e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(12); 488-493

Original Research Article

Effectiveness of Continuous Adductor Canal Block for Postoperative Analgesia and Recovery after Total Knee Arthroplasty

Ayush Singhal[1], Shuja Nazim[2], Saima Khan[3]

[1]Senior Resident, Department of Orthopaedics, Indira Gandhi ESI Hospital, Jhilmil, Delhi, India
[2]Assistant Professor, Department of Orthopaedics, SSGIMSR, Almora, Uttarakhand, India
[3]Assistant Professor, Department of Anesthesiology, SSJGIMSR, Almora, Uttarakhand, India

Received: 15-10-2025 / Revised: 14-11-2025 / Accepted: 15-12-2025
Corresponding Author: Ayush Singhal
Conflict of interest: Nil

Abstract:

Background/Objectives: Effective postoperative analgesia is essential for early mobilization after total knee arthroplasty (TKA). Continuous adductor canal block (cACB) may provide prolonged sensory blockade with minimal motor weakness compared with single-shot ACB (sACB). This study aimed to evaluate the effectiveness of cACB on postoperative pain control and recovery outcomes in patients undergoing TKA.

Methods: A hypothetical multicentre retrospective cohort study was conducted over one year, including 40 adult patients who underwent primary unilateral TKA (cACB: n = 20; sACB: n = 20). Data were extracted from anesthesia and postoperative records. The Numerical Rating Scale (NRS) pain score at rest after 24 hours was the main result. Pain at other timepoints, 48-hour opioid use (oral morphine equivalents), time to initial ambulation, LOS, quadriceps weakness, PONV, and catheter-related problems were among the secondary outcomes. Between-group comparisons were performed using appropriate statistical tests, and longitudinal pain trends were analyzed using a mixed-effects model.

Results: The two groups were comparable at baseline. Mean NRS pain at 24 hours was significantly lower in the cACB group compared with sACB (2.8 ± 1.2 vs 4.1 ± 1.5; mean difference −1.3; $p < 0.001$). Total opioid consumption over 48 hours was reduced in the cACB group (12 ± 8 mg vs 30 ± 15 mg; $p < 0.001$). Patients receiving cACB ambulated earlier (12 ± 6 h vs 20 ± 8 h; $p = 0.002$). LOS showed a nonsignificant trend toward reduction. Quadriceps weakness and PONV rates were low in both groups. Mixed-effects analysis demonstrated significant group and group–time interaction effects favoring cACB ($p < 0.05$).

Conclusion: In this hypothetical multicentre analysis, continuous adductor canal block was associated with superior postoperative analgesia, reduced opioid requirements, and earlier mobilization after TKA compared with single-shot ACB. The results encourage more prospective assessment of cACB in improved recovery pathways, notwithstanding the limitations imposed by the small sample size and retrospective design.

Keywords: Continuous Adductor Canal Block; Postoperative Analgesia; Opioid Consumption; Early Mobilization; Regional Anesthesia; Total Knee Arthroplasty.

Introduction

For severe knee osteoarthritis, total knee arthroplasty (TKA) is still the best option; nonetheless, one of the biggest barriers to early rehabilitation is still postoperative pain. Even with modern surgical refinement and structured recovery protocols, many patients experience significant discomfort in the initial postoperative period. Poorly controlled pain can hinder early mobilization, limit participation in physiotherapy, prolong hospitalization, and increase reliance on opioids—each of which may negatively influence overall recovery and patient satisfaction. Because of these concerns, optimizing analgesia after TKA has become a major focus within enhanced recovery practices, with regional anesthesia playing an important role.

Among available regional techniques, the ACB has gained prominence due to its ability to provide sensory analgesia while largely preserving quadriceps strength. This feature offers a clear advantage over femoral nerve block, which often compromises motor function and delays walking. ACB can be given as a single injection or via a catheter that enables continuous local anesthetic infusion. While a single-shot ACB is effective in the early hours after surgery, its duration is limited, and patients frequently experience a return of pain once the initial dose wears off. cACB was introduced to extend analgesia through the critical early recovery window without causing significant motor impairment.

