



ISSN (P): 2521-3466  
ISSN (E): 2521-3474  
© Clinical Orthopaedics  
www.orthoresearchjournal.com  
2019; 3(2): 47-50  
Received: 26-02-2019  
Accepted: 28-03-2019

**Dr. Umesha Chowdaiah**  
D. Ortho, DNB Orthopaedics,  
Resident, Department of  
Orthopaedics, Mandya Institute  
of Medical Sciences, Mandya,  
Karnataka, India

**Dr. Pavan Kumar H Patil**  
MBBS, D. Ortho, DNB Ortho  
Assistant Professor, Vydehi  
Institute of Medical Science and  
Research Center, Bangalore,  
Karnataka, India

**Dr. Shashidhar Matam**  
MBBS, DA, IDRA, FICM FCCS  
Consultant Anesthesiologist,  
Department of Anesthesiology,  
Yahsoda Multispeciality  
Hospital, Malakpet, Hyderabad,  
Telangana, India

**Dr. Sudarshan Reddy Jitta**  
MBBS MD, Consultant  
Anesthesiologist, Department of  
Anesthesiology, Yahsoda  
Multispeciality Hospital,  
Malakpet, Hyderabad,  
Telangana, India

**Correspondence**

**Dr. Pavan Kumar H Patil**  
Assistant Professor, Vydehi  
Institute of Medical Science and  
Research Center, Bangalore,  
Karnataka, India

## A prospective comparative study between the effect of adductor canal block and femoral nerve block on early pain management among post-operative unilateral total knee arthroplasty patients

**Dr. Umesha Chowdaiah, Dr. Pavan Kumar H Patil, Dr. Shashidhar Matam and Dr. Sudarshan Reddy Jitta**

DOI: <https://doi.org/10.33545/orthor.2019.v3.i2a.10>

### Abstract

Analgesia after TKA can be achieved by integrated multimodal analgesic protocols using two or more analgesic modalities that work by different mechanisms that will optimize the analgesia and minimize the potential risks and side effects. The study was a prospective, randomized Trial. It was approved by the Ethics Committee. All the patients who were diagnosed clinically and radiologically as severe osteoarthritis of the knee planning for unilateral TKR were selected for the study. Written informed consent was obtained from all patients. When patients during the postoperative period were asked to perform the TUG and 10-min walk tests, all patients in the ACB group were able to perform it on POD1 and POD2, whereas in the FNB group, four patients were not able to complete the walk test (fall risk) on POD1 but all of the patients performed the test on POD2. Furthermore, patients in the ACB group performed both tests significantly faster than the FNB patients on POD1.

**Keywords:** Adductor canal block, femoral nerve block, unilateral total knee arthroplasty

### Introduction

Total-knee arthroplasty (TKA), one of the most common orthopedic surgeries, which is performed in patients with severe degenerative osteoarthritis. However, over 60% of patients have suffered severe pain after TKA, which has affected the quality of sleep, appetite, and functional exercise [1-4]. Immediate postoperative pain is top on the list of concerns for TKA candidates, which often results in a delay or cancellation of the surgical intervention. Therefore, Good post-operative analgesia after TKR facilitates early mobilization less post-operative complications, reduction of length of hospital stay, prevents progression of acute pain to chronic pain and provides a hemodynamic stability [5].

Analgesia after TKA can be achieved by integrated multimodal analgesic protocols using two or more analgesic modalities that work by different mechanisms that will optimize the analgesia and minimize the potential risks and side effects [6]. In addition to the preemptive analgesia such as NSAIDs, analgesia after knee surgery can be provided by multiple non-systemic methods such as local anesthetic infiltration and peripheral nerve block, which is commonly used to relieve post-operative pain and decrease opioid requirement and its adverse effects.

Femoral nerve block (FNB) is commonly used in TKA to control postoperative pain. However, as the FNB is invariably associated with reduced quadriceps muscle strength [7], increased risk for fall is estimated to be 2% [8, 9]. Consequently, with the FNB, the goal of pain relief will compromise the goal of preserving the muscle strength. The ideal nerve block for TKA should provide effective analgesia while preserving the muscle power to expedite the recovery.

