

# Comparison of Adductor Canal Block versus Femoral Nerve Block for Ambulatory Distance on Postoperative Day-1 Following Unilateral TKR Surgery- An RCT Study

Ruqaiya Bano<sup>1</sup>, Mudit Varshney<sup>2</sup>, Deepika Kesarwani<sup>3</sup>, Anil Kumar Sharma<sup>4</sup>

<sup>1</sup>Senior Resident, Department of Anaesthesia and Critical Care, VMMC & Safdarjung Hospital, New Delhi

<sup>2,3</sup>Senior Resident, Department of Anaesthesia, VMMC & Safdarjung Hospital, New Delhi

<sup>4</sup>Head of Department, Department of Anaesthesia, Northern Railway Central Hospital, New Delhi

Corresponding Author: Ruqaiya Bano

## ABSTRACT

**Background:** Total knee replacement (TKR) is associated with intense post-operative pain. Providing both optimal analgesia and early mobilization are vital for the patient. We hypothesized the adductor-canal-block, being a pure sensory block, provides a longer ambulation distance by patient when compared with femoral nerve block as the latter causes both sensory and motor block.

**Method:** Patients aged 30-80 years scheduled for TKR were included in this randomized controlled trial. The patients were divided into two groups, one received a continuous adductor-canal-block (n=25) and other group received continuous femoral nerve block(n=25) via a catheter with continuous infusion of 0.2% Ropivacaine at the rate of 5-10 ml/hour. During the next 24 hours VAS and MMT score were calculated at different intervals. 10 metre ambulation distance covered by patients was measured after 24hr of surgery.

**Result:** 50 patients were analysed using student t test. The Visual Analogue Scale and Manual Muscle Testing score were noted during 24-hour period post-op. There was a significant difference among the VAS scores in the two groups at 2 hours post-op period only. The MMT was significantly different at 2 instances – 6 and 12-hours post-op. The ambulation distance post-24-hours surgery showed no significant difference between the two groups.

**Conclusion:** Based on our study it can be concluded that either ACB or FNB can be administered to the patients as both blocks are

almost equally effective in terms of ambulation distance after 24 hrs of surgery and pain relief in post-operative period.

**Keywords:** Total knee replacement, Adductor canal block, Femoral nerve block, Ambulation distance, VAS and MMT.

## INTRODUCTION

Total knee arthroplasty is one of the common surgeries performed to alleviate pain and discomfort in patients suffering from knee problems. The surgery causes moderate to severe pain in post-operative period<sup>[1]</sup> that requires various interventional methods of analgesia.

Post-operative pain is a significant cause of joint motion limitation and prolongation of hospital stay. Therefore, adequate pain relief is essential for a successful outcome and patient satisfaction.

Postoperative pain control can be achieved by various methods, i.e. patient education (counseling and reassurance), analgesics, neuraxial analgesia (epidural analgesia)<sup>[2]</sup>, periarticular injection<sup>[3]</sup>, peripheral nerve blocks (femoral nerve block<sup>[4]</sup>, adductor canal block<sup>[5,6]</sup> and selective tibial nerve block<sup>[7]</sup>), physiotherapy, etc.

Among various modalities of post-operative pain control, femoral nerve block and adductor canal block have become

popular with the increased use of ultrasound in anaesthesia practice [5,8].

The femoral nerve has both motor and sensory components. The motor component supplies anterior thigh muscles and extensors of knee. Sensory component gives cutaneous branches to the anteromedial thigh and medial side of the leg and foot (saphenous nerve).

Following knee surgery, continuous femoral block is an effective method of pain relief [9].

The adductor canal is an aponeurotic neurovascular tunnel in mid-thigh region and is bordered anteriorly by sartorius muscle, laterally by vastus medialis and posteromedially by adductor longus and magnus muscle [8].

