

A Comparative Study of Adductor Canal Block versus Femoral Nerve Block for Analgesia after Total Knee Arthroplasty

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Abstract

Background: To compare adductor canal block versus femoral nerve block for analgesia after total knee arthroplasty. **Methods:** Seventy patients of primary TKA were equally divided into 2 groups containing 35 patients each. Group A patients received adductor canal block (ACB) and group B patients received femoral nerve block (FNB). Parameters such as duration of surgery, VAS at rest and at 45degree flexion of knees, amount of blood loss, muscle strength and the TUG test preoperatively and at 24 hours postoperatively. **Results:** The mean blood loss was 40.5 ml in group A and 25.7 ml in group B, duration of surgery 84.2 minutes in group A and 71.3 minutes in group B, preoperative VAS pain score at rest, mm was 28 in group A and 22 in group B, preoperative VAS pain score at 45 degrees flexion of the knee, mm was 16 in group A and 12 in group B. The quadriceps muscle strength % in group A was 50.2 and in group B was 18.2 and for adductor muscle was 63.1 in group A and 70.6 in group B. A significant difference was observed between both groups ($P < 0.05$). Habitual analgesics was paracetamol used by 32% in group A and 14% in group B, weak opioids in 10% in group A and 17% in group B and none 58% in group A and 69% in group B. A significant difference was observed between both groups ($P < 0.05$). **Conclusion:** Adductor canal block was found to be superior as compared to femoral nerve block. ACB preserved quadriceps muscle strength better than FNB.

Keywords: Adductor Canal Block, Femoral Nerve Block, Total Knee Arthroplasty, Quadriceps

INTRODUCTION

Total knee arthroplasty (TKA) is widely believed to be the best choice for the treatment of end-stage of knee arthropathy, and the procedure can significantly relieve pain and restore physical functioning and improve the quality of life for these patients.^[1] Multiple diseases such as OA, rheumatoid arthritis (RA), and hemophilia

can result in severe bilateral knee destruction, with a prevalence of severe bilateral

Involvement as high as 19%. Bilateral TKA (BTKA) can be performed simultaneously under a same anesthetic or as staged procedures, with 2 unilateral knee arthroplasties under separate anesthetics and hospitalizations.^[2]

Knee arthroplasties (KAs), whether total knee arthroplasty (TKA) or unilateral knee

arthroplasty (UKA) involve extensive bone resection and soft tissue manipulations, and patients can suffer from severe pain during the early postoperative period.^[3] Appropriate pain management after TKA allows for faster recovery, reduces the risk of postoperative complications, and improves patient satisfaction. Although the pre-emptive use of multimodal measures is currently accepted as a principle of pain management after TKA, no gold standard pain management protocol has been established.^[4]

Pain management regimens include oral analgesics, periarticular injection, peripheral nerve blocks (PNBs), and intravenous patient-controlled analgesia. PNBs are considered to be an essential part of the current multimodal pain management protocol following knee arthroplasty (KA) as they provide effective and synergistic pain relief.^[5] Peripheral nerve blocks are commonly used to relieve pain and to reduce opioid requirements and opioid-related adverse effects. Nerve blocks involving the femoral nerve may lead to femoral quadriceps muscle weakness.^[6] Quadriceps weakness results in functional impairment and is associated with an increased risk of falling postoperatively. Adductor canal block (ACB) is predominantly a sensory block, which preserves quadriceps muscle strength and ambulation ability better than FNB. Adductor canal block has also been shown to reduce pain and morphine consumption compared with placebo after TKA. The effect

of ACB on pain and muscle strength in a postsurgical population has not, however, been directly compared with that of the FNB.^[7] Considering this, the present study aimed at comparing adductor canal block versus femoral nerve block for analgesia after total knee arthroplasty.

MATERIALS & METHODS

Seventy patients were selected for primary TKA with spinal anesthesia, aged ranged 45 to 75 years of either gender with an American society of anesthesiologists physical status I-III. Patients on steroid, alcoholics, smokers, drug abusers and those not giving consent to participate in the study were excluded. Those selected were subjected to written consent in vernacular language. Approval for the study was obtained from higher ethical committee.

