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

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

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 929-933

Original Research Article

Analgesic Efficacy of Single Shot Adductor Canal Block with Levobupivacaine and Dexamethasone for Postoperative Analgesia in Total Knee Arthroplasty

Jugaratna Khatua[1], Bhabani Sankar Mohapatra[2], Manmatha Nayak[3], Arpita Jena[4], Basanta Kumar Pradhan[5]

[1,2,3]Assistant Professor, Department of Orthopaedics, SCB Medical College, Cuttack, Odisha, India
[4]Assistant Professor, Department of Anaesthesiology, SCB Medical College, Cuttack, Cuttack, Odisha, India
[5]Professor, Department of Anaesthesiology, Kalinga Institute of Medical Sciences, BBSR, Odisha, India

Received: 01-03-2026 / Revised: 15-04-2026 / Accepted: 21-05-2026
Corresponding author: Dr. Arpita Jena
Conflict of interest: Nil

Abstract

Aim: The goal of this study was to compare the analgesic efficacy of dexamethasone and levobupivacaine in adductor canal block (ACB) in total knee arthroplasty surgeries.

Methods: Sixty patients were randomized into two groups; Group L received 20 mL of 0.25% levobupivacaine and Group LD received 20 mL of 0.25% levobupivacaine plus dexamethasone 8 mg for ACB. The time for the first analgesic request, the rescue analgesia consumption in a 24-hour period, the postoperative pain score, and the range of motion (ROM), 100-foot walking test and any other adverse effects were measured.

Results: LD group had lower scores of VAS both at rest and on movement at all-time intervals. The mean time to first analgesic request in group LD was delayed compared to group L. The mean total dose of paracetamol consumed in first 24 h postoperative was significantly lower in LD group when compared to L group. There were significant differences in ROM test and 100 foot test between both groups.

Conclusion: The study concludes that adding dexamethasone to levobupivacaine for ACB may significantly improve postoperative pain relief in TKA patients without causing any harmful side effects.

Keywords: Adductor Canal Block, Levobupivacaine, Dexamethasone, Total Knee Arthroplasty.

DOI: 10.25258/ijcpr.18.6.150

Introduction

Total knee arthroplasty (TKA) surgery is accompanied with considerable postoperative pain. Early postoperative mobilization and rehabilitation require adequate pain management. Despite the fact that femoral nerve block (FNB) or continuous epidural anaesthesia (CEA) can provide adequate postoperative pain control, both treatments have negative side effects such as muscle weakness, which can delay postoperative mobilization.[1] The adductor canal block (ACB) is a relatively novel analgesic block for knee surgery that not only blocks the femoral nerve's largest sensory branch, but also causes a smaller decrease in quadriceps muscle strength in adult patients than the femoral nerve block (FNB) .[2] ACB provides similar analgesia to FNB, preserves quadriceps muscular strength better than FNB, and so allows for functional recovery within the first day after TKA.[3] The brief duration of analgesia provided by single shot peripheral nerve block is a significant disadvantage because severe pain usually lasts 2–3 days after TKA, a continuous ACB via catheter appears to be a suitable option. Perineural catheters, on the other hand, can be difficult to insert, are prone to early dislodgement, and can raise the risk of infection. After continuous ACB, certain cases of local anaesthetic-induced myotoxicity have been reported. [4] Levobupivacaine is a new long-acting amide-type local anaesthetic that is less toxic to the heart and nervous system.[5] Dexamethasone not only extends the duration of local anaesthetics through its vasoconstrictive and anti-inflammatory effects but also enhances nerve block by inhibiting neural transmission in nociceptive C-fibers.[6] Our study was designed to look at the benefits of dexamethasone used as an adjuvant to levobupivacaine for extending the duration of postoperative analgesia produced by adductor canal block in TKA patients. Primary outcome was the assessment of duration of analgesia detected by the

first analgesia request and total analgesic consumption. Secondary out comes included the VAS pain scores, maximal ranges of flexion and extension and a 100-foot walking test and any side effects.

Methods

This prospective, randomized, double-blind trial was conducted in a tertiary care hospital after obtaining Institutional ethics committee approval and informed consent from all participants. 60 patients (aged 18–70 years, American Society of Anaesthesiologists grade I–II) undergoing unilateral TKA under subarachnoid block were included. Patients were randomized into two groups by using a sealed envelope method. Investigators and patients were blinded to group assignment.