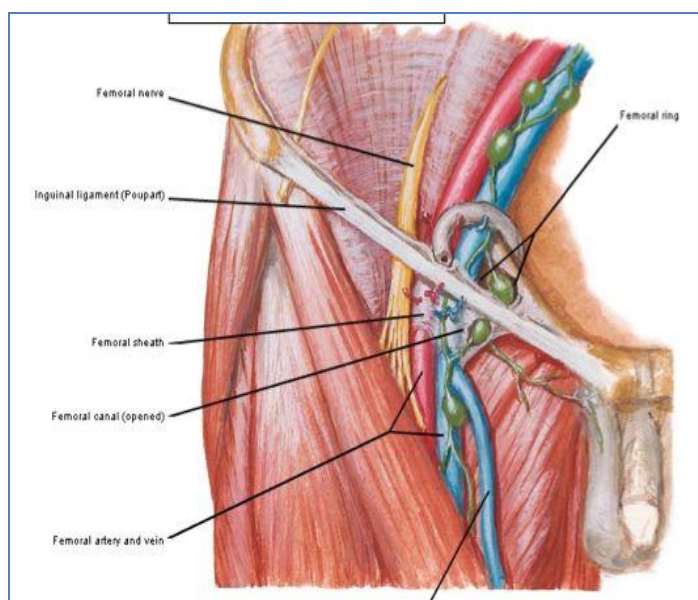
The adductor canal blocks mainly blocks the saphenous nerve which is a branch of femoral nerve and arise in femoral triangle. It lies lateral to femoral vessels and enters the adductor canal. The nerve continues its descent on medial side of knee and at lower end of adductor canal, it leaves the femoral vessels and gives off

infrapatellar branch that supply skin over anteromedial side of knee and patellar ligament.

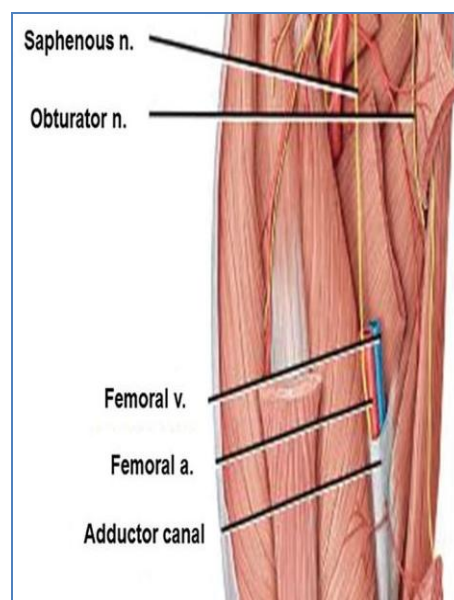
Saphenous nerve is a sensory nerve and hence provides analgesia without loss of motor control of thigh. Apart from pain control, benefits of this technique may include shorter hospital stay, earlier and more efficient rehabilitation.

Adductor canal blocks are effective in providing analgesia after knee surgery and can spare function of the quadriceps muscles and helps in early ambulation [10].

Hence this study was undertaken presuming that both techniques provide an effective post-operative pain relief, we hypothesized that adductor canal block {mainly blocking the saphenous nerve (sensory)} administered distally may have advantage as compared to femoral nerve block {motor and sensory} which is given proximally regarding preservation of motor power and thereby helping in early mobilization of patients following total knee replacement surgery.



Femoral Nerve Anatomy



Adductor Canal Anatomy

## AIMS AND OBJECTIVES

Comparison of Adductor canal block versus femoral nerve block for ambulatory distance on postoperative day-1 following

unilateral TKR surgery- A RCT study with regards to following parameters:

### **Primary objective:**

10 metres ambulation distance on post-operative day 1 (POD-1).

### **Secondary objective:**

1. Pain scores during post-operative period.
2. Rescue analgesics requirements in post op period.
3. Any post op complications like nausea, vomiting, hypotension, pruritus etc.

### **MATERIAL AND METHODS**

After obtaining clearance from Institutional ethical committee, a well-informed written consent was taken from all patients preoperatively who participated.

**STUDY POPULATION:** Patient belonging to either sex, aged between 30-80 years posted for elective unilateral TKR surgery under spinal anaesthesia.

