Original Research Article

Indian Journal of Anesthesia and Analgesia
2019; 6(3) (Part - II): 1006-1011
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.6319.44

A Comparative Study: USG guided Adductor Canal Block Versus Femoral Nerve Block for Postoperative Analgesia for Knee Surgeries

Sarita S. Swami[1], Uma A. Deshpande[2]

[1]Professor and Head, [2]Junior Resident, Department of Anaesthesia, Bharati Hospital and Research Centre, Pune, Maharashtra 411043, India.

Abstract

In today's era, multimodal analgesia is the main strategy used for providing postoperative analgesia in patients undergoing knee surgeries yet 25-40% patients experience severe postoperative pain [1]. Intravenous opioids, epidural analgesia and non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used analgesics but have many systemic side-effects [2]. Peripheral nerve blocks have minimal systemic side-effects and ultrasonography guided peripheral nerve block isa preferred method for providing pain relief. The femoral nerve block (FNB) was widely used for knee surgeries but it had the disadvantage of prolonged quadriceps muscle weakness which can be minimized by Adductor canal block (ACB). Therefore ACB has been introduced recently for knee surgeries. Thus, we decided to compare the efficacy of USG guided femoral nerve block and adductor canal block for postoperative analgesia in knee surgeries. Our study included adult patients undergoing knee surgeries. Fifty patients were randomly divided in two groups – group A: (n=25) received adductor canal block; group F: (n=25) received femoral nerve block, postoperatively. Both blocks were performed under USG guidance after complete wearing off of central neuraxial blockade. The average duration of sensory blockade for group F was 6.53 hours ± 4.64 while for group A was 5.77 hours ± 1.30 which was statistically not significant (p value >0.05). However, we found statistically significant difference in motor blockade in group A as compared to group F (p value <0.05). Thus we conclude that USG guided Adductor canal block effectively provides comparable postoperative analgesia to femoral nerve block while preserving the quadriceps muscle strength.

Keywords: Postoperative analgesia; Knee surgeries; Adductor canal block; Femoral nerve block.

How to cite this article:

Sarita S. Swami, Uma A. Deshpande. A Comparative Study: USG guided Adductor Canal Block Versus Femoral Nerve Block for Postoperative Analgesia for Knee Surgeries. Indian J Anesth Analg. 2019;6(3):1006-1011.

Introduction

The aim of postoperative analgesia is to provide adequate pain relief with minimum side-effects. The benefits of an effective postoperative pain management include patient comfort and satisfaction, early ambulation, fewer cardio-respiratory complications, a decreased risk of deep vein thrombosis, faster recovery with less chances of development of neuropathic pain and reduced cost of care [1,2].

Corresponding Author: Uma A. Deshpande, Junior Resident, Department of Anaesthesia, Bharati Hospital and Research Centre, Pune, Maharashtra 411043, India.

E-mail: umadeshpande583@gmail.com

Received on 12.03.2019, **Accepted on** 16.04.2019

The rising incidence of knee trauma and osteoarthritis has led to increase in number of knee surgeries. Recent consensus (2010) stated that about 14-28% of the cases operated for unilateral total knee arthroplasty (TKA) were not satisfied with regards to postoperative pain relief [3]. This intense pain often results in delayed mobilization, systemic side effects, increased in-hospital stay and expenditure for the patient [1-3].

Intravenous opioids were used to treat postoperative analgesia. They had some undesirable side-effects like sedation, respiratory depression, nausea, vomiting, hypotension, bradycardia, pruritus (37%) and inhibition of bowel function [1]. Non-steroidal anti-inflammatory drugs (NSAIDs) were mostly used to treat pain due to prostaglandins. However, they were associated with side effects like peptic ulcer disease, gastrointestinal bleeding, altered liver, platelets and renal functions [1].

Epidural analgesia has also been used for postoperative pain relief but the effect was found to be unpredictable due to the patchy action or possible dislodgement of the catheter. It also lead to retention of urine, hypotension and motor blockade. The motor blockade further hindered in mobilization [2].

Modern techniques for postoperative analgesia include the peripheral nerve blocks. Evidence based data has proved their efficacy in improving postoperative outcome and reducing the requirement of intra-venous (I.V.) opioids [1,2]. Among the peripheral nerve blocks, femoral nerve block (FNB) has been widely used to provide postoperative pain relief after knee surgeries. Despite being a successful block, it invariably decreases quadriceps muscle strength; thus delaying mobilization and increasing the risk of falling [2,4,5].