Exclusion criteria included allergies to levobupivacaine, coagulopathy or infection at the injection site, psychiatric illness or cognitive dysfunction, neuromuscular deficits, severe cardiac, pulmonary, or renal disease and body mass index >35 kg/m^2.All patients received subarachnoid block with 3 ml of 0.5% heavy bupivacaine and 25 mcg of fentanyl at the L3-L4 interspace in the sitting position.

Following surgery, each patient received ultrasound-guided ACB. Patients were positioned supine with their thighs slightly abducted and externally rotated. Under sterile conditions, a high-frequency linear transducer was used to identify the femoral artery within the adductor canal (defined by the sartorius muscle superiorly, adductor longus posteromedially, and vastus medialis anterolaterally.

A 22-gauge Stimuplex Ultra 360 needle (B. Braun Medical AG, Melsungen, Germany) was then advanced until its tip was lateral to the femoral artery, at which point the local anaesthetic mixture was injected.[7] Group L received 20 mL of 0.25% levobupivacaine and Group LD received 20 mL of 0.25% levobupivacaine plus dexamethasone 8 mg for ACB. All ACBs were performed by a single investigator. Paracetamol was given as rescue analgesia when VAS >4.VAS pain score [8] was assessed immediately after the ACB and then 2-hourly for the next 8 hours, then at 12 h, 24 h till 48 h at rest and the score was recorded on movement at 24 h and 48 h. Time to first rescue dose and total paracetamol consumption in 24 hours were recorded. Maximal ranges of flexion and extension were also assessed and recorded by a blinded physiotherapist preoperatively, 1 day and 1 month postoperatively. In addition, a 100-foot walking test data throughout the preoperative time, at 24 and 48 hours after the surgery was recorded. Sample size was calculated based on the results of a pilot study. According to a power analysis, a sample size of 27 patients in each group would have 95% power at the 0.05 level of significance to detect a difference of 0.8 effect size between the two groups in the time to the first request for rescue analgesics. 30 patients were included in each group to adjust for any dropout.

The distribution of baseline variables was calculated using the Shapiro–Wilk test. Continuous variables were described using mean (SD) and evaluated using Student's t-test and one-way test of variance (ANOVA) with many comparisons. The median (range) was utilized to show nonparametric data, and the Mann–Whitney U-test was employed to compare the two groups. Categorical data was reported using numbers and percentages, which were analysed via chi- square test or Fisher's exact test. Statistical significance was defined as a P value <0.05.

Results

A total of 60 patients posted for TKA were included in the study. The demographic profile and duration of surgery were comparable in both the groups. (Table1)The mean time to first analgesic request 12.9± 1.7 hours in group LD and 6.73± 0.9 hours in group L.($P < 0.05$) The total dose of paracetamol consumed in 24 hours was 1.9± 0.5 gm in group LD and 3.8± 0.9gm in group L.($P < 0.05$) (Table 2)

Table 1: Descriptive variables of groups.

Variables	Group LD(n=30) (Mean±SD)	Group L(n=30) (Mean±SD)	P value
Age(years)	54.93±11.25	55.18±11.34	0.231
Male: Female(n)	25:5	26:4	0.228
ASA I/II (n)	19/11	18/12	0.241
Surgical time (mins)	84.15±21.24	82.32±19.34	0.209
BMI (kg/m^2)	23.9±2.15	22.6±2.13	0.229

Table 2: Total analgesic consumption in 24 hrs and time to first analgesia request

Parameters	Group LD (n=30) (Mean±SD)	Group L(n=30) (Mean±SD)	P value
Total analgesic consumption (Paracetamol in gm)	1.9± 0.5	3.8± 0.9	0.018
Time to 1st rescue analgesia request (hrs)	12.9± 1.7	6.73± 0.9	0.017

