

Comparative Study of Adductor Canal Block with Adductor Canal Block Plus Ipack for Postoperative Analgesia in Patients Undergoing Total Knee Arthroplasty

Madiha Kafeel, Shankaranarayana Paniye, Shilpa Gopala Krishna Bhat

Department of Anaesthesiology, Yenepoya Medical College, Mangalore, India

Email address:

madiha.kafeel@gmail.com (M. Kafeel)

To cite this article:

Madiha Kafeel, Shankaranarayana Paniye, Shilpa Gopala Krishna Bhat. Comparative Study of Adductor Canal Block with Adductor Canal Block Plus Ipack for Postoperative Analgesia in Patients Undergoing Total Knee Arthroplasty. *International Journal of Anesthesia and Clinical Medicine*. Vol. 9, No. 2, 2021, pp. 23-27. doi: 10.11648/j.ijacm.20210902.11

Received: May 24, 2021; **Accepted:** June 30, 2021; **Published:** July 8, 2021

Abstract: BACKGROUND: Total Knee Arthroplasty (TKA) is a common surgical procedure for advanced osteoarthritis. Pain management in patients undergoing TKA is the critical component for better recovery and early ambulation. Peripheral nerve blocks is a better alternative to systemic analgesics in relieving pain after TKA. The aim of the study was to compare the VAS score and rescue analgesia requirement in ACB+IPACK group compared to ACB alone in patients undergoing the total knee arthroplasty. METHOD: This observational study is conducted in Yenepoya Medical College Hospital, Mangalore who are in the age group from 40 to 80 years admitted for elective total knee replacement surgery during the period of October 2020 to December 2020 after approval from the ethical committee and written informed consent from participants. The patients were selected by closed envelope method into two groups; as group 1 patients received ACB+IPACK and group 2 received ACB only. Pain assessment was done by a 10 cm visual analogue scale (VAS); 0: no pain; 10: worst imaginable pain. Patient were reassessed for pain and any side effects like nausea, vomiting, gastric irritation and respiratory depression at 8 hours, 12 hours and 24 hours or till the need of rescue analgesia. RESULT: The mean age of the patients in the study group was 58.7 years. The VAS score at rest after 8th hr, 12th hr and 24th hr showed a significantly lower score in ACB+IPACK group compared to the ACB group. However, there was no significant pain noted in two groups to provide the rescue analgesics. CONCLUSION: ACB+IPACK is safer and efficient than ACB alone for postoperative pain management in patients undergoing total knee arthroplasty.

Keywords: Total Knee Arthroplasty, Adductor Canal Block, IPACK, Visual Analogue Scale, Postoperative Analgesia

1. Introduction

Total knee arthroplasty (TKA) is a common surgical procedure for advanced osteoarthritis. Pain management in patients undergoing TKA is the critical component for better recovery and early ambulation. [13-15] Targeting postoperative pain management in major knee surgery is a real obstacle for recent developments in science and expertise. Over the last decade, the development of ultrasound guided nerve blocks for acute and chronic pain became more popular. [1] Adductor canal block (ACB) is a peripheral nerve block which provides postoperative analgesia to the peripatellar and intra articular aspect of knee joint without affecting quadriceps muscle strength [2, 9].

Adductor canal block provides a comparable level of pain relief and early mobilization. [12] The new technique for controlling posterior knee pain after TKA is ultrasound guided local anaesthesia infiltration of the interspace between popliteal artery and the capsule of posterior knee (IPACK) introduced by Sanjay Sinha which has shown comparable posterior knee analgesia without affecting main trunks of tibial and common peroneal nerves thereby maintaining the sensory and motor function of the leg and the foot. [3, 4] We postulated that ACB + IPACK block provide better pain relief and early rehabilitation compared to ACB alone and therefore conducted the study to verify this hypothesis.

Total knee arthroplasty can involve severe postoperative pain that can limit recovery and prolong hospital stay. [8] Postoperative pain management in TKA continues to evolve from earlier to opioids consumption, periarticular injections, epidural to recent regional techniques such as femoral nerve block, adductor canal block and IPACK [3].