Adductor canal block (ACB) is a relatively new block with promising results. The local anaesthetic acts on saphenous nerve in the adductor canal. Being purely a sensory nerve, it not only provides adequate pain relief in postoperative phase but may also benefit by enabling the patients in early mobilization [2].

Thus taking in to consideration previously determined properties of both the blocks, we decided to do a comparative study to know the efficacy of USG guided femoral nerve block and adductor canal block for postoperative analgesia in all knee surgeries in our tertiary care centre.

Materials and Methods

After the approval of the institutional ethical committee, this study was conducted at the attached tertiary care teaching hospital during the period from 2016 to 2018.

Study design: The study was an interventional prospective study.

Entire procedure was explained to the patients during pre-anaesthesia check-up and a written informed consent was taken from each patient preoperatively, in the language that he or she understood well.

Sample size: The study included 50 patients randomly divided in two groups of 25 each.

Group A(n=25) received USG guided Adductor canal block postoperatively.

Group F (n=25) received USG guided Femoral nerve block postoperatively.

Inclusion criteria: Patients belonging to ASA Grade I-II, who were 18 years and above and were posted for elective knee surgeries.

Exclusion criteria: Patients who were unwilling to participate in the study or who had infection at the site of the block or had coagulopathies.

All patients were kept nil by mouth for at least 6 hours prior to surgery. All patients received spinal anaesthesia (SA) under all septic precautions and standard monitoring, with Inj. Bupivacaine 0.5% heavy 0.3 mg/kg with 25G spinal needle, in L_3–L_4 space, after confirming free flow of cerebrospinal fluid. Patients were monitored for haemodynamic parameters throughout the intraoperative and postoperative period. After completion of the surgery and confirmation of complete regression of the central neuraxial blockade, peripheral nerve blocks (FNB or ACB) were administered under USG guidance. Image 1 shows the USG guided Right Adductor canal block.

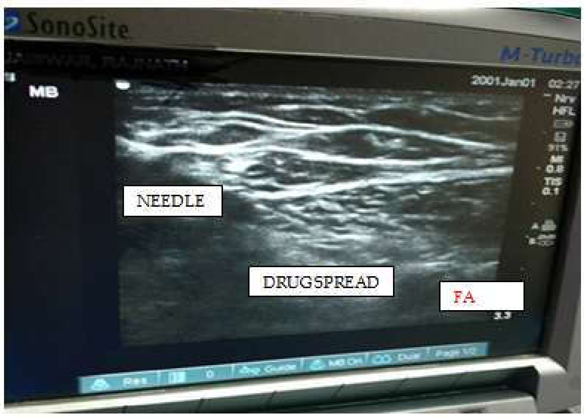

Image 1: USG image of needle position and the spread of drug while administration of Right Adductor canal block. FA- femoral artery.

Patients were monitored postoperatively for

1) The onset and duration of sensory blockade in both the groups by pin prick test.

2) The onset and duration of motor blockade in both the groups by leg raise test.

3) Pain scores using the visual analogue scale (VAS). VAS > 3/10 was considered to be significant and rescue analgesia was given.

4) Haemodynamic variability in both the groups.

5) Time taken for requirement of rescue analgesia in both the groups.

6) Occurrence of complications like infection, haematoma, vascular puncture and nerve injury, from the blocks in their respective groups.

Patients were monitored, starting from the time of administration of block (taken as 0 min) followed by intervals of 15 min, 0.5 hour, 1 hour and then at 2 hourly intervals till rescue analgesia was administered. Patients were observed for first 24 hours to know occurrence of any complication of the block administered.

Observations and Results

The sample size for the study wasdetermined from previous studies. We had included 50 patients undergoing elective knee surgeries, randomly divided into two groups of 25 each. Postoperatively, after wearing off of the effect of spinal anaesthesia, Group A (n=25) received USG guided Adductor canal block, while Group F (n=25) received USG guided Femoral nerve block and were monitored for haemodynamic parameters, pain scores, time for requirement of rescue analgesia and complications for first 24 hours.

In the entire study, the p-value less than 0.05 were considered to be statistically significant. All the hypotheses were formulated using two tailed alternatives against each null hypothesis (hypothesis of no difference). The entire data is statistically analysed using Statistical Package for Social Sciences (SPSS version 21.0, IBM Corporation, USA) for MS Windows [6-8].

Table 1 shows that distribution of mean pain score at rest and on leg raise at 0-min, 15-min, 0.5-Hr, 1.0-Hr, 2.0-Hr, 4.0-Hr and 6.0-Hr did not differ significantly between two study groups (p-value > 0.05).