Table 3: Post-operative VAS scores

Times of Measurement	Group LD (n=30) (Mean±SD)	Group L(n=30) (Mean±SD)	P value
0 h	1.48±1.4	1.16±1.45	0.261
2nd h	1.99±1.2	1.18±1.44	0.251
4th h	1.83±1.1	1.29±1.37	0.284
6th h	1.99±1.67	3.85±1.99	0.028
8th h	2.6±1.7	4.05±1.31	0.021
12th h	2.7±1.8	4.26±1.48	0.026
24th h	2.9±1.4	3.33±1.38	0.022
48h	2.95±1.4	3.88±1.72	0.316
VAS 24 Hr after mobilisation	2.97±1.1	4.15±1.75	0.024
VAS 48 Hr after mobilisation	2.69±1.14	3.11±1.15	0.282

The VAS scores in the LD group were lower compared to L group in the first 4 hours but it was not statistically significant. (Table 3) At 6 th, 8th, and 12th hours difference in VAS scores between the two groups was statistically significant. ($P < 0.05$)

At 24 hours following surgery, the difference in VAS scores (after mobilization) between the two groups was statistically significant. L group had poorer range of extension and flexion than the LD group on the first day and first month after surgery.(Table 3).

In contrast to the preoperative measurements, the time for performing the 100-foot walk test in the L group was significantly longer than in the LD group which was statistically significant.

Table 4: Range of movement (ROM) and 100-foot walking tests

Time taken to 100 feet (sec).	Group L (n=30) (Mean±SD)	Group LD (n=30) (Mean±SD)	P- Value
Pre op	95±9.7	96.2±7.86	0.114
1st day	231.8±17.5	183.4±17.8	0.031
2nd day	128.5±16.7	105.5±14.2	0.012
ROM in flex			
Pre op	112.3±8.3	111.3±5.12	0.217
1st day	61.1±8.2	70.2±2.8	0.018
1st mon	116.2±5.3	121.6±5.6	0.121
ROM in Ext			
Pre op	4.6±2.2	4.5±2.1	0.159
1st day	8.7±2.5	9.9±1.7	0.219
1st mon	1.7±1.4	1.9±1.5	0.173

Discussion

The aim of the present study was to determine whether addition of dexamethasone to levobupivacaine is able to improve the efficacy of ACB in patients undergoing TKA. The results revealed that addition of 8 mg dexamethasone to 0.25% levobupivacaine during ACB improved the duration and the quality of post-operative analgesia in patients undergoing TKA.

The use of dexamethasone reduced the consumption of paracetamol during the post-operative period. Increasing the duration of action of local anaesthetics used in nerve blockade is often desirable, as it improves the quality of surgical anaesthesia and prolongs post-operative analgesia.

Various additives have been used to prolong regional blockade.[9] Dexamethasone has been extensively studied as an adjunct to local anaesthetic in peripheral nerve blockade.[10] The use of dexamethasone at doses of 4–12 mg via intravenous and perineural routes has been described in regional anaesthesia, but few studies have examined the use of perineural dexamethasone for ACB.[11] In the present study, the magnitude of the effect of dexamethasone was substantial.

It prolonged the duration of sensory block in patients undergoing TKA. However, the safety of perineural adjuvants has been the subject of recent debate, with questions being raised regarding potential neurotoxicity of the adjuvant drug.[12]

Corticosteroid-mediated neurotoxicity appears to be associated with the vehicle polyethylene glycol and the preservative benzyl alcohol, as well as insoluble steroid particulate matter in the injectate.[13]

In vitro and in vivo pre-clinical studies have demonstrated that locally applied corticosteroids have no long-term effect on the structure, electrical properties or function of peripheral nerves. In one study that used a rat sciatic nerve experimental model, extra fascicular injection of dexamethasone

caused no damage to the nerve and intrafascicular injection caused only minimal damage (as compared to the damage caused by other steroids, hydrocortisone and triamcinolone).[14]

Sreckovic S et al [15] in their study found that adding dexamethasone to the local anaesthetic for ACB and IPACK blocks, along with a non-opioid scheduling strategy, enhances postoperative pain management, reduces opioid consumption, and helps decrease the occurrence of rebound pain and chronic postsurgical pain 1 year after TKA.

Thus, the use of dexamethasone as an adjuvant to local anaesthetics for peripheral nerve block appears safe.

In the present study, patients who received dexamethasone had significantly effective sensory block which is consistent with the known pharmacodynamics of dexamethasone.

Paracetamol requirement in the first 24 h after surgery was significantly reduced in patients who received dexamethasone. This reduction may have been due to the efficacy of dexamethasone in suppressing inflammation and early post-operative pain.

