

ORIGINAL RESEARCH

To Compare the Effectiveness of Adductor Canal Block and Femoral Nerve Block for postoperative analgesia following Knee Surgery

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ABSTRACT

Background and Aim: Due to the lack of motor sparing in adductor canal block and the analgesic effects postoperatively being on par with those of femoral nerve block, it is now regarded as a worthy substitute for femoral nerve block after knee surgeries. In this study, we tested the effectiveness of these 2 commonly used blocks by administering a standard dose of local anaesthetics to patients undergoing all knee surgeries, randomly assigning them to 2 groups, administering one block to each group, and monitoring the quadriceps' motor function and postoperative analgesia in both groups.

Materials and Method: Study was done on sixty patients divided into two groups (FN and AC) randomly after getting clearance from Institutional Ethics Committee. For both blocks, 15ml of 0.5% Bupivacaine with 5ml of Epinephrine was given. Demographics of each patient, hemodynamic data recorded intraoperatively, pain score (VAS score), muscle power grading, rescue analgesia and complications were noted and statistically analyzed using various tests.

Results: 60 patients in two groups- 30 in FN and 30 in AC were evaluated at T4, T5, T6 hours for FN were 3.80, 4.81, 5.6 and AC were 3.91, 5.87, 6.2 (p=0.001, 0.001, 0.032). VAS, rescue analgesia, patient satisfaction were not significant.

Conclusion: Adductor canal block showed significant higher grade of strengthening of quadriceps muscle than femoral nerve block postoperatively in 4th, 5th and 6th hour.

Keywords: Adductor canal block, Bupivacaine, Femoral nerve block, Rescue analgesia, VAS score

INTRODUCTION

An extended hospital stay, early ambulation, and moderate to severe postoperative pain are all common after knee surgeries. These complications increase patient dissatisfaction with the hospital and their perception of its performance, which raises the cost of healthcare services. Furthermore, acute and severe pain throughout the healing process can result in persistent pain after surgery. Postoperative pain that is not eased might result in clinical and psychological changes that reduce quality of life.^[1]

Multimodal analgesia is achieved by combining a number of analgesics that work through various mechanisms and at various locations in the nervous system.^[2] In order to lessen discomfort during and following knee surgery, a number of local anaesthetic techniques were used, such as femoral nerve block, fascia iliaca, and three in one block.

Effective nerve blocks preserve motor function, hasten mobilization, and reduce opioid intake and side effects. The ultimate goal following orthopaedic surgery is to maintain motor strength while using the appropriate analgesics to shorten hospital stays, recovery times, and physical therapy.

FNB works better than an epidural or intravenous patient-controlled analgesia for reducing pain and length of hospital stay. (PCA).^[3] A motor block caused by FNB makes falls more likely by 2%. FNB usually causes muscle weakness and pain relief.^[4]

Adductor canal blockage (ACB) has been proven effective in assisting knee surgery patients in controlling postoperative pain. According to anatomical research, the adductor canal may transport nerves besides the saphenous nerve. These nerves are the medial retinacular, vastus medialis, medial cutaneous, and articular branches of the obturator nerve. The medial and anterior knee, from the superior pole of the patella to the proximal tibia, are all affected by the sensory alterations. These areas are supplied by the saphenous nerve. The midhigh adductor canal block (ACB) is a frequent and efficient injection location because to ultrasonography.^[5]

The purpose of this study is to discuss the two regional blocks, Femoral Nerve Block and Adductor Canal Block, that are currently available for post-operative analgesia. It also aims to use ultrasound to determine early

ambulation for knee surgeries, such as total knee replacement, partial knee replacement, patellar surgeries, ligament repairs of the knee, etc., as well as to use Visual Analog Score (VAS) for pain assessment and Muscle Power Grading for measuring quadriceps strength after surgery.

MATERIAL AND METHOD

Following institutional ethical committee approval, details of operation and its goals described to the patients in their own language. Consent was obtained. The subarachnoid block was administered in sitting position in L2- L3 or L3-L4 spaces using 25G Quincke needle. Randomization via the chit-and-box method.