Figure 1 shows that the distribution of mean duration of sensory blockade for Group A was 5.77 hours ± 1.30 while for Group F was 6.53 hours ± 4.64 which did not differ significantly between two study groups (p-value = 0.438).

Figure 2 shows that the mean ± SD of time to rescue analgesia among the cases studied in Group F and Group A was 5.62 ± 2.75 Hours and 5.71 ± 1.25 Hours respectively which did not differ significantly between two study groups (P-value = 0.878).

The duration of motor blockade was significantly higher in Group F (5.92 hours ± 4.39) as compared to mean duration of motor blockade in Group A (no motor blockade was appreciated) (p-value = 0.001) as shown in Figure 3.

Table 1: Inter-group comparison of average (median) pain score in postoperative period.

Pain Score (VAS)		Group F (n=25)		Group A (n=25)		p-value
		Median	**Min – Max**	**Median**	**Min – Max**	
At Rest	0-Min	1	1 – 2	1	1 – 2	0.389NS
	15-Min	0	0 – 1	0	0 – 2	0.188NS
	0.5-Hr	0	0 – 0	0	0 – 2	0.069NS
	1.0-Hr	0	0 – 1	0	0 – 1	0.641NS
	2.0-Hr	0	0 – 2	0	0 – 2	0.761NS
	4.0-Hr	2	0 – 3	2	0 – 3	0.435NS
	6.0-Hr	2	1 – 4	2	2 – 3	0.721NS
On Leg Raise	0-Min	2	1 – 3	2	1 – 3	0.881NS
	15-Min	1	0 – 2	1	0 – 3	0.923NS
	0.5-Hr	1	0 – 1	1	0 – 3	0.132NS
	1.0-Hr	1	0 – 2	1	0 – 2	0.661NS
	2.0-Hr	2	0 – 4	1	0 – 3	0.366NS
	4.0-Hr	3	0 – 5	3	1 – 5	0.187NS
	6.0-Hr	4	2 – 6	4	3 – 5	0.863NS

Values are median and (Min – Max), P-values by Mann-Whitney U test. P-value<0.05 was considered to be statistically significant. NS-Statistically non-significant.

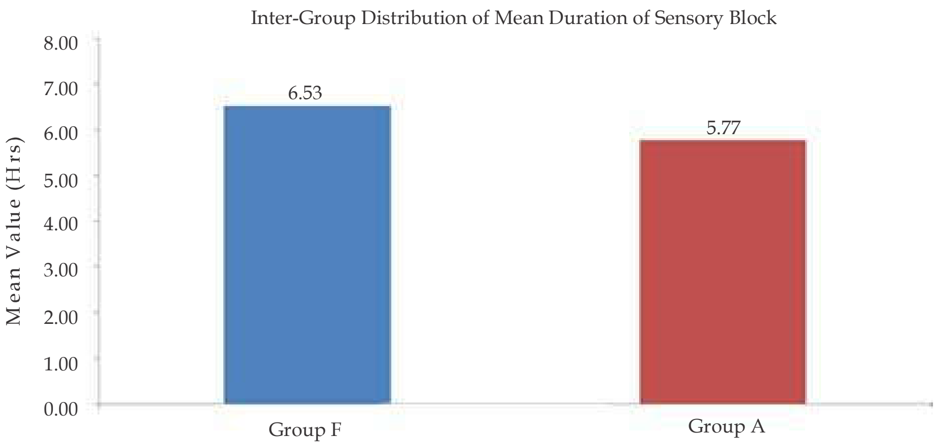

Fig. 1: Inter-group comparison of mean duration of sensory blockade.

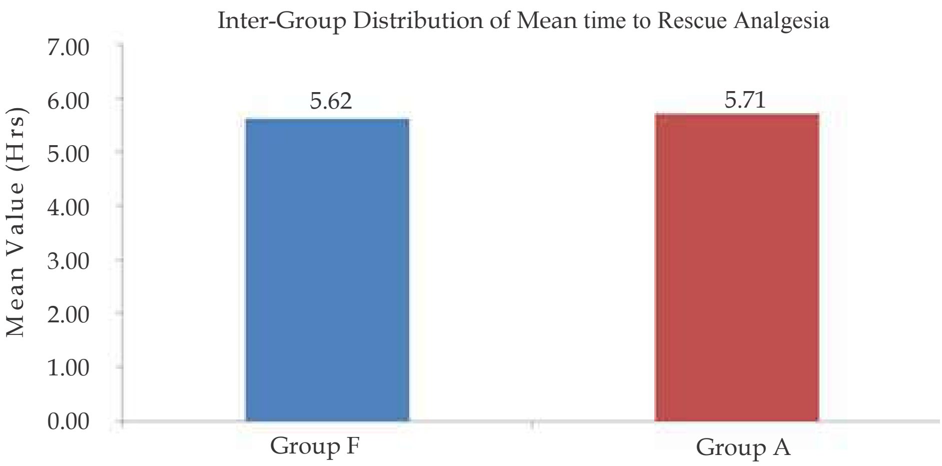

Fig. 2: Inter-group comparison of mean time to rescue analgesia.