**STUDY DESIGN:** Randomized controlled study.

**RANDOMISATION:** Computer generated random numbers to avoid selection bias.

**SAMPLE SIZE:** Sample size was calculated based on sample size formula  $n = \{(\sigma_1^2 + \sigma_2^2) \cdot [Z_{1-\alpha/2} + Z_{1-\beta}]^2\} / (M_1 - M_2)^2$  where:

$M_1$  = Mean of the Outcome variable (quadriceps strength) in Group-A (ACB)

$M_2$  = Mean of the Outcome variable (quadriceps strength) in Group-B (FNB)

$\sigma_1$  = SD of the Outcome variable (quadriceps strength) in Group-A (ACB)

$\sigma_2$  = SD of the Outcome variable (quadriceps strength) in Group-B (FNB)

$Z_{1-\alpha/2}$  and  $Z_{1-\beta}$  are probability of two errors.

Sample size was calculated to be 21 subjects in each group to have significant results. We decided to include minimum 25 patients in each group in our study to get wider participation of subjects.

### **INCLUSION CRITERIA:**

- Posted for unilateral Total Knee Replacement (TKR)
- Age between 30-80 yrs

- Either sex
- Belonging to ASA Grade 1-3

### **EXCLUSION CRITERIA:**

- Patients' refusal to participate.
- Infection at the site of catheter entry point.
- Allergy to local Anaesthetic drugs.
- Hepatic or Renal impairment.
- Severe cardiac or respiratory disorders.
- Patient with psychiatric illnesses that would interfere with perception and assessment of pain.
- Participating in another study.

### **METHODOLOGY**

In this study 50 subjects who were scheduled for unilateral total knee replacement surgery to be performed under spinal anesthesia were included. 50 patients were divided into 2 groups consisting of 25 patients in each group.

Group A (ACB) -25 patients received adductor canal block

Group B (FNB) -25 patients received femoral nerve block.

After taking the patient in operation theatre, under all aseptic precautions subarachnoid block were given using 26G Quinke's spinal needle using 0.5% Bupivacaine (Heavy) 10-12.5mg mixed with injection Clonidine 15-30microgram in lower lumbar vertebral space according to patient's age, weight and height.

Group A (ACB) patients received adductor canal block under ultrasound guidance. The linear probe (4Hz) was placed on the medial part of the thigh after slightly abducting the thigh half way between the inguinal ligament and the patella. The femoral artery was visualized in short axis immediately under the sartorius muscle. After skin preparation with chlorhexidine and isopropyl alcohol, an 18-gauge epidural needle was inserted in plane of the probe from lateral direction. Sartorius muscle was identified and the needle tip was placed under it just lateral and superior to the artery. Ten ml of normal saline slowly

injected with repeated aspiration following which an indwelling catheter was placed under ultra sound guidance pre-operatively before the application of tourniquet.

Group B (FNB) patients received femoral nerve block under ultra sound guidance. The linear probe (4Hz) was placed below the inguinal ligament and the femoral artery was visualized in short axis. After skin preparation with chlorhexidine and isopropyl alcohol, an 18-gauge epidural needle was inserted in plane of the probe from lateral direction. The needle tip was placed just lateral to the femoral artery. Ten ml of normal saline slowly injected with repeated aspiration following which an indwelling catheter was placed under ultra sound guidance post-operatively after removal of tourniquet.

The difference in timing for catheter insertion was done because area of ACB gets covered in dressing postoperatively and do not allow access to the area for insertion of catheter. The initial bolus drug injection of 10 ml 0.2% ropivacaine in both groups were administered after completion of surgery, followed by initiation of continuous infusion of 0.2% ropivacaine at the rate of 5-10 ml/hour (titrated to requirement) and continued for next 24 hours.

Patients in both groups also received injection paracetamol 1gm intravenously every 8 hourly in PACU.

All patients recruited for the study were familiarized with visual analogue scale (VAS) score by showing a pain scale ranging from 0 to 10 (VAS) where a 0-score means no pain and 10-score means excruciating pain.

Postoperative pain was measured using visual analogue scale (VAS) score ranging from 0 to 10. Pain was recorded every half hourly for first 3 hours, then hourly for next 3 hours and every 3-hour interval up to 24 hours post-surgery.

