The European Research Journal 2019;5(3):473-478 ORIGINAL ARTICLE

Comparison of femoral block and adductor canal block in the postoperative analgesia of patients undergoing arthroscopic knee surgery

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DOI: 10.18621/eurj.390275

ABSTRACT

Objectives: The aim of the study was to compare adductor canal block and femoral nerve block in the postoperative analgesia of patients undergoing elective arthroscopic knee surgery with respect to opioid use and Visual Analogue Scale (VAS), which is a unidimensional measurement of pain intensity.

Methods: The study was designed and conducted prospectively between April 2016 and November 2016 in a tertiary care hospital but the results were evaluated retrospectively. Prior to the induction of general anesthesia for knee surgery, (the first) 20 consecutive patients underwent femoral nerve block, and (the second) 20 consecutive patients received adductor canal block. Patients receiving adductor canal block for analgesia were referred to as Group A and patients receiving femoral nerve block for analgesia were defined as Group F. Pain was evaluated using the VAS score.The results were compared statistically.

Results: Both the femoral nerve block and adductor canal block groups showed similar results in terms of VAS and opioid use ($p < 0.05$).

Conclusion: In the postoperative analgesia of patients undergoing elective arthroscopic knee surgery, no difference was found between adductor canal block and femoral nerve block in terms of opioid use and VAS scores.

Keywords: adductor canal block, femoral nerve block, visual analogue scale

Received: February 5, 2018; Accepted: March 8, 2018; Published Online: June 10, 2018

Knee arthroscopy is a frequent procedure in orthopedic surgery. Providing effective analgesia after such a procedure is crucial to facilitate early rehabilitation and to reduce the duration of hospitalization [1]. There are several methods to provide analgesia in the postoperative period. Among these methods, peripheral nerve blocks are increasingly being used It has been reported that peripheral nerve blocks cause fewer systemic side effects [1, 2].

The femoral nerve block has been shown to be superior to intra-articular local anesthesia in the postoperative analgesia of patients undergoing knee surgery [3, 4). However, reduced quadriceps muscle strength as a result of motor blockade and the consequent increase in the risk of falls may limit the value of this procedure, especially in minor surgeries [3, 5]. On the other hand, adductor canal block has

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e-ISSN: 2149-3189

been reported to preserve quadriceps muscle strength better than femoral nerve block [6, 7].

Our aim in this study was to compare adductor canal block and femoral nerve block in the postoperative analgesia of patients undergoing elective arthroscopic knee surgery with respect to opioid use and Visual Analogue Scale (VAS), which is a unidimensional measurement of pain intensity.

METHODS

The study was designed and conducted retrospectively between April 2016 and November 2016 in a tertiary care hospital. Ethical committee approval was obtained before the study, and informed patient consent was taken from all patients. Prior to the induction of general anesthesia for knee surgery, (the first) 20 consecutive patients underwent femoral nerve block, and (the second) 20 consecutive patients received adductor canal block as a complement to a standardized analgesic regimen. Patients between 20 and 60 years of age, who had an ASA score of I-III and who underwent elective surgery were included in the study. Patients with neurological or psychiatric pathologies and patients with BMI > 40 were excluded from the study. Exclusion criteria also included contraindications to peripheral nerve blockade such as infection, bleeding disorders and allergy to the drugs used in thestudy.

Patients receiving adductor canal block for analgesia were referred to as Group A and patients receiving femoral nerve block for analgesia were defined as Group F. Nerve blocks were performed under aseptic conditions using an ultrasound device equipped with a high frequency linear probe (LOGIQE GE Healthcare ultrasound machine, GE Medical Systems, Phoenix - USA).

For femoral nerve block, the femoral artery was located using the in-plane technique, under aseptic conditions. Then, the femoral nerve immediately lateral to the femoral artery was identified and 30 mL of 0.25% bupivacaine was injected around the nerve. For adductor canal block, the probe was placed on the medial part of the mid-thigh, halfway between the anterior spina iliaca superior and the patella. The superficial femoral artery and vein were identified under the sartorius muscle. Using an in-plane technique, the needle was advanced towards the saphenous nerve, which was visualized as a hyperechoic structure located immediately lateral to the superficial femoral artery, and 10 mL 0.25% bupivacaine was injected around the nerve.