The introduction of USG and its use in different nerve blocks was the key of inventing the adductor canal block (ACB), which is relatively new block with high success rate [10]. In contrast to FNB, ACB is predominantly a sensory block that preserves the quadriceps muscle

strength with the favorable earlier mobilization than the FNB [11]. ACB blocks the main sensory contributions from the femoral nerve to the knee, namely the saphenous nerve and the nerve to vastus medialis while they pass through the adductor canal [12]. Because of the small size and the absence of motor component, the conventional nerve localization techniques such as nerve stimulation have inconsistent success [10].

### Methodology

The study was a prospective, randomized Trial. It was approved by the Ethics Committee. All the patients who were diagnosed clinically and radiologically as severe osteoarthritis of the knee planning for unilateral TKR were selected for the study. Written informed consent was obtained from all patients. The inclusion criterion includes primary unilateral TKA for osteoarthritis who belongs to 60 – 80 years, a BMI of 18–35, and ability to follow the study protocol.

Exclusion criteria included contraindication for neuroaxial anesthesia or nerve block (bleeding diathesis, pre-existing lower extremity neuromuscular disorder, local infection, or sepsis), allergy or contraindication to the drugs used in the study (local anesthetic, NSAIDs, opioids), epilepsy, mental illness, dementia, preexisting neuropathy on the operative limb, chronic opioid use (defined as daily use of narcotic analgesic equivalent to oral morphine 60 mg for >1 month), alcohol or drug abuse, renal impairment, or obstructive sleep apnea, history of abnormal liver enzymes, hepatic failure, renal insufficiency, uncontrolled hypertension, congestive heart failure, previous heart or coronary bypass surgery, history of stroke or major neurological deficit, sensory and motor disorders in the operated limb, gastritis or gastrointestinal bleeding, organ transplantation, chronic pain requiring opioid medications, neuropathic pain, failure in preoperative Timed-Up and Go (TUG) test, and subject refusal.

Demographic characteristics, preoperative VAS, functional performance-based evaluation including TUG test and quadriceps muscle strength, were recorded by a research assistant. TUG test measures the time to rise from an armchair (seat height, 50 cm), walk 10 metres, turn, and return to sitting in the same chair. Quadriceps muscle strength of each subject was evaluated by a digital dynamometer.

### Standardized anesthesia and analgesia

All patients received a standardized anesthesia and analgesia upon hospitalization. Preoperative oral paracetamol (650mg, twice a day) was administered day before surgery. On the day of the surgery, all patients were randomly assigned to the ACB and FNB groups (1:1 allocation, parallel trial design) 30minutes before the surgery using sequentially numbered, opaque-sealed envelopes, based on a computer-generated randomization list created by an independent researcher (anesthetist). The patient and research assistant were blinded to the group assignment, but the anaesthesiologist performing the block was aware of the treatment. In the ACB group, ultrasound-guided ACB (20 mL of 0.5% of ropivacaine with 5mg/mL epinephrine, via a 22 gauge 2-inch needle;) was performed at the mid-thigh level using a high-frequency linear ultrasound transducer (10–12Hz;). Block success was verified by testing for pinprick sensation in the saphenous nerve distribution. Ultrasound guided FNB (30mL of 0.33% of ropivacaine with 5mg/mL epinephrine, via a 22-gauge 2-inch needle) with nerve stimulator confirmation was performed below the inguinal ligament, block success was verified by testing for pinprick sensation in the femoral nerve distribution.

All surgeries were performed under spinal anaesthesia with paramedian approach using a 27-gauge spinal needle at the L3/L4 or L2/L3 intervertebral space with the patient in the sitting position. Spinal anaesthesia using 0.5% hyperbaric bupivacaine 3 ml was used in all patients. If the spread of the sensory block was insufficient, the patient was excluded from the study, and general anaesthesia was later administered. All patients received intravenous dexamethasone 10 mg and Ondansetron 4 mg for postoperative nausea and vomiting prophylaxis. The decision of whether to provide intravenous fluid during operation or to sedate using propofol was made at the discretion of the anaesthesiologist. The minimally invasive mini-midvastus approach was applied in all knees, with the use of tourniquet.