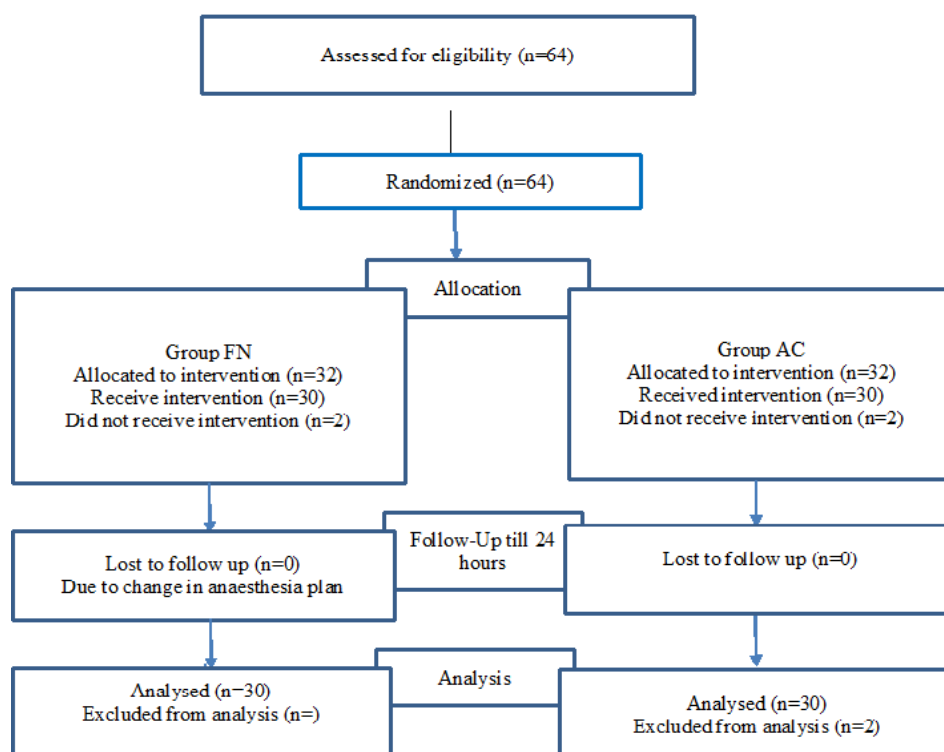


Figure 1: Consort flow diagram

In Group AC, an adductor canal block was performed using 15 ml of 0.5% Bupivacaine and 5 mcg of epinephrine. At time 0, 15, 30 minutes, 1 hour, 2, 4, 6, 10, 14, 18, and 24 hours, VAS scores were measured. A similar medication dose was administered for femoral nerve block in group FN. Additionally, hemodynamic parameters were evaluated.

As a first round of rescue analgesia following surgery, the patient was given an Inj. PCM 1mg IV infusion. This was followed by 8 hours of daily rescue analgesia.