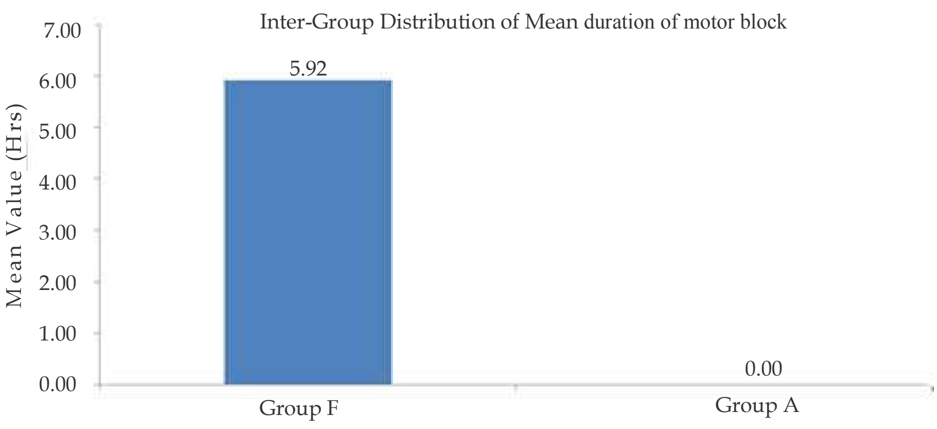

Fig. 3: Inter-group comparison of mean duration of motor blockade.

Discussion and Conclusion

Patients undergoing knee surgeries require adequate postoperative pain relief. It results in early recovery and rehabilitation thus improving overall outcome. The patients perceive maximum pain during the first 24 hours after surgery. We aimed to study the efficacy of USG guided Adductor canal block versus femoral nerve block for postoperative analgesia in knee surgeries. With the help of these blocks, we were able to keep these patients relatively pain free during immediate postoperative period.

The mean pain scores (Table 1) did not differ significantly at rest and on leg raise test, throughout the duration of the study till the time of administration of rescue analgesia between both the groups (p value >0.05 for all). The patients who received Adductor canal block were able to do an active leg raise test, while the patients who received femoral nerve block required assistance to do the leg raise test.

The duration of sensory blockade was comparable in both groups as shown in Figure 1. The mean duration of sensory blockade for patients in Group F was 6.53 hours ± 4.64, while for patients in Group A was 5.77 hours ± 1.30 with P value- 0.438. The time required for receipt of rescue analgesia did not differ significantly in both the groups with P value-0.878. (Figure 2)

Our results correlated well with results of the study by Stavros G. Memtsoudis et al. (2015). They compared ACB and FNB side to side on patients undergoing bilateral total knee replacement surgeries and concluded that FNB & ACB had equivalent analgesic potential; hence ACB could be an alternative to FNB [9]. Shu-Qing Jin et al. (2015) did a meta-analysis for effect of saphenous nerve block on knee surgeries and concluded that saphenous nerve block provided pain relief both during active flexion of the knee and at rest after knee surgery [10]. Similar findings were presented by Faraj W. Abdallah, M.D et al. (2016). They concluded that ACB provided non-inferior analgesia to FNB for patients undergoing anterior cruciate ligament surgeries [11].

In our study, patients who received USG guided femoral nerve block had significant motor blockade as compared to patients who received USG guided adductor canal block (p value-0.001). Also the duration of motor blockade was significantly higher in Group F as compared to Group A where we did not find any motor blockade (P value-0.001) as shown in Figure 3. These findings are supported by Sanjeev Sharma MD et al. (2009) wherein they had recognised quadriceps weakness as the major contributing factor (67%) in incidence of postoperative falls [4]. Similar study of Faraj W. Abdallah M.D et al. (2016) concluded that ACB preserved quadriceps muscle function as compared to FNB in patients of anterior cruciate ligament reconstruction surgeries [11].

Recently, Duan Wang et al. (2017) did a meta-analysis and concluded that ACB is more beneficial to FNB regarding avoiding quadriceps muscle weakness and faster knee function recovery. It provided comparable pain relief to FNB and is associated with decreased risks of fall [12].

