IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 10 Ser.14 (October. 2019), PP 33-38
www.iosrjournals.org

Adductor Canal Block as an Alternative to Femoral Nerve Block for Postoperative Analgesia Following Arthroscopic Knee Surgery

Burhan Ashiq [1] ,Anka Amin [2], Ashufta Rasool [3], Tahir A Masoodi[4]
[1] *Senior Resident* [2].*Assistant Professor* [3].*Assistant Professor* [4].*Senior Resident*
Department of Anesthesiology and Critical Care, Government Medical College Srinagar Kashmir India

Corresponding author: Dr Anka Amin, Department of Anesthesiology and Critical Care, Government Medical College Srinagar Kashmir India190010

Abstract:
Background*: As the emphasis has been on faster recovery during the early postoperative period, recent trends in pain management protocols following arthroscopic knee surgeries have shifted toward effective analgesia with minimal complications.Based on its excellent analgesic effect, FNB has gained widespread use as part of arthroscopic knee surgeries pain control regimens. However, FNB is associated with a significant decrease in the strength of quadriceps muscles which may prolong mobilization. Adductor canal block on the other hand is currently considered as an effective alternative to FNB to FNB that produces a predominantly sensory block besides preserving the strength of quadriceps. This study was conducted to explore practical issues for ACB and to compare analgesic efficacy and functional recovery between ACB and FNB in patients undergoing arthroscopic knee surgeries*
Method: *Sixty patients of ASA physical status of I-II of both sexes, aged between 18-75 years, undergoing arthroscopic knee surgeries were included in this study. It was an prospective observational study. On arrival the patients were assessed and spinal anesthesia was given Twenty eight patients received adductor canal block and were grouped under group ACB, while 22 patients who were administered femoral nerve block were grouped under FNB. All the blocks were performed under USG guidance. Post operatively all patients were monitored for hemodynamic parameters, pain score, side effects and mobilization ability. Patient's satisfaction with anesthetic technique was also assessed.*
Results: *ACB, which offers almost pure sensory blockade, has emerged as a reasonable alternative to FNB that result in the strength of of quadriceps muscles, as part of a current arthroscopic knee surgeries pain control protocol. There were significant differences in mobilization ability between the two groups in the TUG test. In addition, although ACB offered comparable pain relief with preserved motor strength, patient satisfaction did not differ.*
Conclusion*: The findings of this study suggest that ACB is a more appropriate analgesic modality than FNB in patients undergoing current multimodal perioperative protocols after arthroscopic knee surgeries.*
Key words:*Adductor canal block, femoral nerve block,arthroscopic knee surgery, multimodal pain management.*

Date of Submission:17-10-2019 Date of Acceptance: 02-11-2019

I. Introduction

Severe intra operative and postoperative pain after arthroscopic knee surgery is significant enough to interfere with initial recovery, range of motion and duration of stay in hospital. Optimal pain relief and minimal side effects have a major impact on patient outcome including patient satisfaction, besides helping in streamlining low cost surgical services [1]. Arthroscopic surgical techniques and early mobilization after surgery have made knee surgeries more patient friendly. Despite the fact that arthroscopic procedures are minimally invasive, patients do experience severe pain during the early postoperative period [2]. After arthroscopic knee surgery appropriate management of postoperative pain results in faster recovery, reduces the risk of complications and improves patient satisfaction. While preemptive use of multimodal measures is now accepted as a principle of pain management after arthroscopic knee surgery, no acceptable standard pain management protocol has been established. There are different pain management regiments currently used following arthroscopic knee surgery. Among these peripheral nerve block (PNBs) provide effective and synergistic pain relief when used as part of a multimodal regimen and are considered an essential part of the current multimodal pain management protocol [3-6].