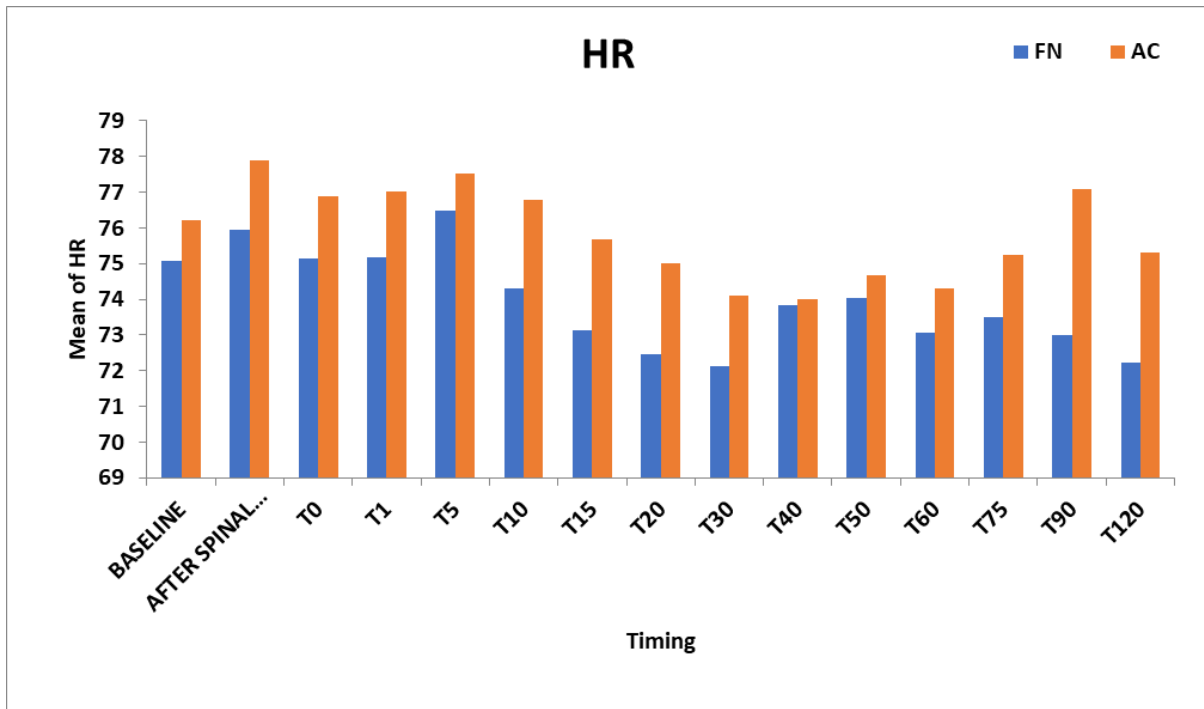
Statistical Analysis

We compared Quantitative variables by use of Independent t test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups. Qualitative variables were correlated using Chi-Square test/Fisher's Exact test. A p-value of <0.05 was considered statistically significant. Analysis was done using Statistical Package for Social Sciences (SPSS) version 21

Data was exported from Excel Sheet 2019 after collection and further processed and categorised for analysis. To calculate MEAN, SD, and t Test, the SPSS programme version 26 was utilised. A significance threshold of less than 0.05 was used for the study.