Adductor canal block also causes motor blockade if given proximally or if large volume of the local anaesthetic is used. This is because the local anaesthetic blocks the motor nerve to vastus medialis as it traverses the adductor canal. There have been studies reporting motor blockade post ACB (8%) but the blockade was not significant to cause any dysfunction [5]. In our study, we chose mid to lower $1/3^{rd}$ part of adductor canal as the site of administration of the block and used 10cc volume of the local anaesthetic. Choosing a distal site for blockade spared the nerve to vastus medialis from being blocked and thus prevented motor weakness of the vastusmedialis. USG guidance helped us in accurate nerve location. It enhanced the success of the block and enabled us to use smaller volumes of the drug to achieve comparable analgesia.

Although there were no complications of the blocks, there were certain limitations to our study:

First of all, as per the protocol of Orthopaedic Department in our institute, mobilization of the patients undergoing knee surgeries starts after 48 hours postoperatively. Our study concluded at 24 hours postoperatively, hence we could not comment upon the mobilization of the patients and risk of falls in these patients. The second limitation was the small sample size. Further studies on large population groups are required to confirm whether the results of this study can be replicated.

Newer techniques are evolving day by day to help manage patients with severe postoperative pain. Among them, use of USG guided perineural catheters instead of single shot USG guided ACB or FNB, IPACK (Interspace between Popliteal Artery and posterior Capsule of the Knee) block and Cryoneurolysis have been introduced and comparative studies are on-going. The results of these studies can help in designing a comprehensive analgesic strategy for the postoperative period. It can benefit these patients and aid in their rehabilitation.

Thus from our study we conclude that USG guided adductor canal block can be used as an equivalent alternative to USG guided femoral nerve block for analgesia in postoperative period after knee surgeries. As Adductor canal block preserved quadriceps muscle strength, it may prove beneficial for early mobilization and rehabilitation of the patients.

References

1. Michael A.E. Ramsay. Acute postoperative pain management. BUMC Proceedings. 2000;13:244-247.
2. U. Grevstad, O. Mathiesen, T. Lind and J. B. Dahl. Effect of adductor canal block on pain in patients with severe pain after total knee arthroplasty: a randomized study with individual patient analysis. British Journal of Anaesthesia. 2014;112(5):912-19.
3. Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? ClinOrthopRelat Res. 2010 Jan;468(1):57-63.
4. Sanjeev Sharma, Richard Iorio, Lawrence M. Specht, Sara Davies- Lepie, William L. Healy. Complications of femoral nerve block for total knee arthroplasty. ClinOrthopRelat Res. 2010;468:135-140.
5. Pia Jaeger, Zbigniew J.K. Nielsen, Maria H. Henningsen R.N, Karen Lisa Hilsted R.N, Ole Mathiesen, Jorgen B. Dahl. Adductor canal block versus Femoral nerve block and Quadriceps strength. Anaesthesiology. 2013;118:409-15.
6. Bernard Rosner. Fundamentals of Biostatistics, 2000, 5th Edition, Duxbury, page 80-240.
7. Robert H Riffenburg. Statistics in Medicine 2005, 2nd Edition, Academic press. pp.85-125.
8. Sunder Rao P, Richard J, An Introduction to Biostatistics, A manual for students in health sciences, New Delhi: Prentice hall of India. 2006; 4th Edition, pp.86-160.
9. Stavros G. Memtsoudis, Daniel Yao, Ottokar Stundner, Thomas Dannings, Yan Ma, Lazaros Poultsides et al. Subsartorial adductor canal vs femoral nerve block after total knee replacement. International Orthopaedics (SICOT). 2015; 39:673-80.
10. Shu-Qing Jin, Xi-Bing Ding, Yao Tong, HaoRen, Zhi- Xia Chen, Xin Wang, et al. Effect of saphenous nerve block for postoperative pain on knee surgery: a meta-analysis. Int J ClinExp Med. 2015;8(1):368-76.
11. Faraj. W. Abdallah, Daniel B. Whelan, Vincent W. Chan, Govindarajulu A. Prasad, Ryan V. Endersby, John Theodoropolous, et al. Adductor canal block provides noninferior analgesia and superior quadriceps strength compared with femoral nerve block in anterior cruciate ligament reconstruction. Anaesthesiology. 2016;124:1053-64.
12. Duan Wang, Yang Yang, Qi Li, Shen- Li Tang, Wei-Nan Zeng, Jin Xu et al. Adductor canal block versus femoral nerve block for total knee arthroplasty: a meta-analysis of randomized controlled trials. Scientific reports | 7:40721 | DOI: 10.1038/ srep40721.