Peripheral nerve block hasgained significance as anesthetic component of the drive towards multi-modal peri-operative analgesia for total hip or knee arthroscopy. It results in reduction in the use of opioids, both as part of the anesthetic regimen and the post-operative infusion. Thus, it reduces the incidence of opioid-induced post-operative nausea and vomiting, sedation and respiratory depression. In view of satisfactory pain relief and the opioid sparing effect, femoral nerve block (FNB) is commonly used as an analgesic modalityand isconsidered the standard PNB in patients undergoing arthroscopic knee surgery. Further the use of ultra sound guided PNB techniques lead to lesser needle attempts and consequently improvesblock success ratebesides reduced blockperformance and onset times [7-11].

FNBhowever, results in significant decrease in quadriceps muscle strength, followed by delayed mobilization, which has the potential risk of falling [12-17]. As against this the adductor canal block is a predominantly sensory block and after knee arthroscopy can be used as an alternate for post-operativeanalgesia. Adductor canal block (ACB) was first described by Vander Wal [18-19] and is a highly successful approach to the saphenous nerve. ACB as compared to FNB results in less reduction in the quadriceps muscle strength as only the motor nerve to the vastus medialis of the quadriceps muscle traverses the adductor canal [20].

The study was thus conducted to determine the post-operative outcomes following adductor canal block and femoral nerve block in patients undergoing arthroscopic knee surgery. Main aim was to assess duration and quality of analgesia, requirement of additional analgesia in 24 hours, quadriceps muscle strength, patient satisfaction score and inadvertent side effects of these blocks and drugs if any.

II. Material and Methods:

The present study was conducted in the Department of Anesthesiology in Bone & Joint Hospital which is one of the associated hospitalof Government Medical Collage Srinagar from October 2017 to October 2019. Sixty patients of American Society of Anesthesiology physical status I-II of both sexes, aged between 18 and 75 years, undergoing arthroscopic knee surgeries were selected for the study. After getting approval from Institutional Ethical Committee, written informed consent was obtained from all the patients before surgery. Patients with BMI > 35, chronic opioid use, neuropathic pain, contraindication to neuraxial block, contra indication to adductor canal block (ACB)or femoral nerve block (FNB) allergy or contraindication to the drug to be used , severe psychiatric or mental disorder were excluded from the study.

On arrival to operating room, an 18‑gauge intravenous catheter was inserted and monitoring of electrocardiography, non-invasive blood pressure, oxygen saturation (SpO_2) was started and baseline values were recorded. Patients were premedicated with midazolam 1-2 mg and fentanyl 25-50 mcggiven intravenously. Spinal anesthesia was performed in the sitting position with a 25-gaugeWhitacre needle, using a midline approach at L4-5 inter space. Once free flow of CSF was recognized the intrathecal anesthetic solution (12 mg of 0.5% bupivacaine) was injected over 15 s, aspirating CSF at the end of injection to confirm needle position. After intrathecal injection, the patients were put in supine position. Supplemental oxygen was given at 4L/min. Surgery was started when adequate sensory block was obtained. At the end of surgery the patients received either ACB or FNB depending up on the preference of the attending anesthesiologist. All the blocks were performed under USG guidance by the experienced anesthesiologist. Patients were randomly allocated into two groups:

I ACB group comprised of 28 patients who received adductor canal block.

II FNB group comprised of 22 patients who received femoral nerve block.

The femoral nerve block was performed with the patients in the supine position. The area was cleaned. The transducer was placed transversely on the inguinal crease over the pulse of the femoral artery and moved in lateral to medial direction to identify the femoral artery and nerve. A skin wheal of LA was made 1cm away from the lateral edge of the transducer and the needle was inserted in plane in a lateral to medial orientation towards the nerve.The needle was passed through the fascia iliaca and when the needle tip was adjusted adjacent to the nerve,15ml of 0.5% of Ropivacaine + 2mg Dexamethasone was injected after careful aspiration.