After operation, we used acetaminophen (500mg, twice a day) and to control the postoperative pain. Moreover, we administered pethidine hydrochloride (50mg) to the patients who experienced persistently severe postoperative pain or when their visual analog scale (VAS) at rest was over 5. After a 4-hour postoperative care in the anesthesia recovery unit, all patients returned to the in-patient unit. It was on the day of the surgery that all patients began walking after the assessment of the physiotherapist. From the day of the surgery until the day of discharge, each patient underwent physical therapy supervised by a physiotherapist 2 times per day.

### Outcome measurements

Postoperative pain at rest was measured using VAS at 6, 12 and 18 hours after surgery. VAS during knee flexion and extension were measured in the morning and evening on postoperative day (POD) 1. VAS during stand-up and walking was measured on POD 2, 3. The results were recorded by research assistants who were blinded from group randomization. pethidine consumption via PCA device was recorded at the first-time requirement and 12, 24 and 48 hours, postoperatively.

Quadriceps strength and TUG test on POD 2, 3 were recorded by a physiotherapist who was blinded to studied group. The incidence of nausea and vomiting (1= none, 2= queasy, 3= severe nausea, 4= vomiting), pruritus (1= none, 2= mild, 3=moderate, treatment requested, 4= severe, treatment requested), patient satisfaction (0-10), length of hospital stay, adverse events including local anesthetic toxicity and incidence of fall were recorded.

Home discharge criteria included (1) no pain on functional activities of daily living, (2) ability to get in and out of bed and a chair with minimal assistance, (3) walk along a hallway independently or with standard walker, crutches or cane, (4) ability to go up and down stairs safely. If a higher level of ongoing support was required, the patient was retained for further rehabilitation facilities.

The primary outcome was the total pethidine consumption during postoperative 24 hours. Secondary outcomes included postoperative pain score, time to first and total dosage of rescue pethidine in postoperative 48 hours, early and late postoperative period (from POD 0 to 3 months follow-up) performance-based test (TUG test, and quadriceps strength). Postoperative nausea and vomiting, length of hospital stay, patient satisfaction and other adverse events were also evaluated.

### Results

A total of 200 patients were initially screened for inclusion criteria. In all, 152 patients met the inclusion criteria. A total of 108 patients were recruited and consented to participate in the study. Two patients were excluded from the study due to

difficult spinal with necessity of general anesthesia. All of these two patients were excluded from the study before knowledge of which of the study groups they belonged to. The 108 patients were randomized to receive either FNB (n = 52) or ACB (n =

54). All patients completed the study and were included in the data analysis. Both groups were similar with respect to the patient demographic characteristics and perioperative data (Table 1).

**Table 1:** Demographic characteristics and perioperative data

Variables	FNB group (no = 52)	ACB group (no= 54)	P value
Age (years)	60+/-12	65+/-15	
Sex (male/female)	25/27	23/31	
Height (cm)	160.3+/-9.4	162.2+/-8	
Weight (kg)	85.2+/-7.8	86.4+/- 7.2	
BMI (kg/m2)			
Tourniquet time (min)	87.2+/-15	86.8+/- 14	
TUG test (s)	4.1+/-0.5	4.0+/-0.3	
10-m walk test (s)	4.8+/-0.3	4.6+/-0.2	

When patients during the postoperative period were asked to perform the TUG and 10-min walk tests, all patients in the ACB group were able to perform it on POD1 and POD2, whereas in the FNB group, four patients were not able to complete the walk test (fall risk) on POD1 but all of the patients performed the test

on POD2. Furthermore, patients in the ACB group performed both tests significantly faster than the FNB patients on POD1, but the difference was non-significant on POD2 as illustrated in Table 2.

**Table 2:** Outcome of Tests

Tests	POD 1		P Value	POD 2		P Value
	FNB (No-52)	ABC (No-54)		FNB (No-52)	ABC (No-54)	
TUG test	11.2+/-4.3	5.6 +/- 0.8		4.9 +/- 0.6	4.4 +/- 0.5	
10m WALK test	11.8+/- 5.5	5.8 +/- 0.9		4.7 +/- 0.7	4.5 +/- 0.3	

the difference between both study groups with respect to the Visual analogue scale and the opioid consumption was statistically nonsignificant, suggesting that the ACB was not inferior to FNB with respect to the postoperative analgesia.