A pain score of more than 4 on the VAS scale was considered as insufficient analgesia and rescue analgesic in the form of intravenous injection Diclofenac 75 mg (Injection Tramadol hydrochloride 50 mg in

hypertensive or diabetic patients) was administered.

Motor block assessment of leg was done using Manual Muscle test (MMT) scoring:

Score 0 – No contraction or movement of muscle.

Score 1 – Feeble contraction felt in muscle but no visible movement.

Score 2 – Movement through complete range of motion in horizontal plane

Score 3 – Patient holds test position against slight flexion in antigravity plane.

Score 4 – Patient holds test position against moderate flexion in antigravity plane.

Score 5 – Patient holds test position against strong flexion in antigravity plane.

Manual muscle testing was done while patient in supine position.

Assessment of motor block was also recorded every half hourly for first 3 hour, hourly for next 3 hours and then every 3 hours till 24 hours post-surgery.

On first post-operative day (POD-1), infusion was stopped and the patients were made to ambulate in post anaesthesia care unit. The patient was asked to flex and extend the operated knee and ankle. The patients were made comfortable by asking them to stand slowly from bed and using a four-legged walker to ambulate a distance of 10 metres in the presence of a trained physiotherapist.

The observations recorded were compiled together and statistical analysis was done using SPSS 16.0 and student-t test.

Any episodes of complication such as hemodynamic changes, nausea, vomiting, headache, pruritus, fever, inadvertent vascular injury, kinking or dislodgement of catheter, hematoma or infection were also recorded in observation proforma.

## OBSERVATIONS AND RESULTS

### A -DEMOGRAPHIC DATA

	ACB n=25	FNB n=25	P value
AGE	70.8	71.8	0.27
HEIGHT	160.5	161.0	0.801
WEIGHT	69.3	69.5	0.892



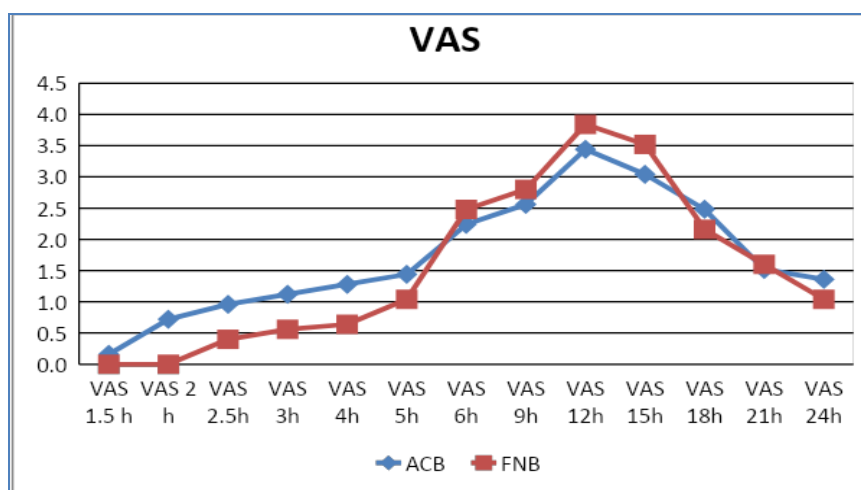
Hence, from the above data we can infer that the demographic data of both study groups are comparable.

	ACB	FNB	P value
VAS(1.5hr)	0.2	0.0	0.155
VAS(2hr)	0.7	0.0	0.007
VAS(2.5hr)	1.0	0.4	0.17
VAS(3 hr)	1.1	0.6	0.143
VAS(4hr)	1.3	0.6	0.153
VAS(5hr)	1.4	1.0	0.414
VAS(6hr)	2.2	2.5	0.279
VAS(9hr)	2.6	2.8	0.42
VAS(12hr)	3.4	3.8	0.397
VAS(15hr)	3.0	3.5	0.35
VAS(18hr)	2.5	2.2	0.449
VAS(21hr)	1.5	1.6	0.764
VAS(24hr)	1.4	1.0	0.295

### B-VISUAL ANALOGUE SCALE (VAS)

The data at 30 min and 1-hour post-op has not been analysed as patients had no pain and standard deviation is zero for VAS.