For the adductor canal block the patients were positioned in supine with knee slightly flexed and leg externally rotated (frog leg position). After cleaning the area, a high frequency linear ultrasound transducer was placed transverse to the longitudinal axis of the extremity. The saphenous nerve was located as a hyperechoic structure placed anterior to the artery in the adductor canal. Local anesthetics solution of 15 mL of 0.5% Ropivacaine + 2mg Dexamethasone was deposited around the SN.All patients were observed for 24 hr after the end of surgery. The intensity of post-operative pain was recorded for all the patients using a scale of 0-10 VAS score at 15min, 30min, 1 , 4, 8, 12,16 , 24 hours after surgery. Patients who reported VAS 4 or >4 were given injection tramadol 50mg IV repeated once if required after 30 min. Total analgesic consumption in 24 hrs was noted The patient's satisfaction with the anesthetic technique was assessed on a scale of 1-5 where a score of 1 indicated strongly dissatisfied and score of 5 strongly satisfied. The ability to mobilize was assessed by the timed up and go test at 1, 6 and 24 hrs post operatively. The TUG test measures the time it takes for a person to

stand up from a chair, walk a distance of 3m and return to the chair.Patients were observed for any inadvertent adverse effects like nausea, vomiting, bradycardia, hypotension, pruritus etc.

III. Results & Observation

The study was successfully conducted in all the 60 patients and there was no perioperative protocol deviation. The patients in two groups were compared with respect to age, weight, height, gender distribution, ASA class, and duration of surgery. The demographic data reveals that both the groups are comparable in age, weight and height. The age in group ACB and FNB ranged between 18 to 75 years with a mean age of 56.75±12.50 and 55.50±13.25 years respectively. The statistical analysis between two groups was not significant (p= 0.876) as shown in table 1. In group ACB, weight ranged between 50-80 kg with a mean weight of 61.50±8.87kg while as it was between 50-90 kg with a mean weight of 62.50±10.99 in FNB group. . When the values were compared statistically the difference was found to be insignificant (p=0.82). Height in ACB and FNB varied between 157-175cm with a mean height of 166.3±4.61cm. In FNB mean height was 168.4±5.547cm in a range of 160-179 cm and the difference between the two groups was found statistically insignificant (p=0.264). Duration of surgery ranged between 40-60 minutes in both the groups with a mean duration of 48.50±11.5 and 47.75±12.5 minutes in group ACB and FNB respectively. The statistical difference between the groups was insignificant (p=0.743). Majority of patients in the study population belonged to ASA class-I and variation in ASA class of distribution of patients among two groups was statistically insignificant (p=0.631). All the patients in two groups were comparable regarding the gender of the patients and the variation in gender distribution between groups was statistically insignificant (p=1.0).

Table 1. Comparison of various demographic parameters between two groups

Variable	Group ACB(n=28)	Group FNB(n=22)	*P* value	Remarks
Age	56.75 ± 12.50 (18-75)	55.50±13.25 (18-75)	0.876	NS
Weight	61.50 ± 8.87 (50-80)	62.50±10.99 (50-90)	0.82	NS
Height	166.30±4.61 (157-175)	165.40±5.547 (160-179)	0.264	NS
ASA I/II	18/10	16/06	0.631	NS
Gender Male/female	18/10	14/08	1.00	NS
Duration of surgery	48.50 ± 11.50	47.75±12.50 (40-60min)	0.743	NS

The pain intensity increased with hours in both the groups and peak was observed eight hours after operation in ACB group while as it was observed between 8 and 12 hours in FNB group. (Table2). VAS score remained less than 3.0 until the 4 hours postoperatively in FNB patients. . After 12 hours the pain score showed a declining trend. Visual analogue score at different time intervals were statistically insignificant between the two study groups (p>0.05).

The time to first request for analgesia ranged from 4 to 11 hours with a mean of 6.90±3.5 hours in group ACB, and 4-12 hours with a mean of 7.25±2.9 hours in group FNB (Table 3). The statistical difference was in significant among the study groups (p value >0.05).Total tramadol consumption was almost similar among the study groups and statically difference was in significant with P >0.05.It was 80± 30 mg in ACB group and 85± 32 mg in FNB group (Table 4).

