB + IPACK) | p-value |
|---|---|---|---|
| VAS at rest (6 h] | 2.1 ± 0.8 | 3.5 ± 1.0 | 0.001 |
| VAS at rest (24 h) | 2.8 ± 0.9 | 4.0 ± 1.1 | 0.002 |
| Time to rescue analgesia (h) | 10.5 ± 2.1 | 6.4 ± 1.8 | 0.001 |
| Fentanyl use (mcg) | 42 ± 8 | 62 ± 10 | 0.001 |
| Ambulation at 12 h (m) | 28.6 ± 6.2 | 24.1 ± 5.4 | 0.04 |
| Ambulation at 24 h (m) | 54.2 ± 9.1 | 44.7 ± 8.6 | 0.02 |
| 1 episode of nausea (Group B) | | | |

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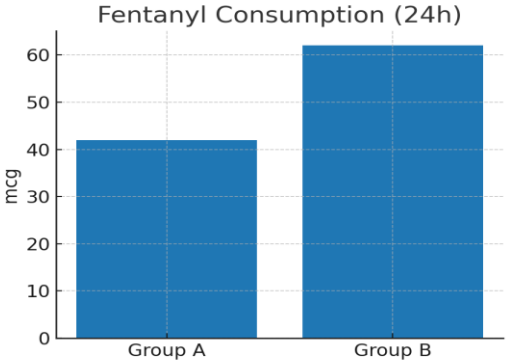
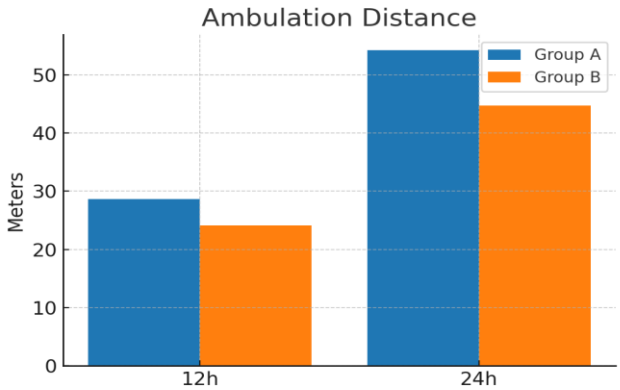



Graph 2:




Graph 3:

**Discussion**

This study demonstrates that continuous ACB provides superior postoperative analgesia and improved early mobilization compared to single-shot ACB + IPACK following total knee arthroplasty. These findings align with previous studies showing the sustained analgesic benefits of continuous ACB [11,12].

The limited duration of the IPACK block may explain why Group B had inferior prolonged analgesia despite sufficient posterior knee coverage initially. The preservation of quadriceps strength further supports the advantage of ACB in facilitating early mobilization [5].

Limitations: Small sample size, Single-centre design, Follow-up limited to 24 hours, Potential variability in rehabilitation practices. Future multicentre trials with larger samples and longer follow-up are recommended.

**Conclusion**

Continuous adductor canal block provides superior analgesia, reduced opioid requirements, and improved early mobilization compared to single-shot ACB combined with IPACK. It should be considered an essential component of ERAS protocols for total knee arthroplasty.

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