**Discussion**

Effective analgesic modalities are essential in TKA to facilitate early rehabilitation and postoperative recovery [13]. The ideal analgesic regimen after TKA should offer adequate analgesia with little or no effect on motor power to allow for safe early ambulation [14]. The local anesthetic that can selectively anesthetize sensory nerves while sparing motor nerves does not exist [15].

Our results suggest that the use of the ACB was associated with improvement regarding early postoperative ambulation in patients with TKA surgery compared with patients who received FNB and this difference was significant on POD1 but non-significant on POD2. This was indicated by the difference in the TUG test and 10-min walk test between both groups. This finding was supported by other previous studies [14, 16-18]. However, Jaeger *et al.* [17] and Mudumbai *et al.* [18] studied the continuous catheter infusion technique, whereas we studied single-shot technique, and they collected data for 24 h postoperatively, whereas our data were for 48 h postoperatively. Worth to mention that Kim *et al.* [16] used dynamometer to measure the quadriceps strength and their anesthetic technique was combined spinal epidural neuroaxial block with postoperative epidural patient-controlled analgesia with continuous background epidural infusion.

In addition, a study performed on healthy volunteers showed that ACB preserved quadriceps strength and ability to ambulate better than what FNB did [9]. In addition to the positive effect of early ambulation on the surgical outcome of TKA, it helps to decrease the incidence of deep venous thrombosis of the legs [19] and enhance muscle strength and gait control [20]. Furthermore, there have been concerns raised regarding a potential risk for

patient falling with FNB [5, 21]; we observed two patients who were not able to complete the walk test and considered at risk for falling.

Direct comparison between the pain scores and total opioid use did not demonstrate significant difference between both study groups on POD1 and POD2, which indicates that ACB is an effective analgesic modality when compared with FNB after TKA surgery. Other secondary outcomes such as nausea, vomiting, pruritus, LOS, and complications showed no significant difference between both groups, which may be attributed to the similar analgesic effects and narcotic use in both the study groups. Previous studies [2, 16, 18, 22] demonstrated the analgesic efficacy.

**Conclusion**

The introduction of ACB in patients undergoing TKA surgery perioperatively, as part of multimodal analgesic approach, is associated with good analgesic effect with earlier postoperative ambulation when compared with patients receiving FNB within the same clinical analgesic approach.

**References**

1. Parvizi J, Miller AG, Gandhi K. Multimodal pain management after total joint arthroplasty. *J Bone Joint Surg Am.* 2011; 93:1075-84.
2. Vendittoli PA, Makinen P, Drolet P *et al.* A multimodal analgesia protocol for total knee arthroplasty - a randomized, controlled study. *J Bone Joint Surg Am* 2006; 88:282-9.
3. Abdul-Hadi O, Parvizi J, Austin MS *et al.* Nonsteroidal anti-inflammatory drugs in orthopaedics. *J Bone Joint Surg Am.* 2009; 91:2020-7.
4. Husted H, Lunn TH, Troelsen A *et al.* Why still in hospital after FastTrack hip and knee arthroplasty? *Acta Orthop.* 2011; 82:679-84.
5. Chaubey D, Mahajan HK, Chauhan PR, Govind PS, Singh