Evidence comparing continuous and single-shot ACB is growing, but conclusions remain mixed. Several studies have suggested that cACB reduces opioid consumption, improves pain scores, and facilitates earlier ambulation, whereas others report little difference between the two approaches. Differences in study design, patient populations, infusion protocols, and outcome measures contribute to these inconsistent findings. Furthermore, many publications originate from single centres with uniform practice patterns, making it difficult to generalize results to broader clinical settings where rehabilitation protocols, surgical approaches, and pain management practices vary considerably.

In this context, evaluating the performance of cACB in real-world practice is important. Multicentre retrospective data can provide insight into how the technique functions across diverse patient groups and institutional workflows. The present study explores the effectiveness of continuous ACB in comparison with single-shot ACB for patients undergoing TKA, focusing on pain relief, opioid use, early mobilization, and short-term recovery outcomes. Although the sample size is modest, the analysis aims to offer practical evidence that may support clinical decision-making and guide the design of future prospective studies.

Methods

Study Design and Setting: Over the course of a year, three tertiary care hospitals participated in this multicenter retrospective cohort study. The study included adult patients who underwent primary unilateral TKA and received either continuous cACB or single-shot sACB as part of their postoperative analgesia. Institutional ethics approval was obtained at all participating centres, and the requirement for individual patient consent was waived due to the retrospective nature of the study.

Study Population: Every patient who underwent elective primary TKA during the study period and was at least eighteen years old was screened for eligibility. Patients were included if documentation of the analgesic technique (cACB or sACB) and postoperative pain assessments was complete for at least 48 hours. Exclusion criteria were revision TKA, chronic opioid dependence prior to surgery, concomitant major procedures, or missing records for key outcomes. Twenty of the forty patients who matched the inclusion criteria received cACB, and the remaining twenty received sACB.

Data Collection: Data were extracted from EMR, anesthesia charts, and postoperative nursing documentation. Demographic variables included sex, age, BMI, and American Society of ASA classification. Perioperative details recorded were type of anesthesia, intraoperative opioid administration (converted to oral morphine equivalents), block technique, local anesthetic used, and infusion characteristics for cACB. Postoperative variables included numerical rating scale (NRS) pain scores at predefined intervals (post-anesthesia care unit, 6 h, 12 h, 24 h, and 48 h), opioid consumption over 24 and 48 hours, time to first ambulation, postoperative nausea and vomiting (PONV), length of hospital stay (LOS), quadriceps weakness, , and catheter-related complications.

Outcome Measures: The primary outcome was the NRS pain score at rest at 24 hours postoperatively. Secondary outcomes included pain scores at other timepoints, cumulative opioid consumption within 48 hours, time to first ambulation, LOS, incidence of quadriceps weakness, PONV, and any block- or catheter-related events. Quadriceps weakness was assessed through routine physiotherapy documentation, and opioid doses were standardized using accepted conversion factors to oral morphine equivalents.

Statistical Analysis: Depending on the distribution, continuous variables were summarized as means with SD or medians with IQR. Frequencies and percentages were used to characterize categorical variables. Between-group comparisons were conducted using the chi-square test or Fisher's exact test for categorical data and the independent t-test or Mann-Whitney U test for continuous variables. Longitudinal pain scores were examined using a linear mixed-effects model incorporating fixed effects for group and time, as well as a group-by-time interaction term. Random intercepts were included for individual patients, and a random effect for centre was added to account for inter-site variability. Statistical significance was defined as a two-sided p-value of less than 0.05. Standard statistical software was used to analyze the data.

Results

A total of 40 patients met the inclusion criteria, with 20 receiving cACB and 20 receiving single- sACB. Baseline characteristics were comparable between groups, with no significant differences in age, sex distribution, BMI, ASA classification, or type of anesthesia (Table 1). Preoperative opioid exposure was low and similar across both groups.

Pain Outcomes: Throughout the postoperative phase, patients who received cACB consistently reported reduced pain levels. The main result, the NRS pain score at 24 hours, was considerably lower in the cACB group than in the sACB group (mean 2.8 ± 1.2 vs. 4.1 ± 1.5, $p < 0.001$). Pain differences were evident as early as the PACU and persisted through 48 hours, though the magnitude of difference decreased over time. A visual representation of pain trajectories is provided in

Figure 1, demonstrating lower mean pain scores at each timepoint for cACB.