After applying student t-test the p value between the 2 groups is significant only at 2 hrs post-op.



### C-MANUAL MUSCLE TESTING

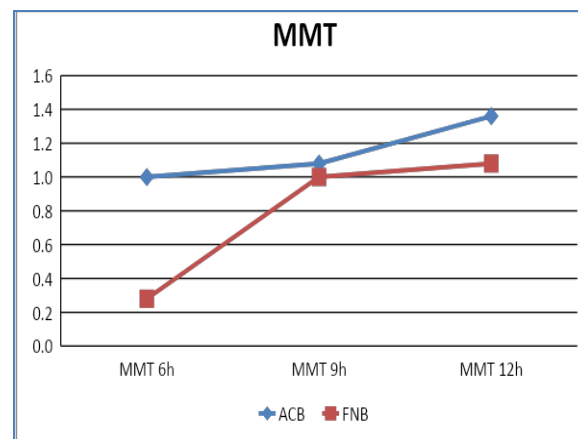
The data at 0.5 hr, 1 hr, 1.5 hr, 2 hr, 2.5hr, 3 hr, 4hr, 5hr post-op has not been analysed as the MMT score was zero for all patients at these times.

	ACB	FNB	P value
MMT(6hr)	1.0	0.3	<0.001
MMT(9hr)	1.1	1.0	0.155
MMT(12hr)	1.4	1.1	0.016

At 6 hrs and 12 hrs, after applying student t-test the p value between the 2 groups is <0.001 and 0.016 respectively which is significant.

It is not possible to calculate p-value the data as standard deviation is zero at 15

hr, 18hr, 21hr and 24hr between the two groups.

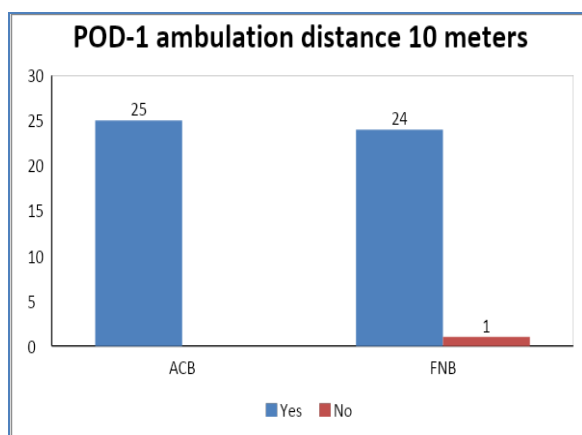


### D- 10 metres ambulation distance on POD-1

(Ambulation distance covered on POD-1)

		Group		Total	Pearson Chi-Square	p-value
		ACB	FNB			
POD-1 ambulation distance 10 meters	Yes	25	24	49	1.02	0.312
	No	0	1	1		
Total		25	25	50		

The p value obtained after applying student t-test is 0.312, hence statistically not significant.



## DISCUSSION

Our randomized controlled trial was performed on 50 ASA grade I-III patients who underwent unilateral TKR under subarachnoid block. Our study groups were similar in demographic profiles.

Femoral nerve block (FNB) is a commonly used modality for post-operative pain relief after TKR. Disadvantage of FNB is that it reduces quadriceps muscle strength which limits patient's mobility and increases the risk of fall since it blocks both sensory and motor components of femoral nerve. Ilfeld et al [11] in 2012 concluded significant quadriceps femoris weakness caused by continuous femoral nerve block.

Adductor canal block (ACB) is an alternative to FNB in providing post-op analgesia after TKR because it blocks only sensory component (saphenous nerve). It provides equally effective analgesia and preserves motor function of quadriceps muscle. In 2013, Kwofie MK et al [12] concluded that compared with FNB, ACB results in significant quadriceps motor sparing and preserved balance. In 2014, Grevstad et al [13] conducted a study to see reduction in pain score with movement of knee and found that ACB reduced the VAS score during active knee flexion.