After administration of the block, general anesthesia was induced with 2 mg/kg propofol, 2 mg midazolam, 2 µg/kg fentanyl and 0.6 mg/kg rocuronium. During the operation, anesthesia was maintained in all patients with 2% sevoflurane. Adductor canal block and femoral nerve block are used routinely in our clinic.

Postoperative analgesia was provided by peripheral nerve blocks and a standardized analgesic regimen. As routine postoperative analgesia, the patients were given 50 mg iv tramadol and 20 mg/kg acetaminophen every 12 hours. If insufficient, 2 mg morphine was administered as supplementary analgesia. Additional doses of morphine were recorded.

Pain was evaluated using the VAS score. We routinely use this score in our clinic. Patients were asked to rate their pain on a scale of 0-10, with 0 representing "no pain" and 10 representing "worst possible pain". The hemodynamic data were also recorded alongside VAS at the 1st, 6th, 12th, 18th and 24th hours after surgery. The patients were discharged after 24 hours.

Statistical Analysis

Statistical analyses were performed using SPSS version 20 (SPSS Inc., Chicago, Illinois) program. The descriptive data (average, standard deviation, median, frequency, and ratio) and the quantitative data with non-normal distribution were analyzed using the Mann Whitney U test. The Student's t test was used for data with normal distribution. All statistical analyses were performed at a 95% confidence interval. A p-value < 0.05 was considered significant.

RESULTS

The demographic data of the patients are presented in Table 1. There was no demographic difference between the two groups ($p < 0.05$).

During the 24-hour postoperative follow-up, the mean arterial pressure and heart rate were monitored

Table 1. Demographic data

	Group F (n = 20)	Group A (n = 20)	*p* value
Age (year)	40.41 ± 15.31	33.42 ± 12.21	0.183
ASA	2.30 ± 1.65	1.57±0.64	0.129
Duration of surgery (min)	87.14 ± 51.65	99.50 ± 36.70	0.524
Duration of anesthesia (min)	10.81 ± 4.90	12.28 ± 4.17	0.373
Gender (male)	16 (80%)	14 (70%)	0.478

Data are shown as mean±standard deviation or number (%). ASA = American Society of Anaesthesiologists, Group A = patients receiving adductor canal block for analgesia, Group F = patients receiving femoral nerve block for analgesia

and recorded (Table 2), but no statistically significant difference was observed between the groups ($p < 0.05$).

The data on analgesia are presented in Table 3. The VAS scores were recorded at 1, 6, 12, 18, and 24 hours postoperatively. No difference was observed between the two groups in terms of VAS scores ($p < 0.05$). There was no statistically significant difference between the groups in terms of morphine consumption. Both the femoral nerve block and adductor canal block groups showed similar results in terms of VAS scores and opioid consumption.

None of the patients in the two groups experienced any complications of nerve damage due to regional block. Two of the patients in Group A, and one patient in Group F had postoperative nausea and vomiting. These patients received granisetron as antiemetic treatment.

DISCUSSION

In this study, no difference was observed between adductor canal block and femoral nerve block in terms of VAS and opioid consumption in the postoperative analgesia of patients undergoing knee arthroscopy. Our findings are in accordance with theliterature.

It is important to ensure early mobilization and efficient rehabilitation after arthroscopic knee surgery. Uncontrolled pain may hinder mobilization and consequently prolong the rehabilitation period [8]. Previous studies have shown that effective pain control results in better outcomes and decreases the duration of hospitalization [3, 8-10].

Femoral nerve block has been reported to be nearly as effective as epidural block, with fewer opioid-related side effects [8, 11, 12]. In terms of

Table 2. Postoperative hemodynamic data

	Group F (n = 20)	Group A (n = 20)	*p* value
MAP 1st hour (mmHg)	88.38 ± 8.62	87.26 ± 10.84	0.759
MAP 12th hour (mmHg)	85.60 ± 4.64	88.00 ± 5.52	0.163
MAP 24th hour (mmHg)	83.48 ± 6.35	88.92 ± 9.06	0.113
HR 1st hour (beat/min)	71.93 ± 8.91	78.00 ± 8.83	0.061
HR 12th hour (beat/min)	76.15 ± 8.51	76.32 ± 4.67	0.941
HR 24th hour (beat/min)	77.86 ± 6.76	75.31 ± 4.88	0.343