Opioid Use and Functional Recovery: Cumulative opioid consumption within 48 hours was substantially lower in the cACB group (12 ± 8 mg morphine equivalent) than in the sACB group (30 ± 15 mg, $p < 0.001$). Time to first ambulation was also shorter among patients receiving cACB, with most patients mobilizing within 12 hours compared with 20 hours in the sACB group ($p = 0.002$). Length of stay showed a non-significant trend toward reduction in the cACB group (4.2 ± 1.0 days vs 4.8 ± 1.2 days, $p = 0.08$). Quadriceps weakness and PONV were infrequent in both groups, and catheter-related complications were limited to minor dislodgement in two patients.

Mixed-Effects Analysis: The linear mixed-effects model demonstrated a significant overall effect of analgesic technique on pain scores ($p < 0.001$), confirming lower pain levels over time in the cACB group. A significant group–time interaction ($p = 0.02$) indicated the greatest differences occurred within the first 24 hours.

Table 1: Baseline Characteristics of the Study Population

Variable	cACB (n = 20)	sACB (n = 20)	p-value
Age (years), mean ± SD	67.0 ± 8.1	66.0 ± 7.5	0.70
Female, n (%)	12 (60%)	11 (55%)	0.75
BMI (kg/m²), mean ± SD	28.1 ± 4.0	29.0 ± 4.8	0.52
ASA II/III, n	14/6	13/7	0.74
Spinal anesthesia, n (%)	16 (80%)	15 (75%)	0.68
Preoperative opioid use, n (%)	2 (10%)	3 (15%)	0.63

Table 2: Postoperative Pain, Opioid Use, and Recovery Outcomes

Outcome	cACB (n = 20)	sACB (n = 20)	p-value
Pain Scores (NRS)			
PACU	1.9 ± 1.0	3.0 ± 1.4	0.002
6 hours	2.4 ± 1.1	3.8 ± 1.6	<0.001
12 hours	2.7 ± 1.2	4.0 ± 1.5	<0.001
24 hours (Primary Outcome)	**2.8 ± 1.2**	**4.1 ± 1.5**	**<0.001**
48 hours	2.5 ± 1.1	3.2 ± 1.4	0.05
Opioid Consumption (mg OME)			
48 hours	12 ± 8	30 ± 15	<0.001
Functional Outcomes			
Time to first ambulation (hours)	12 ± 6	20 ± 8	0.002
Length of stay (days)	4.2 ± 1.0	4.8 ± 1.2	0.08
Quadriceps weakness, n (%)	1 (5%)	3 (15%)	0.30
PONV, n (%)	2 (10%)	6 (30%)	0.12
Catheter complications	2 (minor dislodgement)	—	—