Machi et al [14] in their study concluded that both continuous FNB and continuous ACB provide similar analgesia

and intravenous opioid consumption and ACB helps in early mobilization. Wang D et al [15] in his study found that both ACB and FNB provided equally effective post op pain relief. Wiesmann T et al [16] conducted a study and found that continuous ACB was equivalent to continuous FNB with regard to pain relief and mobilisation. Kuang MJ et al [17] conducted a meta-analysis and found ACB gives equally effective pain relief as FNB.

In our study, on POD-1, infusion of ropivacaine was stopped after 24 hours of surgery. Under the guidance of a physiotherapist, patients were observed for a 10-meter ambulation distance test. The patient was made to walk using a four-legged walker.

All patients in ACB group were able to cover 10 metres without tripping. In FNB group, out of 25 patients 1 patient was not able to ambulate next morning. The possible cause could be related to surgical procedure or pain. Pain relief was not adequate as his VAS score was observed to be 4 next day. The failure of pain relief in this patient could also be due to wrong placement or misplacement of the catheter. This can occur during insertion of catheter or later on due to movement of patient in post-operative period. The other 24 patients who received FNB were able to ambulate 10 metres distance satisfactorily.

Machi et al [14] study in 2015, found that early mobilization seen in continuous ACB when compared with FNB. Another study by Elkassabany et al [18] in 2016 found no significant difference in both ACB and FNB group with regard to risk of fall or ambulation distance. Manual muscle testing (MMT) was assessed during frequent intervals during 24 hr stay in PACU. Patients were not able to perform up to 6 hrs post op due to subarachnoid block. In ACB and FNB group patient scored 0 as there was no contraction or movement seen. After 6-hour post-op in ACB group due to better preservation of quadriceps strength feeble contraction felt in muscles and all the patient scored 1 whereas in FNB group only

7 patients scored 1 and the remaining all scored 0 as FNB blocks both sensory and motor component.

As in the 6<sup>th</sup> hour all patients scored 1 in ACB group and in FNB only 7 patients could score 1, mean in ACB is 1.0 and in FNB is 0.3. The p value is <0.001 which is highly significant. In relation to Jaeger P et al [10] study statistically significant difference in quadriceps strength was seen only between FNB and placebo. ACB reduces quadriceps strength by 8% compared with baseline whereas FNB reduces by 49% compared with baseline. The study by Elkassabany N et al [18] found better preservation of quadriceps muscle strength in ACB compared to FNB. Our study is also in accordance with Jaeger et al [10] and Elkassabany N et al [18]. At 6 hours we found significant quadriceps muscle activity in ACB group compared to FNB group (p <0.001).

At 12 hrs, five patients in ACB group scored 3. Remaining patients scored 2. In FNB group 9 patients scored 2 and remaining patients scored 1. The p value is 0.016 which is statistically significant. At 15 hrs, all patients in ACB group scored 3 and all patients in FNB group scored 2 and at 18, 21 & 24 hrs in both groups MMT score were 3 in all patients. The study by Kim D et al [19] showed significantly high dynamometer reading at 6 to 8 hr post anaesthesia in ACB group, but at 24 and 48 hr there was no statistically significant difference in dynamometer reading. In our study we observed statistically significant MMT scoring at 6 hr and 12 hr; after that there was no significant difference.

Visual analogue scale was assessed during frequent intervals during 24 hr stay in PACU. upto 1 hr post op the VAS score was zero in both groups due to subarachnoid block. Kim et al [19] in their study found that ACB provides equally effective post op pain relief as FNB. Opioid consumption was also similar. In another study, Machi et al [14] confirmed that both groups experienced similar analgesia and opioid requirements. In our study, at 1.5 hr, 2 patients in ACB

group had VAS score 2 whereas in FNB group VAS score was 0, hence the p value was 0.155 which is statistically not significant.

At 2 hr, the VAS score increased to 4 in 2 patients in ACB group despite continuous infusion of Inj. Ropivacaine whereas it was still 0 in FNB group, hence the p value was 0.007 which is statistically significant. From this data we can infer that early initiation of pain was seen in ACB compared to FNB. The cause could be improper placement of catheter or dislodgement of catheter during fixation or manipulation during surgery.