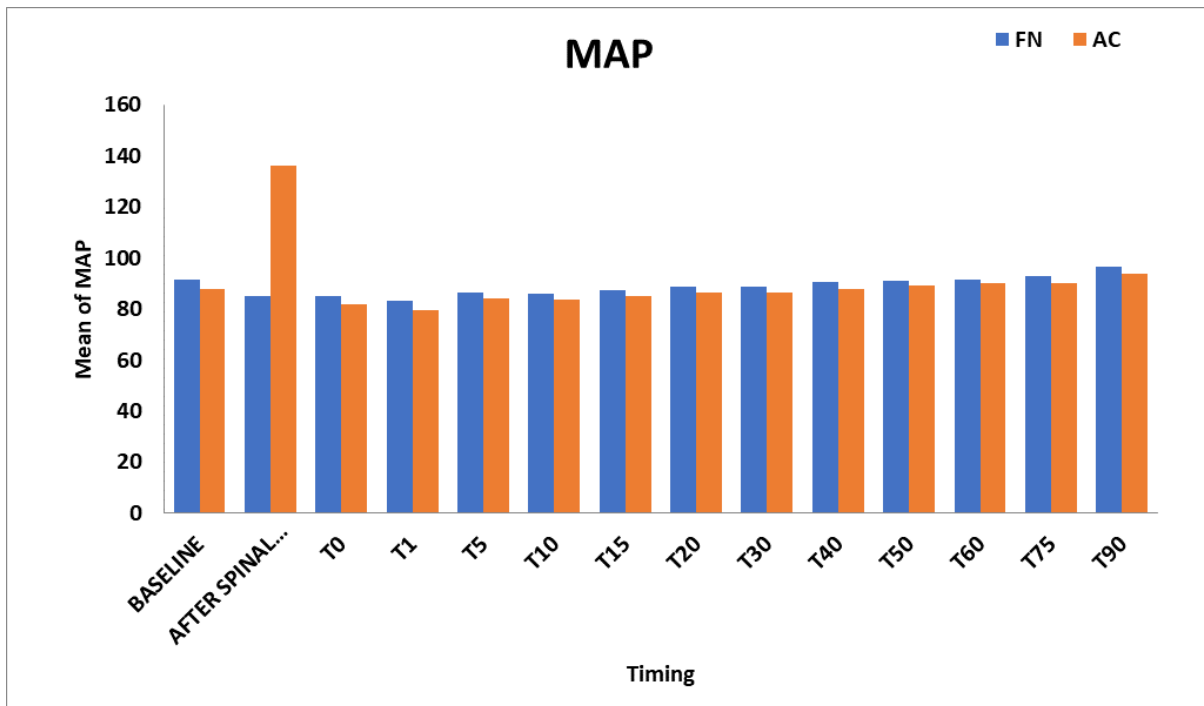
RESULT

Comparing Mean of Heartrate between FN and AC group



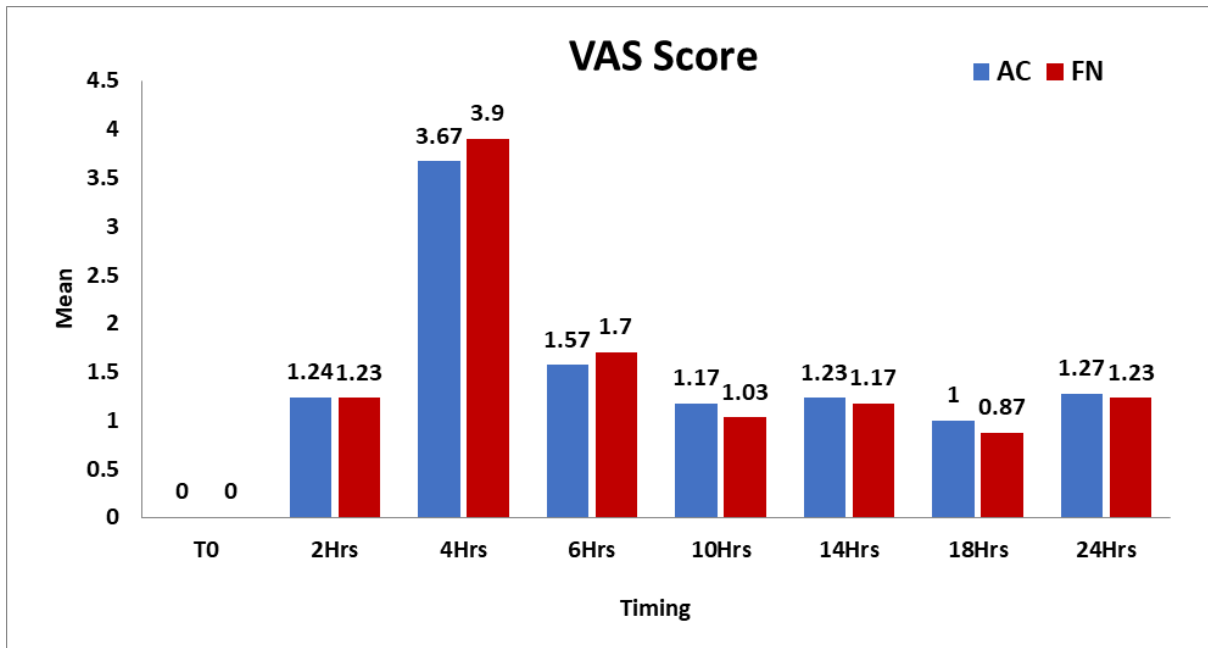
Graph 1: The result of difference was found not significant.