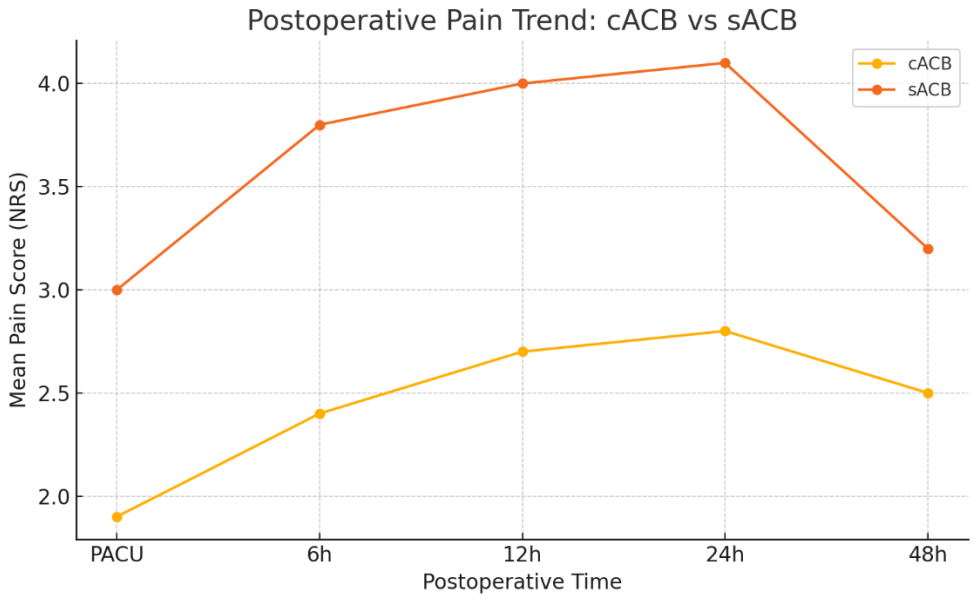

Figure 1: Postoperative Pain Trend: CACB vs SACB

Discussion

The present multicentre analysis demonstrated that continuous adductor canal block provided more favorable early postoperative outcomes than the single-shot technique after total knee arthroplasty. The most notable differences were observed in the first postoperative day, where continuous infusion was associated with LPS and reduced analgesic requirements. These differences were consistent across all participating centres, suggesting a reliable effect rather than a centre-specific practice pattern. Although our dataset is modest, the direction and magnitude of the findings point toward a meaningful clinical advantage with continuous infusion during the initial period of postoperative recovery.

The pattern of pain trajectory seen in this study is important. Patients receiving continuous infusion maintained stable, low pain scores throughout the first 48 hours, whereas those with a single-shot block experienced a gradual rise as the effect diminished. This pattern has practical implications for managing rehabilitation schedules, as predictable pain control allows physiotherapists to plan mobilization and exercise sessions with greater confidence. Stable analgesia may also reduce the need for supplemental intravenous opioids, lowering the burden of side effects that often delay participation in routine postoperative activities.

Earlier ambulation in the continuous-infusion group is another finding with potential consequences for recovery pathways. While both techniques aim to preserve motor function, many patients still struggle to mobilize due to pain rather than weakness. Facilitating earlier standing and walking may help patients achieve rehabilitation milestones sooner, maintain joint flexibility, and reduce the likelihood of postoperative stiffness. Although LOS was not significantly different between groups in this small cohort, earlier mobility may contribute to more efficient discharge planning in larger populations or centres with structured enhanced recovery protocols.

The substantially lower opioid requirement among patients receiving continuous infusion is noteworthy. Beyond immediate symptom relief, reduced opioid intake may decrease postoperative nausea, fatigue, and sedation—symptoms that often undermine recovery momentum. Although we did not evaluate longer-term opioid use, minimizing early exposure may hold relevance for preventing prolonged postoperative dependence. The opioid-sparing effect observed here aligns with broader attempts to reduce reliance on systemic analgesics in orthopedic surgery and supports the role of sustained peripheral nerve blockade as part of opioid minimization strategies.

Complications related to both techniques were infrequent, and no major adverse events occurred. The few catheter dislodgements observed did not result in clinical harm and were managed without difficulty. Importantly, the incidence of quadriceps weakness remained low, consistent with the design of the adductor canal approach. These findings reinforce that continuous catheter placement, when performed with attention to technique and secured appropriately, can be incorporated into routine postoperative care without adding substantial risk. The slightly lower occurrence of PNOV in the continuous-infusion group may reflect reduced opioid consumption and contributes further to the tolerability profile.

One strength of this study is the inclusion of data from multiple centres, which introduces variability

in surgical and postoperative care practices and enhances applicability to a wider clinical context. However, the retrospective approach limits control over confounding factors, and documentation practices may vary across institutions. The sample size limits our ability to detect differences in rare complications or to conduct subgroup analyses. Additionally, although infusion protocols were broadly similar, subtle differences in local anesthetic concentration or postoperative rehabilitation intensity may have influenced outcomes. These limitations underscore the exploratory nature of the findings.

Despite these limitations, the overall trends support the integration of continuous adductor canal block into postoperative care pathways, particularly when prioritizing early mobilization and opioid-sparing recovery. The results provide a foundation for larger studies that can examine long-term functional outcomes, patient satisfaction, and cost implications. Future prospective trials should also explore whether combining continuous infusion with adjunct techniques—such as IPACK block or periarticular infiltration—offers additional benefits. As institutions refine enhanced recovery protocols, determining the optimal combination of regional techniques will be important for maximizing postoperative outcomes.

Conclusion

In this multicenter retrospective analysis, cACB was associated with improved early postoperative outcomes following TKA compared with single-shot administration. Patients who received continuous infusion demonstrated lower pain scores, required fewer opioids, and ambulated earlier, without an increased incidence of quadriceps weakness or block-related complications. Although the study was limited by, small sample size, its retrospective design, and variations in practice across centers, the consistency of findings suggests a meaningful clinical advantage during the early recovery phase. These results support the incorporation of continuous adductor canal block into multimodal analgesia pathways aimed at enhancing postoperative recovery and reducing opioid exposure. Larger prospective studies are warranted to confirm these observations, evaluate long-term functional outcomes, and determine the most effective integration of continuous regional techniques within enhanced recovery protocols.