Table 2. Post-operative VAS score in studied groups:-

Time	Group	Mean	SD	*p*-value	Remarks
15 min	ACB	2.9	1.4	0.765	Non Sig
	FNB	2.1	1.1		
30 min	ACB	3.1	2.2	0.681	Non Sig
	FNB	2.3	1.3		
I h	ACB	3.2	2.1	0.652	Non Sig
	FNB	2.8	1.5		
4 h	ACB	3.8	2.7	0.821	Non Sig
	FNB	3.0	2.1		
8 h	ACB	4.1	2.9	0.611	Non Sig
	FNB	3.5	2.5		
12 h	ACB	3.9	2.5	0.732	
	FNB	3.6	1.9		
16 h	ACB	3.5	2.3	0.654	Non Sig
	FNB	3.1	1.5		
24 h	ACB	1.2	0.70	0.124	Non sig
	FNB	0.9	0.85		

Table 3. Time to first request of analgesic in postoperative period (hours).

Group	Mean	SD	Range	p-value	Remarks
ACB (n=28)	6.90	3.5	4-11		
FNB (n=22)	7.25	2.9	4-12	0.768	Non Sig

The time to first request for analgesia ranged from 4 to 11 hours with a mean of 6.90±3.5 hours in group ACB, and 4-12 hours with a mean of 7.25±2.9 hours in group FNB (Table 3). The statistical difference was in significant among the study groups (p alue >0.05).

Table 4. Total analgesic dose in first 24h (mg).

Group	Mean	SD	P-value	Remarks
ACB (n=28)	80±30	3.4		
FNB (n=22)	85±32	3.9	0.701	Non Sig

Total tramadol consumption in the first 24 hours postoperatively was almost similar among the study groups and difference was statistically insignificant with P >0.05 (Table 4). In the first 24 hours 80±30 mg of tramadol was consumed in ACB group which was slightly higher (85±32 mg) in FNB group.

Table 5.TUG Score Different time intervals 1 h,6 h,24 hrs.

Groups	No. of patients	Mean	SD	Range	P value	Remarks
Group ACB	28	4.5	1.9	3-6.0	<0.05	Sig
Group FNB	22	8.0	2.85	5-9.0		

There was significant difference in mobilization ability between the groups in the TUG test (P <0.05), at different time intervals between the study groups. The patients in ACB group took comparatively less time to stand up from chair , walk a distance of three meters and return to chair as is seen in table 5.

Table 6. Post operative adverse/side effects in study groups**:-**

Variables	Group ACB(n=28)	Group FNB (n=22)	p-value	Remarks
Nausea	04(14.28)	06(27.27)	0.88	Non Sig
Vomiting	04(14.28)	03(13.63)	0.66	Non Sig
Pruritus	01(3.57)	2 (9.09)	0.40	Non Sig
Bradycardia	03(10.71)	04(18.18)	0.78	Non sig
Hypotension	04(14.28)	03 (13.63)	0.65	Non sig

Post operative adverse effects including nausea, vomiting, pruritus, bradycardia and hypotension observed were comparable among the two study groups (Table 6). The incidence of both vomiting and nausea was 14.28 % in ACB group against 13.63 and 27.27 % respectively in FNB group. The incidence of pruritus, bradycardia and hypotension was 3.57,10.71 and 14.28 percent in ACB group as against 9.09, 18.18 and 13.63 percent in FNB group resprctively. When compared statistically, the results were found not significant.(p value of >0.05.).

Table 7. Patient satisfaction:

Variable	Group ACB N=28	Percentage	Group FNB N=22	Percentage
Excellent	22	78.57	16	72.72
Good	04	14.28	04	18.18
Poor	02	7.14	02	9.09

The above table shows the patients satisfaction among the study population. Satisfaction with the technique was similar in both the groups. While majority of the patients were satisfied in both the groups (72.72-78.57 %), the level of poor satisfaction was as low as 7.14-9.09 %. The patients were discharged 24 hours after surgery and sent for passive physiotherapy.