However, opioids may not provide adequate pain control and associated with side effects such as nausea, constipation, sedation, respiratory depression. Epidural may be associated with restricted range of movements along with hypotension. Regional techniques have a benefit of better pain control and reduce opioid related side effects after TKA.[17] However, patients receiving FNC or ACB block may encounter postoperative posterior knee pain requiring supplemental intravenous analgesics due to sparing of tibial and peroneal nerves. A new technique IPACK block provides an alternative for controlling posterior knee pain following TKA. [6, 12] Therefore, present study has been undertaken to compare the effect of IPACK and ACB with ACB alone on postoperative pain scores and rescue analgesia requirements.

Aim of the study was to compare the VAS score and rescue analgesia requirement in ACB+IPACK group compared to ACB alone in patients undergoing the total knee arthroplasty.

2. Methodology

This observational study is conducted after approval from the ethical committee and written informed consent from participants who were posted for TKR surgery under spinal anaesthesia was put into two groups. Participants in Yenepoya Medical College Hospital, Deralakatte, Mangalore who are in the age group from 40 to 80 years admitted for elective total knee replacement surgery during the period of October 2020 to November 2020.

Participants were divided into two groups by close envelope method.

Group 1 - patient received IPACK + adductor canal block

Group 2 - patient received adductor canal block alone with 15 participants in each group. Post operative pain score and requirement of rescue analgesia was assessed.

Patients in age of 40 to 80 yrs undergoing unilateral total knee replacement with ASA physical status upto 3 were included in the present study. Whereas the patients with history of bleeding diathesis or prior vascular surgery on femoral vessels, severe renal insufficiency and pre-existing lower extremity neurological abnormalities were excluded from the study.

After having met inclusion and exclusion criteria, having obtained informed consent from patient, all patients were given spinal anaesthesia with 3.0 ml 0.5% hyperbaric bupivacaine at the L3/4 interspaces (alternatively at the L2/3 or L4/5 interspaces). All the surgeries were performed using the medial peripatellar approach, and posterior stabilized knee prosthesis will be used in all the patients. All patients received ACB in the immediate postoperative period under a

high frequency ultrasound guidance in which the adductor canal was identified beneath the sartorius muscle and 20 ml of 0.2% Ropivacaine was injected in the canal using a 22 gauge 100 mm short beveled regional block needle. The patients in group 1 received IPACK under high frequency ultrasound guidance. The patient were placed in supine position and knee placed in position of 90 degree flexion. A low frequency ultrasound probe was positioned in the popliteal crease and spinal needle was inserted from medial aspect of the knee from anteromedial to posterolateral direction in a plane between the popliteal artery and the femur. The tip of the needle was placed 1-2 cm beyond the lateral edge of the artery and 15 ml of 0.2% Ropivacaine was injected. [10]

Assessment of pain was done in the postoperative ward and it ends with the need of rescue analgesia (Study period). Pain assesment was done by a 10 cm visual analogue scale (VAS); 0, no pain; 10, worst imaginable pain. Patient were reassessed for pain and any side effects like nausea, vomiting, and gastric irritation, respiratory depression at 8 hours, 12 hours, 24 hours and/or till the need of rescue analgesia.

Rescue analgesia such as intravenous paracetamol or tramadol was provided if the VAS score is more than 5.

Statistical analysis: All the data was collected in proforma and entered in Microsoft Excel sheet. The demographic details are presented as frequency, percentage, mean and standard deviations. The mean difference in the VAS score between the two independent groups was analysed using the student unpaired t-test, for the categorical variables the chi-square test was used to assess the significant difference. A p-value of <0.05 was considered statistically significant; all the data analysis was performed using IBM SPSS v21 operating on windows 10.

3. Results

A total of 30 patients were included in present study in which 15 patients received the ACB+IPACK and other 15 patients received ACB alone. The mean age of the patients in the study group was 58.7 years with patients in ACB+IPACK group having the mean age of 58.1 years and patients in ACB group was with a mean age of 59.4 years. The overall demographic details between the groups were comparable. (Table 1) The study group included total of 16 female patients and 14 male patients (Table 2)

The VAS score at the rest after 8th hr, 12th hr and 24th hr showed a significantly lower score in ACB+IPACK group compared to the ACB group. (Table 3 & Figure 1) However, there was no significant pain noted in two groups to provide the rescue analgesics. However, mild to moderate pain was managed with paracetamol in two patients of ACB+IPACK group and one patient in ACB group, which was not statistically significant finding (Table 4). The duration of analgesia was longer among the patients of ACB+IPACK group 16.27 hrs compared to the 16.0 hrs in the ACB group, this finding was not statistically significant. (Table 5)

Table 1. Comparison of mean age of patients between the groups.