Comparing Mean of MAP (mmHg) between FN and AC group



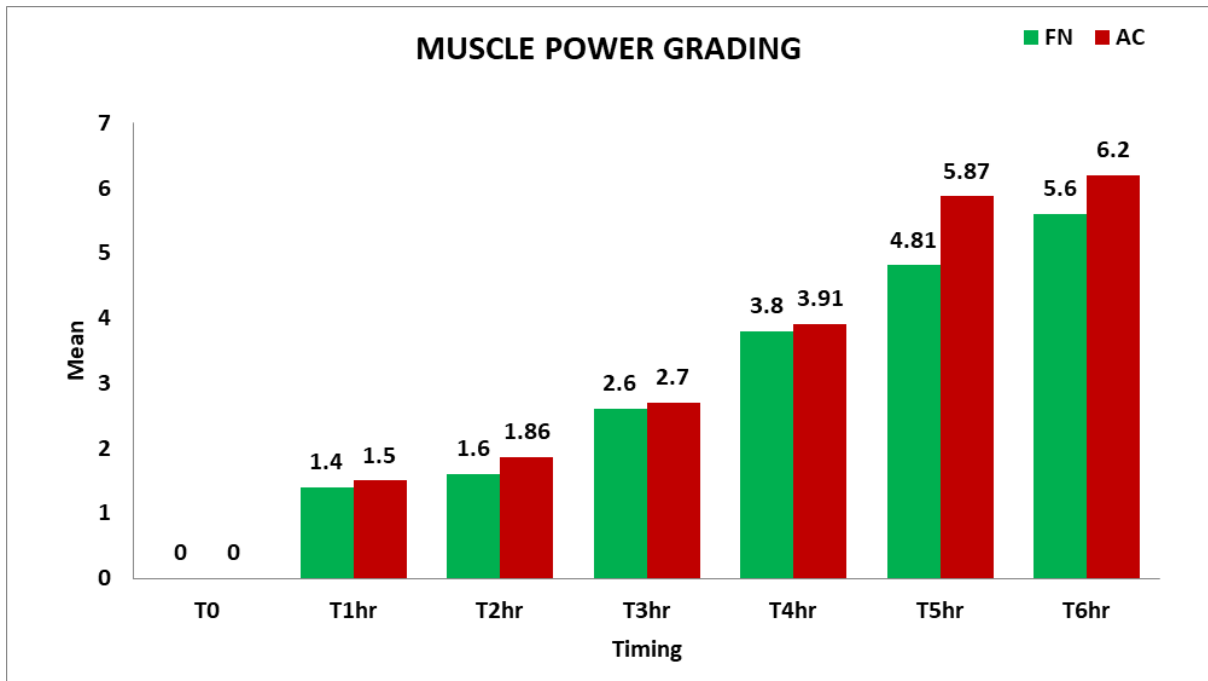
Graph 2: The result of difference between Mean MAP distribution between the two groups were not significant.

Comparing Mean of VAS score between FN and AC group



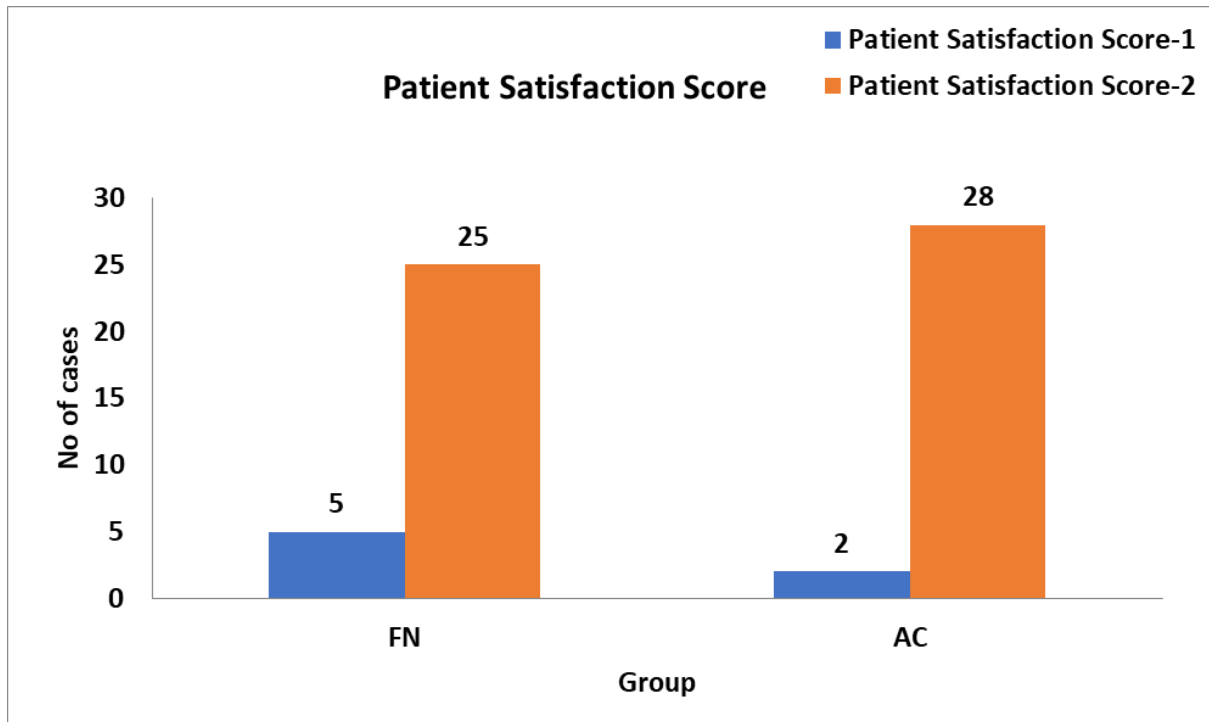
Graph 3: Above representation of VAS score between FN and AC group at T0, T2, T4, T6, T14, T18, T24hrs was not found significant.