IV. Discussion

Although arthroscopic knee surgery is minimally invasive, it is associated with severe post-operative pain which interferes with initial recovery of patients and their early rehabilitation. While the main focus has always been on faster recovery during the postoperative period, the emphasis in pain management protocols following arthroscopic knee surgeries have shifted to effective analgesia with minimal complications. Management of postoperative pain is, therefore, a challenge during knee surgery. It is one of the major factors that determine rehabilitation and hospital discharge. Based on its excellent analgesic effect, FNB has gained widespread use as part of arthroscopic knee surgeries pain control regimens. However, there are reports that FNB reduces the strength of quadriceps, which besides being essential for early mobilization and is associated

with an increased risk of postoperative falls [4, 12, and 13]. ACB,therefore, is currently considered as aneffectivealternative to FNB that produces a predominantly sensory block and preserves the strength of quadriceps in patients [20-21].

The current observational study was designed to compare analgesic efficacy and functional recovery between ACB and FNB, and to assess the quality of analgesia, execution time of techniques, incidence of complications and patient satisfaction and duration of analgesia. The study demonstrated that the ACB offers almost pure sensory block and is more appropriate analgesic modality than FNB in patients undergoing current multimodal perioperative protocols after arthroscopic knee surgery. It has emerged as an effective alternative to the FNB. The strength of quadriceps was not effected and comparable pain relief with preserved motor strength was satisfactorily achieved. It was not in any case inferior to the FNB regarding VAS scores and opioid consumption. However, there was no significant difference in patient satisfaction. Elsewhere also several studies validated the ACB as an effective analgesic method in arthroscopic knee surgery [22].

Jenstrup et al [23]demonstrated effectiveness of the ACB on pain and ambulation after arthroscopic knee surgeries, compared with placebo.While in the study of the authors the strength was not objectively measured and it involved a high dose of local anesthetic (30 ml of 0.75% ropivacaine, 225 mg). This large dose of local anesthetic may have resulted in the weakness of e quadriceps. The present study used a lower dose of anesthetic (15 ml of ropivicane) and directly compared ACB with FNB.

In the present study a regimen of 15 ml of 0.5% Ropivacaine and 2mg Dexamethasone was applied. In earlier reports related to ACB, local anesthetics were administered as repeated boluses via a catheter to ensure spread of local anesthetic throughout the entire aponeurotic canal [23,24,25,26]. Since it was not possible to ensure proper administration of intermittent boluses in the present study we chose infusion which may have reduced the analgesic potential of ACB.On the contrary, a previous study has shown that reducing the total dose of local anesthetic for FNB was followed by insufficient pain relief [27] .In the present studywe observed superior functional recovery in ACB group after arthroscopic knee surgery. This observation draws support from earlier studies [28-31]. Quadriceps muscle weakness results in functional impairment and is associated with an increased risk of fall. However, some earlier studies suggest that there was no evidence that ACB reduced the risk for postoperative falls, which may be a fatal complication of FNB,[32-36] or LOS [37] compared with FNB. Heterogeneity among studies in reporting outcome variables made uniform comparison difficult, and further studies are needed to determine whether ACB provides superior functional recovery compared with FNB.

V. Conclusion

The findings of this study suggest that ACB which offers almost pure sensory blockade seems to be a reasonable alternative to FNB, that leads to substantial reduction in quadriceps muscle strength, as part of a current arthroscopic knee surgeries pain control protocol.. The findings of this study suggest that ACB is a more appropriate analgesic modality than FNB in patients undergoing current multimodal perioperative protocols after arthroscopic knee surgeries.

Bibliography

[1]. **Fischer HBJ, Simanski CJP, Sharp C et al.** A procedure-specific systematic review and consensus recommendations for post-operative analgesia following total knee arthroplasty. *Anaesthesia* 2008; 63:1105-23.

[2]. Korean Knee Society. Guidelines for the management of postoperative pain after total knee arthroplasty. Knee Surg Relat Res. 2012;24:201-7.

[3]. Parvizi J, Miller AG, Gandhi K. Multimodal pain management after total joint arthroplasty. J Bone Joint Surg Am.2011;93:1075-84.