	IPACK + Adductor canal block		Adductor canal block alone		Unpaired t-test
	Mean	SD	Mean	SD	p-value
AGE	58.1	7.0	59.4	6.3	0.606

*p-value <0.05 was considered statistically significant.

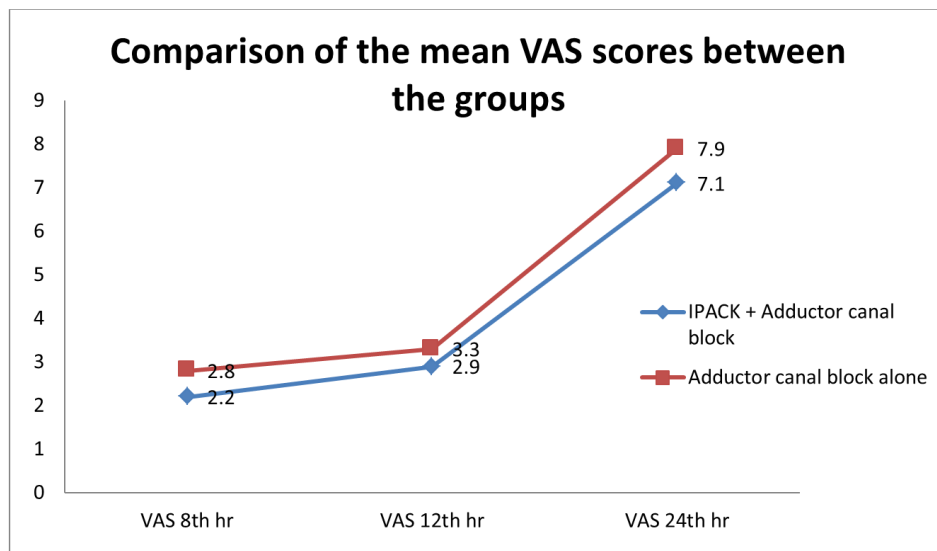
Table 2. Distribution of patients gender wise in present study.

		Frequency	Percent
Gender	Female	16	53.3
	Male	14	46.7
	Total	30	100.0

Table 3. Comparison of the mean VAS scores between the groups at different interval of time.

	IPACK + Adductor canal block		Adductor canal block alone		Unpaired t-test
	Mean	SD	Mean	SD	p-value
VAS 8 th hr	2.2	0.50	2.8	0.63	0.001*
VAS 12 th hr	2.9	0.59	3.3	0.59	0.02*
VAS 24 th hr	7.1	1.16	7.9	0.97	0.04*

*p-value <0.05 was considered statistically significant.

**Figure 1.** Comparison of the mean VAS scores between the groups.**Table 4.** Comparison of the rescue analgesic given in two groups of patients.

		IPACK + Adductor canal block		Adductor canal block alone		Chi-square
		Count	Column N%	Count	Column N%	(p-value)
Rescue analgesia	None	13	86.7%	14	93.3%	0.370 (0.543)
	Paracetamol	2	13.3%	1	6.7%	

*p-value <0.05 was considered statistically significant.

Table 5. Comparison of duration of blockade in between the two groups.

	IPACK + Adductor canal block		Adductor canal block alone		Unpaired t-test
	Mean	SD	Mean	SD	p-value
Blockade duration	16.27	1.94	16.00	1.60	0.685

*p-value <0.05 was considered statistically significant.

4. Discussion

Acute postoperative pain is a common challenge faced by

many care practitioners on the basis of evidence-based clinical standards. As part of the agreed continuum of perioperative anaesthetic treatment, anaesthetists play a vital role as acute postoperative pain management impacts surgical

complications that may contribute to extended hospital stays and dissatisfaction with patients. The increase in the number of TKAs conducted worldwide has also resulted in adequate postoperative pain relief and quicker recovery. This has contributed to the advent of numerous postoperative pain relief techniques that have made peripheral nerve blocks more common.[7] The IPACK procedure involves infiltrating

the gap between the popliteal artery and the posterior capsule with a local anaesthetic to provide analgesia to the posterior aspect of the knee joint. without the intervention of the motor branches of the tibial and peroneal nerves, leading to decreased pain without having an effect on muscle strength. This leads to better ambulation, which in turn leads to better healing and recovery of the patient.