Comparing Mean of Muscle Power Grading Between FN and AC groups



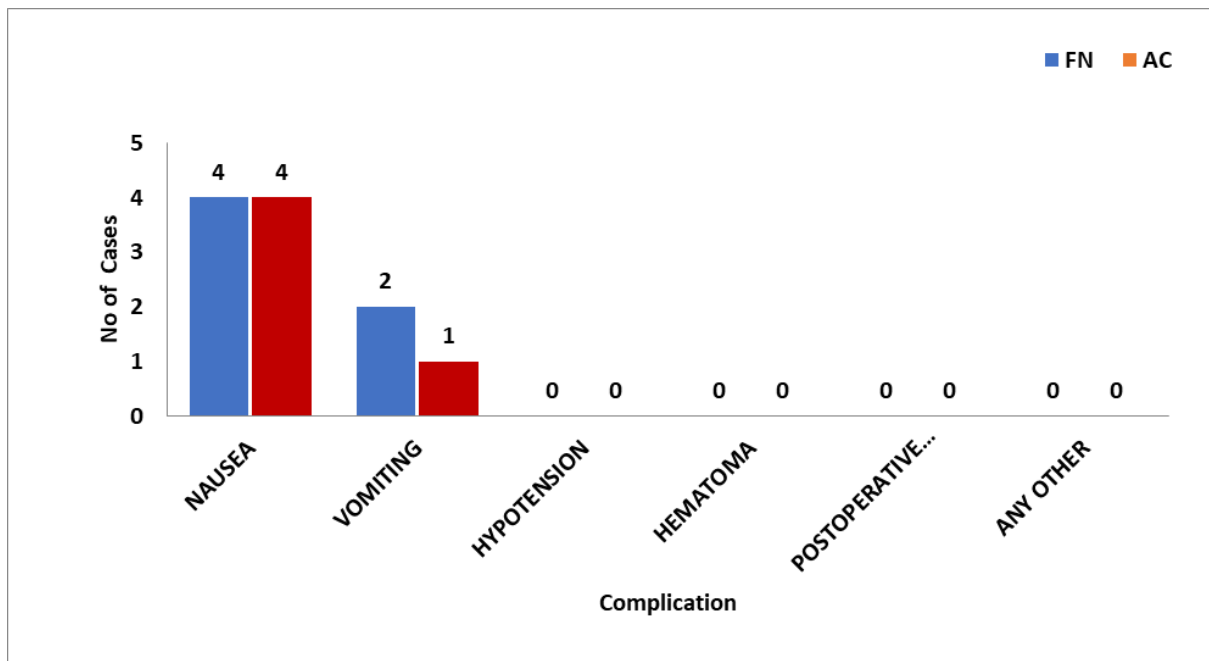
Graph 4: The result of Mean of muscle power grading at T4, T5 and T6hrs were significant. (P= 0.001, 0.001, 0.032)

Frequency distribution of Patient Satisfaction



Graph 5: Represent the frequency distribution of patient Satisfaction Score in which Group FN showed 16.70% and 83.30% and Group AC showed 6.70% and 93.30%

Association of parameters (Complications) between Group FN and AC



Graph 6: Result of Association between Nausea/Vomiting between FN and AC was not significant

DISCUSSION

PNBs, or peripheral nerve blocks, share many qualities with the ideal outpatient anaesthetic. They reduce the requirement for general anaesthesia (GA) by providing site-specific surgical anaesthesia. Opioid requirements and negative effects are decreased by delivering thick analgesia. A patient who is relaxed and symptom-free can be sent home.^[6,7,8,9]

Our study aimed to compare femoral nerve and adductor canal blocks for analgesia during postoperative period and evaluated the visual analogue score and muscle strength for early ambulation.