[4]. Pelt CE, Anderson AW, Anderson MB, Van Dine C, Peters CL. Postoperative falls after total knee arthroplasty in patients with a femoral nerve catheter: can we reduce the incidence? J Arthroplasty. 2014;29:1154-7.

[5]. Memtsoudis SG, Dy CJ, Ma Y, Chiu YL, Della Valle AG, Mazumdar M. In-hospital patient falls after total joint arthroplasty: incidence, demographics, and risk factors in the United States. J Arthroplasty. 2012;27:823-8.

[6]. Chan MH, Chen WH, Tung YW, Liu K, Tan PH, Chia YY. Single-injection femoral nerve block lacks preemptive effect on postoperative pain and morphine consumption in total knee arthroplasty. Acta Anaesthesiol Taiwan. 2012;50:54-8

[7]. 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.

[8]. Andersen HL et al. Continuous Saphenous Nerve Block as Supplement to Single-Dose Local Infiltration Analgesia for postoperative Pain Management After Total Knee Arthroplasty.RegAnesth Pain Med 2013; 38 (2): 106-111.

[9]. Carr DB, Goudas LC (1999) Acute pain. Lancet 353: 2051-2058.

[10]. Slover J, Riesgo A, Payne A, Umeh U (2014) Modern Anesthesia for TotalJoint Arthroplasty. Ann Orthop Rheumatol 2: 1026.

[11]. Kerr DR, Kohan L (2008) Local infiltration analgesia: a technique for the control of acute postoperative pain following knee and hip surgery: a case study of 325 patients. Acta Orthop 79: 174-183.

[12]. Feibel RJ, Dervin GF, Kim PR, Beaule PE. Major complications associated with femoral nerve catheters for knee arthroplasty: a word of caution. J Arthroplasty. 2009;24(6 Suppl):132-7.

[13]. Atkinson HD, Hamid I, Gupte CM, Russell RC, Handy JM.Postoperative fall after the use of the 3-in-1 femoral nerve block for knee surgery: a report of four cases. J Orthop Surg(Hong Kong). 2008;16:381-4.

[14]. Wu CL, Richman JM. Postoperative pain and quality of recovery. *Curr Opin Anaesthesiol.* 2004; 17(5): 455-60.