- P *et al.* Comparison of Continuous Femoral Nerve Block versus Local Infiltration Analgesia as a Postoperative Analgesia in Unilateral Total Knee Arthroplasty. *J Clin Diagn Res.* 2017; 11:13-16.
6. American Society of Anesthesiologists Task Force on Acute Pain Management. Practice guidelines for acute pain management in the perioperative setting: an updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology* 2012; 116:248–273.
  7. Charous MT, Madison SJ, Suresh PJ, Sandhu NS, Loland VJ, Mariano ER *et al.* Continuous femoral nerve blocks: varying local anesthetic delivery method (bolus versus basal) to minimize quadriceps motor block while maintaining sensory block. *Anesthesiology.* 2011; 115:774–781.
  8. Ilfeld BM, Duke KB, Donohue MC. The association between lower extremity continuous peripheral nerve blocks and patient falls after knee and hip arthroplasty. *Anesth Analg.* 2010; 111:1552–1554.
  9. Kandasami M, Kinninmonth AW, Sarungi M, Baines J, Scott NB. Femoral nerve block for total knee replacement – a word of caution. *Knee.* 2009; 16:98–100.
  10. Manickam B, Perlas A, Duggan E, Brull R, Chan VW, Ramlogan R. Feasibility and efficacy of ultrasound-guided block of the saphenous nerve in the adductor canal. *Reg Anesth Pain Med* 2009; 34:578–580.
  11. Jaeger P, Nielsen ZJ, Henningsen MH, Hilsted KL, Mathiesen O, Dahl JB. Adductor canal block versus femoral nerve block and quadriceps strength: a randomized, double-blind, placebo-controlled, crossover study in healthy volunteers. *Anesthesiology.* 2013; 118:409–415.
  12. Lund J, Jenstrup MT, Jaeger P, Sørensen AM, Dahl JB. Continuous adductor-canal-blockade for adjuvant postoperative analgesia after major knee surgery: preliminary results. *Acta Anaesthesiol Scand,* 2011; 55:14–19.
  13. Wang H, Boctor B, Verner J. The effect of single-injection femoral nerve block on rehabilitation and length of hospital stay after total knee replacement. *Reg Anesth Pain Med* 2002; 27:139–144.
  14. Perlas A, Kirkham KR, Billing R, Tse C, Brull R, Gandhi R, *et al.* The impact of analgesic modality on early ambulation following total knee arthroplasty. *Reg Anesth Pain Med.* 2013; 38:334–339.
  15. Ilfeld BM, Yaksh TL. The end of postoperative pain — a fast-approaching possibility? And, if so, will we be ready? *Reg Anesth Pain Med.* 2009; 34:85–87.
  16. Kim DH, Lin Y, Goytizolo EA, Kahn RL, Maalouf DB, Manohar A *et al.* Adductor canal block versus femoral nerve block for total knee arthroplasty: a prospective, randomized, controlled trial. *Anesthesiology.* 2014; 120:540–550.
  17. Jæger P, Zaric D, Fomsgaard JS, Hilsted KL, Bjerregaard J, Gyrn J *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; 38:526–532.
  18. Mudumbai SC, Kim TE, Howard SK, Workman JJ, Giori N, Woolson S *et al.* Continuous adductor canal blocks are superior to continuous femoral nerve blocks in promoting early ambulation after TKA. *Clin Orthop Relat Res.* 2014; 472:1377–1383.
  19. Pearse EO, Caldwell BF, Lockwood RJ, Hollard J. Early mobilisation after conventional knee replacement may reduce the risk of postoperative venous thromboembolism. *J Bone Joint Surg Br.* 2007; 89:316–322.
  20. Labraca NS, Castro-Sánchez AM, Matarán-Peñarocha GA, Arroyo-Morales M, Sánchez-Joya Mdel M, Moreno-Lorenzo C. Benefits of starting rehabilitation within 24 hours of primary total knee arthroplasty: randomized clinical trial. *Clin Rehabil* 2011; 25:557–566.
  21. Feibel RJ, Dervin GF, Kim PR, Beaulé PE. Major complications associated with femoral nerve catheters for knee arthroplasty: a word of caution. *J Arthroplasty.* 2009; 24:132–137.
  22. Jaeger P, Grevstad U, Henningsen MH, Gottschau B, Mathiesen O, Dahl JB. Effect of adductor-canal-blockade on established, severe postoperative pain after total knee arthroplasty: a randomised study. *Acta Anaesthesiol Scand* 2012; 56:1013–1019.
  23. Comparison between effects of adductor canal block and femoral nerve block on early postoperative course in total knee arthroplasty: prospective double-blind, randomized controlled study Nasr A. Hegazy, Sherif S. Sultan. *Ain-Shams Journal of Anesthesiology.* 2015; 08:124-128.