In our study, 60 subjects were enrolled. The proportion of males (81.7%) was higher than females (18.3%) in our study. The mean age, height, weight and BMI of the subjects administered with Femoral Nerve Block (FN) was 36.4 ± 13 , 1.7 ± 0.1 , 66.3 ± 6.4 , 21 , 8 ± 0.5 respectively. On the other hand, with Adductor Canal Block (AC) it was 33.8 ± 12.6 , 1.8 ± 0.1 , 68.1 ± 5.1 , 21.4 ± 0.7 , respectively. The difference in group AC versus FN were insignificant. Similarly, the study conducted by Tan et al^[10] reported that the patients enrolled were similar with respect to demographics and perioperative conditions without any significant difference. The number of cases in respect to ASA physical status shows, 55 % (Grade 1) and 45 % as grade 2 which means there are majority of normal healthy subjects in the study.

When comparing the hemodynamic parameters (HR, SBP, DBP, and MAP) between the patients included in our study's two separate groups, we found some interesting results. It becomes insignificant, demonstrating a small difference between the two groups. We discovered that the SBP, DBP, and MAP of the patients in the FN group were somewhat higher than those in the AC group, although the heart rate was slightly lower in the FN group than in the AC group. Similar findings were found in studies published by Armanious^[11] and team in 2020 and Mahdy et al^[12] in 2021, which both compared the hemodynamic characteristics and effects of an AC block to those of a FN block.

In contrast to the AC group of patients, the FN group of patients in our study exhibits greater muscle strength throughout the first few hours (T1 hours, T2 hours, and T3 hours) following surgery. However, the muscular strengthening at T4 hours, T5 hours, and T 6 hours reveals a substantial difference in favour of the AC over FN, with the AC group displaying much more muscle power than the FN group.

Similar findings were reached in Krishna et al.'s study^[13] comparing adductor canal block and femoral nerve block for post-operative pain management following knee arthroplasty. The VAS score was greater in the FN group than in the AC group, which is contrary to our study, and the statistical significance at time point 24 hours was detected between both groups.

A study conducted in 2018 by Ghodki^[14] and team using ultrasound guided technique for ACB and FNB in patients posted for reconstruction surgery of ACL done in general anaesthesia. Result found that in individuals following ACLR, ACB preserved muscle strength and at the same time provided with pain free period. However, it was shown that FNB and ACB had higher patient satisfaction scores.

Contrary to what we discovered, Grevstad et al^[15] study from 2015 showed that patients in the AC group almost increased their muscle strengthening compared to the FN group. Additionally, the study conducted by Koh et al^[16] in 2017 came to the same conclusion that FN causes muscle weakness, which hinders early mobilisation and raises the risk of postoperative falls. Although we will need to monitor the subjects for a longer period of time in the future.

Only 13.3% of patients in both groups reported experiencing nausea, while 6.7% in the FN group and 3.3% in the AC group reported experiencing vomiting, a negligible difference between the two groups. Our study found no correlation between the side effects of nausea and vomiting between the FN and AC Groups.

Similar results were obtained in the study published in 2019 by Kampitak et al^[17], and there was no difference in the incidence of nausea or vomiting during the postoperative period between the groups. Additionally, Thacher et al^[18] in 2017 discovered no difference between the AC and FN group in terms of the frequency of nausea or vomiting in their patients.

When we compared the patient satisfaction scores for the two groups, we discovered that patients in the ACB (93.3%) group were marginally more satisfied than those in the FNB (83.3%) group. This finding is consistent with many other studies, including one by Wang et al^[19] in 2017 who found no statistically significant difference in patient satisfaction between the two groups. Additionally, AC reduces the risk of falls and offers pain relief that is superior to FNB.

According to Mohamad et al^[20] comparative study between ACB and FNB for postoperative analgesia in knee arthroscopy published in 2018, USG guided ACB is just as effective as ultrasound guided FNB in controlling post-operative pain in patients having knee arthroscopy, and AC block proved to be more satisfying.

CONCLUSION

In the hours following surgery, the grade of quadriceps muscle strengthening was observed to be higher in the adductor canal block group than in the femoral nerve block group (T1, T2). This contrasts with the femoral nerve block group's grade of quadriceps muscle strengthening, which gradually began to decline in the later hours (T3, T4, T5, and T6). As a result, the Adductor Canal Block group had a slightly higher patient satisfaction score. Patients' pain scores did not alter statistically significantly before or after therapy sessions were found.

Limitation

Our study's sample size (n=60) is modest and not generally typical of the population. Due to the small sample size, although the ambulation on POD 2 is trending in favour of ACB, it is not clinically significant. Another is absence of control group in entire study.

Source of Funding

Nil

Conflict of Interest

There are no conflicts of interest.

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