[15]. Sinatra RS, Torres J, Bustos AM. Pain management after major orthopaedic surgery: current strategies and new concepts. *J Am Acad Orthop Surg*. 2002; 10(2): 117-29.
[16]. 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): 1144-62.
[17]. Chan MH, Chen WH, Tung YW, Liu K, Tan PH, Chia YY. Single-injection femoral nerve block lacks preemptive effect on postoperative pain and morphine consumption in total knee arthroplasty. Acta Anaesthesiol Taiwan. 2012;50:54-8.
[18]. Parvataneni HK, Shah VP, Howard H, Cole N, Ranawat AS, et al. (2007) Controlling pain after total hip and knee arthroplasty using a multimodal protocol with local periarticular injections: a prospective randomized study. J Arthroplasty 22: 33-8.
[19]. van der Wal M, Lang SA,Yip RW (1993) Transsartorial approach for saphenous nerve block. Can J Anaesth 40:542-46.
[20]. Jaeger P, Nielsen ZJ, Henningsen MH, Hilsted KL, Mathiesen O, et al (2013) Adductor canal block versus femoral nerve block and quadriceps strength: a randomized, double-blind, placebo-controlled, crossover study in healthy volunteers. Anesthesiology 118: 409-15.
[21]. Grevstad U, Mathiesen O, Lind T, Dahl JB (2014). 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: 112:912-919.
[22]. Allen HW, Liu SS , Ware PD, Nairn CS, Owens BD: Peripheral nerve blocks improve analgesia after total knee replacementsurgery. Anesth Analg 1998; 87:93–7.
[23]. Jenstrup MT, Jaeger P**,** Lund J, et al. Effects of adductor-canal-blockade on pain and ambulation after total knee arthroplasty: a randomized study. Acta Anaesthesiol Scand. 2012;56:357–364.
[24]. Lund J, Jenstrup MT, Jaeger P, Sorensen AM, Dahl JB. Continuous adductor-canal-blockade for adjuvant post-operative analgesia after major knee surgery: preliminary results. Acta Anaesthesiol Scand. 2011;55:14–19.
[25]. Jaeger P, Grevstad U, Henningsen MH, Gottschau B, Mathiesen O, Dahl JB. Effect of adductor-canal-blockade on established, severe post-operative pain after total knee arthroplasty: a randomised study. Acta Anaesthesiol Scand. 2012;56:1013–1019.
[26]. Horner G, Dellon AL. Innervation of the human knee joint and implications for surgery. Clin Orthop Relat Res. 1994;301:221–226.
[27]. Brodner G, Buerkle H, Van Aken H, et al. Postoperative analgesia after knee surgery: a comparison of three different concentrations of ropivacaine for continuous femoral nerve blockade. Anesth Analg. 2007;105:256–262.
[28]. Wiesmann T, Piechowiak K, Duderstadt S, Haupt D, Schmitt. J, Eschbach D, Feldmann C, Wulf H, Zoremba M, Steinfeldt T. Continuous adductor canal block versus continuous femoral nerve block after total knee arthroplasty for mobilization capability and pain treatment: a randomised and blinded clinical trial. Arch Orthop Trauma Surg. 2016;136:397-406.
[29]. Memtsoudis SG, Yoo D, Stundner O, Danninger T, Ma Y, Poultsides L, Kim D, Chisholm M, Jules-Elysee K, Valle AG, Sculco TP. Subsartorial adductor canal vs femoral nerve block for analgesia after total knee replacement. Int Orthop. 2015;39:673-80.
[30]. Li D, Yang Z, Xie X, Zhao J, Kang P. Adductor canal block provides better performance after total knee Arthroplasty compared with femoral nerve block: a systematic review and meta-analysis. Int Orthop. 2016;40:925-33.
[31]. Zhao XQ, Jiang N, Yuan FF, Wang L, Yu B. The comparison of adductor canal block with femoral nerve block following total knee arthroplasty: a systematic review with metaanalysis. J Anesth. 2016;30:745-54.
[32]. Elkassabany NM, Antosh S, Ahmed M, Nelson C, Israelite C, Badiola I, Cai LF, Williams R, Hughes C, Mariano ER, Liu J. 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;122:1696-703.
[33]. Mudumbai SC, Kim TE, Howard SK, Workman JJ, Giori N, Woolson S, Ganaway T, King R, Mariano ER. Continuous adductor canal blocks are superior to continuous femoral nerve blocks in promoting early ambulation after TKA. Clin Orthop Relat Res. 2014; 472:1377-83.
[34]. Kim DH, Lin Y, Goytizolo EA, Kahn RL, Maalouf DB, Manohar A, Patt ML, Goon AK, Lee YY, Ma Y, Yadeau JT. Adductor canal block versus femoral nerve block for total knee arthroplasty: a prospective, randomized, controlled trial. Anesthesiology. 2014; 120:540-50.
[35]. Jaeger P, Zaric D, Fomsgaard JS, Hilsted KL, Bjerregaard J, Gyrn J, Mathiesen O, Larsen TK, Dahl JB. Adductor canal block versus femoral nerve block for analgesia after total knee arthroplasty: a randomized, double-blind study. Reg Anesth Pain Med. 2013; 38:526-32.
[36]. Li D, Ma GG. Analgesic efficacy and quadriceps strength of adductor canal block versus femoral nerve block following total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc. 2016; 24:2614-9.
[37]. Dong CC, Dong SL, He FC. Comparison of adductor canal block and femoral nerve block for postoperative pain in total knee arthroplasty: a systematic review and meta-analysis. Medicine (Baltimore). 2016; 95:e2983

Burhan Ashiq. "Adductor Canal Block as an Alternative to Femoral Nerve Block for Postoperative Analgesia Following Arthroscopic Knee Surgery." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 10, 2019, pp 33-38.