At 2.5 hr, VAS score was further increased to 6 in ACB group in the same 2 patients and rescue analgesia in the form of Inj. Voveron 75 mg was given, but no new patient developed pain whereas in FNB group VAS score was still 0. The p value obtained was 0.17, hence statistically not significant.

At 3 hr, the VAS score reduced in those 2 patients who received rescue analgesic. There was one new patient in both groups who complained of pain. The p value was 0.143 which is statistically not significant.

At 4 hr, VAS score was similar in both groups. Hence p value obtained was 0.153 which is statistically not significant.

At 5 hr, seven patients experienced pain in ACB group and four patients in FNB group. The p value was 0.414 which is statistically not significant. We can say pain relief was comparable in both groups. At 6 hr, all patients in ACB group developed pain and scored 2 or 4. In FNB group also all patients complained of pain. The p value obtained was 0.279, hence statistically not significant.

At 9 hr, one patient in ACB group had VAS score of 6 for which rescue analgesic was given and in remaining patients also VAS score was increasing. In FNB group VAS score was gradually increasing but scored 2 or 4. At 12 hr, VAS score further increased in both groups and

more patients required rescue analgesic. The p value was 0.397 which is not significant.

At 15 hr post op, the number of patients required rescue analgesic in ACB group was 4 and in FNB group was 7. The VAS score was comparable as p value was 0.35 which is statistically not significant.

At 18 hr, VAS score reduced in both groups. At 21 hr, VAS score was between 0-2 in both groups. The p value obtained was 0.764 which was comparable and not significant. At 24 hr post op, the VAS score was either 0 or 2 in ACB group whereas in FNB group except for 1 patient who scored 4 all the remaining patients scored either 0 or 2, hence p value was 0.295 which is not significant.

From the above findings we infer that post op pain relief by ACB and FNB is equal and comparable as all the p value were  $>0.05$  at various time intervals except at 2hrs when p value was 0.007 which could be due to catheter migration. The total rescue analgesic requirements were almost similar in both groups but demand for rescue analgesic was early in ACB group.

ACB cannot be given without ultrasound guidance as hematoma chances are more. FNB is a simple and easy block which can be given without ultrasound guidance and chances of vascular injury are less. No major complications were observed in the subjects included in our study.

In our study, there were limitation that no formal assessment of distribution of sensory and motor block was done.

## CONCLUSION

Based on our study it can be concluded that either ACB or FNB can be administered to the patients as both blocks are equally effective in terms of ambulation distance after 24 hrs of surgery and pain relief in post-operative period.

## Declaration of Patient's Consent:

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their

images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict Of Interest:** There is no conflict of interest in our study.

## REFERENCES

1. Baker PN, Meulen JH, Lewsey J, Gregg PJ. The role of pain and function in determining patient satisfaction after total knee replacement. Data from the National Joint Registry for England and Wales. *J Bone Joint Surg Br.* 2007;89:893–900
2. YaDeau JT, Cahill JB, Zawadsky MW, Sharrock NE, Bottner F, Morelli CM, et al. The effects of femoral nerve blockade in conjunction with epidural analgesia after total knee arthroplasty. *Anesth Analg.* 2005;101(3):891–5.
3. Carli F, Clemente A, Asenjo JF, Kim DJ, Mistraletti G, Gomarasca M, et al. Analgesia and functional outcome after total knee arthroplasty: Periarticular infiltration vs continuous femoral nerve block. *Br J Anaesth.* 2010;105(2):185–95.
4. Salinas FV, Liu SS, Mulroy MF. The effect of single injection femoral nerve block versus continuous femoral nerve block after total knee arthroplasty on hospital length of stay and long-term functional recovery within an established clinical pathway. *Anesth Analg* 2006;102:1234 –9.
5. Manickam B, Perlas A, Duggan E, Brull R, Chan VW, Ramlogan R. Feasibility and efficacy of ultrasound-guided block of saphenous nerve in the adductor canal. *Reg Anesth Pain Med.* 2009;34:578-80.
6. Lund J, Jenstrup MT, Jaeger P, Sørensen AM, Dahl JB. Continuous adductor canal blockade for adjuvant post-operative analgesia after major knee surgery: preliminary results. *Acta Anaesthesiol Scand.* 2011;55:14–9
7. Sinha SK, Abrams JH, Arumugam S, D'Alessio J, Freitas DG, Barnett JT, et al. Femoral nerve block with selective tibial nerve block provides effective analgesia without foot drop after total knee arthroplasty: A prospective, randomized,