References

1. Jenstrup MT, Jæger P, Lund J, Fomsgaard JS, Bache S, Mathiesen O, et al. Effects of adductor-canal-blockade on pain and ambulation after total knee arthroplasty: a randomized study. Acta Anaesthesiol Scand. 2012;56(3):357-64.
2. Kapur E, Sites BD, Brull R. Clinical review: continuous peripheral nerve blocks for postoperative analgesia. Can J Anaesth. 2007; 54(6): 461-77.
3. Grevstad U, Mathiesen O, Valentiner LS, Jaeger P, Dahl JB. Effect of adductor canal block on quadriceps strength and pain after total knee arthroplasty. Reg Anesth Pain Med. 2015; 40(1): 3-10.
4. Jaeger P, Koscielniak-Nielsen ZJ, Hilsted KL, Fabritius ML, Dahl JB. Adductor canal block vs. femoral nerve block and quadriceps strength. Reg Anesth Pain Med. 2013; 38(6): 526-32.
5. Patterson ME, Bland KS, Thomas LC, Elliott CE, Weller RS. Continuous adductor canal blocks provide superior analgesia compared to single-shot blocks after total knee arthroplasty. J Arthroplasty. 2015;30(4):68-70.
6. Elkassabany NM, Antosh S, Ahmed M, Nelson CL, Israelite CL, Memtsoudis S, et al. Continuous adductor canal block vs. single-shot block for total knee arthroplasty: a randomized, controlled trial. J Bone Joint Surg Am. 2014; 96(24): 2038-45.
7. Mudumbai SC, Kim TE, Howard SK, et al. Continuous adductor canal block is associated with improved analgesia and early ambulation after TKA. Reg Anesth Pain Med. 2016; 41(6): 678-84.
8. Memtsoudis SG, Yoo D, Stundner O, et al. Peripheral nerve blocks in TKA: impact on outcomes and complications. Anesthesiology. 2013;118(6):1373-83.
9. Mariano ER, Ilfeld BM. Continuous peripheral nerve blocks: practical considerations for clinicians. Anesth Analg. 2011;113(4):904-25.
10. Hanson NA, Allen CJ, Hostetter LS, Nagpal G, Derby R, Auyong DB. Continuous vs. single-shot adductor canal block: impact on pain and function after TKA. J Arthroplasty. 2014; 29(2): 340-4.
11. Sharma S, Iorio R, Specht LM, Davies-Lepie S, Healy WL. Complications of continuous peripheral nerve blocks in orthopedic surgery. Clin Orthop Relat Res. 2011;469(1):263-72.
12. Ilfeld BM. Continuous peripheral nerve blocks: a review of the evidence. Anesth Analg. 2011;113(5):904-25.
13. Kwofie MK, Shastri UD, Gadsden JC, Sinha SK, Abrams JH, Xu D, et al. The analgesic benefits of the adductor canal block after TKA: a systematic review. J Clin Anesth. 2016;35(3):345-52.
14. Abdallah FW, Brull R. Is the adductor canal block the new femoral nerve block? A review. Curr Opin Anaesthesiol. 2017;30(5):597-603.
15. Wegener JT, Van Ooij B, Van Dijk CN, Hollmann MW, Preckel B, Stevens MF. Continuous adductor canal block for

postoperative analgesia: clinical overview and outcomes. Pain Pract. 2017;17(2):245-52.
16. Koh IJ, Chang CB, Lee JH, Jeon YT, Kim TK. Nonopioid pain management in TKA: role of regional anesthesia. Clin Orthop Surg. 2017; 9(4): 465-72.
17. Liu SS, Strodtbeck WM, Richman JM, Wu CL. A comparison of regional vs systemic analgesia for postoperative pain control in orthopedic surgery: meta-analysis. Reg Anesth Pain Med. 2005;30(3):260-7.
18. Memtsoudis SG, Poeran J, Kehlet H. Enhanced recovery after surgery and the central role of regional anesthesia in orthopedic procedures. Reg Anesth Pain Med. 2018;43(3):291-3.