Table 6. Comparison of Result of Various Studies.

YEAR	AUTHOR	STUDY TYPE SAMPLE SIZE	MEASUREMENT OF OUTCOME	RESULT	CONCLUSION
2017	S. R. Sankineani et al	Prospective non-randomized study N=120 patients ACB+IPACK =60 ACB=60	VAS score was recorded at 8, 12, 24 and 48 hrs Range of movement on POD 2 Ambulatio distance on POD 3	VAS score at rest 8 hr postoperatively showed better values in ACB+IPACK than ACB; mean range of movement (ROM) WAS 71.8 degree in ACB+IPACK and 62.2 degree in ACB; ambulation distance was better in the ACB+IPACK than ACB	ACB+IPACK is a promising technique that offers pain management in the immediate postoperative period resulting in better ROM and ambulation compared to ACB
2016	Dr. Gurvareddy et al	Single blind randomized controlled trial N=120 patients ACB+IPACK =60 ACB=60	VAS score was recorded at 8 pm POD 0, 8 am and 8 pm at POD 1, 8 am at POD 2 Range of movement on POD 1 No of steps walked on POD 1	VAS score for adductor block group was 2.91, 3.18 and 3.45 at the end of POD 0 AND POD 1 whereas VAS Score for adductor +IPACK was 1.43, 2.05, 2.55. ROM for adductor group 62.25 degrees and steps walked 7.13 whereas adductor +IPACK GROUP has mean ROM of 71.83 and steps walked was 8.51	ACB+IPACK is better mode than ACB for control of postoperative pain in patient undergoing Total Knee Arthroplasty.
2017	David H. Kim et al	Triple blinded controlled trial N = 86 IPACK +ACB+PAI=43 PAI=43	NRS score at POD 0 and POD 1 Pain OUT questionnaire; Opioid consumption; distance travelled	IPACK+ACB+PAI reported significantly lower NRS pain scores on POD 0 and POD 1 than PAI alone. Patients in the intervention group were more satisfied, had less opioid consumption. No difference in the distance travelled between two groups	The addition of IPACK+ACB to PAI significantly improves analgesia and reduces opioid consumption after TKA compared to PAI alone

In present study of the two groups, we found that ACB+IPACK group reported a significantly better VAS scores on 8th hr, 12th hr and 24 hrs post-operative period compared to the ACB group.

There was no significant difference in the first rescue drug required in both the group, however the pain free period was longer in ACB+IPACK group compared to the ACB group.

5. Conclusion

ACB+IPACK is safer and efficient than ACB alone for postoperative pain management in patients undergoing total knee arthroplasty. IPACK is relatively safe and simple technique which reduces the posterior pain in TKA patients in conjunction with the adductor canal block.[16]

References

- [1] Amer N. Combined adductor canal and IPACK blocks is better than combined adductor canal and periarticular injection blocks for painless ACL reconstruction surgery. *J Anesth Crit Care Open Access*. 2018; 10 (4): 154-157. doi: 10.15406/jaccoa.2018.10.00381.
- [2] Rasouli MR, Viscusi ER. Adductor Canal Block for Knee Surgeries: An Emerging Analgesic Technique. *Arch bone Jt Surg*. 2017; 5 (3): 131-132.
- [3] Sankineani SR, Reddy ARC, Eachempati KK, Jangale A, Gurava Reddy A V. Comparison of adductor canal block and IPACK block (interspace between the popliteal artery and the capsule of the posterior knee) with adductor canal block alone after total knee arthroplasty: a prospective control trial on pain and knee function in imme. *Eur J Orthop Surg Traumatol*. 2018; 28 (7): 1391-1395. doi: 10.1007/s00590-018-2218-7.
- [4] Kim DH, Beathe JC, Lin Y, et al. Addition of Infiltration Between the Popliteal Artery and the Capsule of the Posterior Knee and Adductor Canal Block to Periarticular Injection Enhances Postoperative Pain Control in Total Knee Arthroplasty: A Randomized Controlled Trial. *Anesth Analg*. 2019; 129 (2): 526-535. doi: 10.1213/ANE.0000000000003794.
- [5] Eccles CJ, Swiergosz AM, Smith AF, Bhimani SJ, Smith LS, Malkani AL. Decreased Opioid Consumption and Length of Stay Using an IPACK and Adductor Canal Nerve Block Following Total Knee Arthroplasty. *J Knee Surg*. November 2019. doi: 10.1055/s-0039-1700840.
- [6] Thobhani S, Scalercio L, Elliott CE, et al. Novel Regional Techniques for Total Knee Arthroplasty Promote Reduced Hospital Length of Stay: An Analysis of 106 Patients. *OchsnerJ*. 2017; 17 (3): 233-238.
- [7] Terkawi AS, Mavridis D, Sessler DI, et al. Pain Management Modalities after Total Knee Arthroplasty: A Network Meta-analysis of 170 Randomized Controlled Trials. *Anesthesiology*. 2017; 126 (5): 923-937. doi: 10.1097/ALN.0000000000001607.
- [8] Cullom C, Weed JT. Anesthetic and analgesic management for outpatient knee arthroplasty. *Current pain and headache reports*. 2017 May 1; 21 (5): 23.