- observer-blinded study. *Anesth Analg.* 2012; 115(1):202–6.
8. Saranteas T, Anagnostis G, Paraskeuopoulos T, Koulalis D, Kokkalis Z, Nakou M, et al. Anatomy and clinical implications of the ultrasound-guided subsartorial saphenous nerve block. *Reg Anesth Pain Med* 2011;36(4):399-402.
  9. Paul JE, Arya A, Hurlburt L, Cheng J, Thabane L, Tidy A, et al. Femoral Nerve Block Improves Analgesia Outcomes after Total Knee Arthroplasty A Meta-analysis of Randomized Controlled Trials. *Anesthesiology.* 2010;113(5):184–94.
  10. Jaeger P, Nielsen ZJK, 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(2):409–15.
  11. Ilfeld BM, Loland VJ, Sandhu NS, Suresh PJ, Bishop MJ, Donohue MC, et al. Continuous femoral nerve blocks: The impact of catheter tip location relative to the femoral nerve (anterior versus posterior) on quadriceps weakness and cutaneous sensory block. *Anesth Analg.* 2012;115(3):721–7.
  12. Kwofie MK, Shastri UD, Gadsden JC, Sinha SK, Abrams JH, Xu D, et al. The effects of ultrasound-guided adductor canal block versus femoral nerve block on quadriceps strength and fall risk: a blinded, randomized trial of volunteers. *Reg Anesth Pain Med.* 2013;38(4):321-5.
  13. Grevstad U, Mathiesen O, Lind T, Dahl JB. Effect of adductor canal block on pain in patients with severe pain after total knee arthroplasty: A randomized study with individual patient analysis. *Br J Anaesth.* 2014;112(5):912–9.
  14. Machi AT, Sztain JF, Kormylo NJ, Madison SJ, Abramson WB, Monahan AM, et al. Discharge readiness after tricompart ment knee arthroplasty: adductor canal versus femoral continuous nerve blocks-a dual-center, Randomized Trial. *Anesthesiology.* 2015;123(2):444-56.
  15. Wang D, Yang Y, Li Q, Tang SL, Zeng WN, Xu J, et al. Adductor canal block versus femoral nerve block for total knee arthroplasty: a meta-analysis of randomized controlled trials. *Sci Rep.* 2017;7:40721.
  16. Wiesmann T, Piechowiak K, Duderstadt S, Haupt D, Schmitt J, Eschbach D, et al. Continuous adductor canal block versus continuous femoral nerve block after total knee arthroplasty for mobilisation capability and pain treatment: a randomized and blinded clinical trial. *Arch Orthop Trauma Surg.* 2016;136(3):397-406.
  17. Kuang MJ, Xu LY, Ma JX, Wang Y, Zhao J, Lu B, et al. Adductor canal block versus continuous femoral nerve block in primary total knee arthroplasty: a meta-analysis. *Int J Surg.* 2016;31:17-24.
  18. Elkassabany NM, Antosh S, Ahmed M, Nelson C, Israelite C, Badiola I, et al. The Risk of Falls after Total Knee Arthroplasty with the Use of a Femoral Nerve Block Versus an Adductor Canal Block: A Double-Blinded Randomized Controlled Study. *Anesth Analg.* 2016;122(5):1696–703.
  19. 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(3):540–50.
- How to cite this article: Bano R, Varshney M, Kesarwani D et.al. Comparison of adductor canal block versus femoral nerve block for ambulatory distance on postoperative day-1 following unilateral TKR surgery- an RCT study. *International Journal of Research and Review.* 2021; 8(2): 17-25.

\*\*\*\*\*