Conclusion

We conclude that the addition of dexamethasone to levobupivacaine for ACB is able to increase the duration of analgesia and decrease early post-operative pain following TKA.

References

1. Lavand'homme PM, Kehlet H, Rawal N, Joshi GP; PROSPECT Working Group of the European Society of Regional Anaesthesia and Pain Therapy (ESRA). Pain management after total knee arthroplasty: PROcedure SPEcific Postoperative Pain Management recommendations. Eur J Anaesthesiol 2022;39:743-57.
2. Hussain N, Brull R, Zhou S, Schroell R, McCartney C, Sawyer T, et al. Analgesic benefits of single-shot versus continuous adductor canal block for total knee arthroplasty: A systemic review and meta-analysis of randomized trials. Reg Anesth Pain Med 2023;48:49-60.
3. Cuvillon P, Ripart J, Lalourcey L, Veyrat E, L'Hermite J, Boisson C, et al. The continuous femoral nerve block catheter for postoperative analgesia: Bacterial colonization, infectious rate and adverse effects. Anesth Analg 2001;93:1045-9.
4. Krishna Prasad GV, Khanna S, Jaishree SV. Review of adjuvants to local anesthetics in peripheral nerve blocks: Current and future trends. Saudi J Anaesth 2020;14:77-84.
5. Song ZG, Pang SY, Wang GY, Zhang Z. Comparison of postoperative analgesic effects in response to either dexamethasone or dexmedetomidine as local anesthetic adjuvants: A systematic review and meta-analysis of randomized controlled trials. J Anesth 2021;35:270-87.
6. Zeng Y, Wang Q, Hu J, Yang J. Adding dexamethasone to adductor canal block combined with iPACK block improve postoperative analgesia of total knee arthroplasty. Clin J Pain 2022;38:575-81.
7. Goyal R, Mittal G, Yadav AK, Sethi R, Chattopadhyay A. Adductor canal block for post-operative analgesia after simultaneous bilateral total knee replacement: A randomised controlled trial to study the effect of addition of dexmedetomidine to ropivacaine. Indian J Anaesth 2017;61:903-9.
8. Aliste J, Layera S, Bravo D, et al. Randomized comparison between perineural dexamethasone and combined perineural dexamethasone-dexmedetomidine for ultrasound-guided infraclavicular block. Reg Anesth Pain Med 2022;47:554-9.
9. Zhang P, Liu S, Zhu J, Rao Z, Liu C. Dexamethasone and dexmedetomidine as adjuvants to local anesthetic mixture in intercostal nerve block for thoracoscopic pneumonectomy: A prospective randomized study. Reg Anesth Pain Med 2019;44:917–22.
10. Pehora C, Pearson AM, Kaushal A, Crawford MW, Johnston B. Dexamethasone as an adjuvant to peripheral nerve block. Cochrane Database Syst Rev 2017;11:CD011770.
11. Morales-Muñoz C, Sánchez-Ramos JL, Díaz-Lara MD, González-González J, Gallego-Alonso I, Hernández-Del-Castillo MS. Analgesic effect of a single-dose of perineural dexamethasone on ultrasound-guided femoral nerve block after total knee replacement. Rev Esp Anestesiol Reanim. 2017;64:19–26.
12. Movafegh A, Razazian M, Hajimaohamadi F, Meysamie A. Dexamethasone added to lidocaine prolongs axillary brachial plexus blockade. Anesth Analg. 2006;102:263–267.
13. YaDeau JT, Paroli L, Fields KG, Kahn RL, LaSala VR, Jules-Elysee KM, Kim DH, Haskins SC, Hedden J, Goon A, et al. Addition of dexamethasone and buprenorphine to bupivacaine sciatic nerve block: A randomized controlled trial. Reg Anesth Pain Med. 2015;40:321–329.
14. Albrecht E, Kern C, Kirkham KR. A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. Anaesthesia. 2015;70(1):71-83.
15. Sreckovic S, Milovanovic D, Vukman P, Djukanovic M, Simic M, Vesic J, Milenkovic M, Aleksic M, Ladjevic N. The effect of adding

dexamethasone to adductor block and IPACK block on acute postoperative, rebound, and chronic pain following knee arthroplasty-1-year follow-up. Front Med (Lausanne). 2025 Apr 29;12:1570795.