- [9] Reddy D, Jangale A, Reddy D, Sagi M, Gaikwad D, Reddy D. To compare effect of combined block of adductor canal block (ACB) with IPACK (Interspace between the Popliteal Artery and the Capsule of the posterior Knee) and adductor canal block (ACB) alone on Total knee replacement in immediate postoperative rehabili. *Int J Orthop Sci.* 2017; 3: 141-145. doi: 10.22271/ortho.2017.v3.i2c.21.
- [10] Kandarian B, Indelli PF, Sinha S, Hunter OO, Wang RR, Kim TE, Kou A, Mariano ER. Implementation of the IPACK (Infiltration between the Popliteal Artery and Capsule of the Knee) block into a multimodal analgesic pathway for total knee replacement. *Korean journal of anesthesiology.* 2019 Jun; 72 (3): 238.
- [11] Tak R, Reddy AG, Jhakotia K, Karumuri K, Sankineani SR. Continuous adductor canal block is superior to adductor canal block alone or adductor canal block combined with IPACK block (interspace between the popliteal artery and the posterior capsule of knee) in postoperative analgesia and ambulation following total knee arthroplasty: randomized control trial. *Musculoskeletal surgery.* 2020 Sep 27: 1-8.
- [12] Singtana K. Comparison of adductor canal block and ipack block with adductor canal block alone for postoperative pain control in patients undergoing total knee arthroplasty. *Thai Journal of Anesthesiology.* 2021; 47 (1): 1-9.
- [13] D'Souza RS, Langford BJ, Olsen DA, Johnson RL. Ultrasound-Guided Local Anesthetic Infiltration Between the Popliteal Artery and the Capsule of the Posterior Knee (IPACK) Block for Primary Total Knee Arthroplasty: A Systematic Review of Randomized Controlled Trials. *Local and Regional Anesthesia.* 2021; 14.
- [14] Jung DW, Shon WY, Seo SS, Kim OG, Lee IS. Comparison of the postoperative analgesic effect for infiltration between the popliteal artery and the capsule of the posterior knee and that of periarticular multimodal drug injection in total knee arthroplasty: retrospective study in the immediate postoperative period. *Knee Surgery & Related Research.* 2020 Dec; 32 (1): 1-9.
- [15] Scimia P, Giordano C, Ricci EB, Budassi P, Petrucci E, Fusco P. The ultrasound-guided iPACK block with continuous adductor canal block for total knee arthroplasty. *Anaesthesia Cases.* 2017 Jan; 5 (1): 74-8.
- [16] Sinha SK, Clement A, Surette AM. Infiltration between the popliteal artery and capsule of the knee (iPACK): essential anatomy, technique, and literature review. *Current Anesthesiology Reports.* 2019 Dec; 9 (4): 474-8.
- [17] Vichainarong C, Kampitak W, Tanavalee A, Ngarmukos S, Songborassamee N. Analgesic efficacy of infiltration between the popliteal artery and capsule of the knee (iPACK) block added to local infiltration analgesia and continuous adductor canal block after total knee arthroplasty: a randomized clinical trial. *Regional Anesthesia & Pain Medicine.* 2020 Nov 1; 45 (11): 872-9.