MAP = mean arterial pressure, HR = heart rate, Group A = patients receiving adductor canal block for analgesia, Group F = patients receiving femoral nerve block for analgesia

Table 3. Data on analgesia

	Group F (n = 20)	Group A (n = 20)	*p* value
VAS 1st hour	2.07 ± 2.40	1.50 ± 1.97	0.463*
VAS 6th hour	3.47 ± 2.19	4.24 ± 2.19	0.306*
VAS 12th hour	4.65 ± 2.00	4.22 ± 2.04	0.520*
VAS 18th hour	4.33 ± 2.16	4.73 ± 2.63	0.653*
VAS 24th hour	3.40 ± 2.01	4.50 ± 1.78	0.189*
Total Opioid Consumption 1st hour	2.10 ± 0.14	2.23 ± 0.32	0.574**
Total Opioid Consumption 6th hour	4.10 ± 1.04	3.70 ± 1.22	0.613**
Total Opioid Consumption 12th hour	6.38 ± 3.26	8.25 ± 3.35	0.376**
Total Opioid Consumption 18th hour	12.10 ± 4.76	12.55 ± 5.51	0.898**
Total Opioid Consumption 24th hour	18.57 ± 8.86	16.52 ± 6.98	0.728**

*The Student's t test, **Mann Whitney U. VAS = Visual Analogue Scale, Opioid = amount of morphine used (mg), Group A = patients receiving adductor canal block for analgesia, Group F = patients receiving femoral nerve block for analgesia

showing the efficacy of femoral nerve block, the results of our study comply with a recent study by Moura *et al*. [1], who have stated that femoral nerve block applied under ultrasonography guidance provides longer postoperative analgesia in patients undergoing knee surgery, in correlation to the bupivacaine concentration used.

In a recently conducted randomized controlled trial, adductor canal block was compared to placebo in a series of 50 arthroscopic knee surgery patients, and adductor canal block was found to be an effective method for analgesia following knee arthroscopy [14]. These results are in accordance with our study in terms of showing the effectiveness of adductor canal block. In another study comparing adductor canal block to placebo in patients undergoing arthroscopic medial meniscectomy, the Numerical Rating Scale (NRS) was used to score the pain, and significantly better results were observed in the adductor canal block group [3]. We have not found a significant difference between the two groups seems to support the previous literature suggesting that both methods have similar efficacies. There are studies in literature stating that femoral nerve block and adductor canal block both yieldexcellent results according to scoring systems based onpatient-satisfaction.

Kim *et al*. [13] have conducted a study similar to the present study, in which they compared femoral nerve block with adductor canal block in 93 patients, and they found no difference between the two groups in terms of opioid consumption. Jaeger *et al*. [7] have compared adductor canal block and femoral nerve block in patients undergoing knee arthroplasty. In their 54 patient series, both groups were shown to be similar in terms of opioid consumption [7]. Similarly, in a series of 100 patients undergoing anterior ligament repair, adductor canal block and femoral nerve block were found to be equal in terms of cumulative oral morphine consumption [15]. In the same way as our subjects, Dong *et al*. [16] reported that adductor canal block (ACB) shows no superiority than femoral nerve block (FNB) group regarding muscle strength and pain control. However, Li *et al*. [17] demonstrated that ACB preserved greater quadriceps strength more than FNB with similar pain control. Likewise again, the VAS pain scores were relatively lower in the two

groups compared with baseline, no significant difference was observed in pain relief at any follow-up time between the groups, suggesting both ACB and FNB provided better analgesia without any statistical significance in the last meta analyze [18].

Limitations

Our study has some limitations. Firstly, the data were gathered retrospectively and consecutively. The lack of randomization may lower the value of this study. However, the results were in accordance with the literature. Another limitation in this study is the lack of an objective assessment of the motor blockade in the quadriceps muscle. Thus, this study is unable to contribute to the literature in terms of early patient mobilization.

CONCLUSION

In conclusion, no difference was found between adductor canal block and femoral nerve block in the postoperative analgesia of patients undergoing elective arthroscopic knee surgery with respect to opioid use and VAS, which is a unidimensional measurement of pain intensity.

Authorship declaration

EKT conceived, designed and did statistical analysis & editing of manuscript; EKT, IB, GS, YP & EE did data collection and manuscript writing; and EKT did review and final approval of manuscript.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

Financing

The authors disclosed that they did not receive any grant during conduction or writing of this study.

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