Patients were equally divided into 2 groups containing 35 patients each. Group A patients received adductor canal block (ACB) and group B patients received femoral nerve block (FNB). The medication was administered as a bolus of 30 mL of ropivacaine 0.5% via the catheter initially, followed by an infusion of 0.2% ropivacaine at a rate of 8 mL/h during the next 24 hours. Parameters such as duration of surgery, VAS at rest and at 45degree flexion of knees, amount of blood loss, muscle strength and the TUG test preoperatively and at 24 hours postoperative. All factors were recorded and analysed statistically using Mann Whitney U test with level of significance set below 0.05.

RESULTS

Table 1: Patient distribution

Groups	Group A	Group B
Agent used	Adductor canal block (ACB)	Femoral nerve block (FNB)
Male	20	16
Female	15	19

There were 20 males and 15 females in group A and 16 males and 19 females in group B [Table 1].

Table 2: Patient characteristics

Characteristics	Group A	Group B	P value
Weight (Kg)	75.2	81.4	<0.05
Height (cm)	165.2	170.4	>0.05
Blood loss (ml)	40.5	25.7	<0.05
Duration of surgery (mins)	84.2	71.3	<0.05
Preoperative VAS pain score at rest, mm	28	22	<0.05
Preoperative VAS pain score at 45 degrees flexion of the knee, mm	16	12	<0.05
Habitual analgesics			
Paracetamol	32%	14%	<0.05
Weak opioids	10%	17%	
None	58%	69%	

The mean weight of patients in group A patients was 75.2 Kgs and in group B was 81.4 kgs, height was 165.2 cm in group A and 170.4 cm in group B, blood loss was 40.5 ml in group A and 25.7 ml in group B, duration of surgery 84.2 minutes in group A and 71.3 minutes in group B, preoperative VAS pain score at rest, mm was 28 in group A and 22 in group B, preoperative VAS pain score at

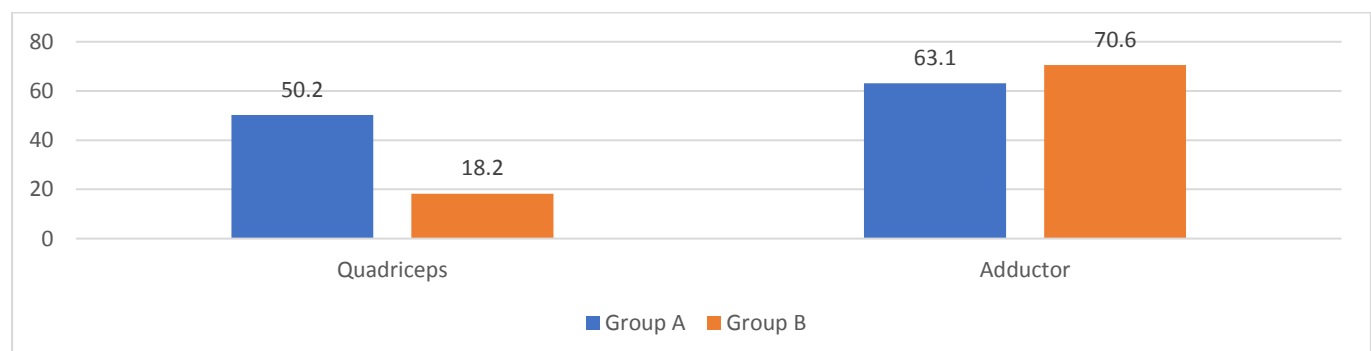
45 degrees flexion of the knee, mm was 16 in group A and 12 in group B. Habitual analgesics was paracetamol used by 32% in group A and 14% in group B, weak opioids in 10% in group A and 17% in group B and none for 58% in group A and 69% in group B. A significant difference was observed between both groups ($P < 0.05$) [Table 2].

Table 3: Assessment of muscle strength

Muscle (MVIC %)	Group A	Group B	P value
Quadriceps	50.2	18.2	<0.05
Adductor	63.1	70.6	<0.05

The quadriceps muscle strength % in group A was 50.2 and in group B was 18.2 and for adductor muscle was 63.1 in group A and 70.6 in group B. A significant difference was observed between both groups ($P < 0.05$) [Table 3, Figure 1].

Graph 1: Assessment of muscle strength



DISCUSSION

Simultaneous bilateral total knee arthroplasty (sim BTKA) has been described as a safe and convenient procedure associated with higher patient satisfaction, faster recovery, and lower costs.^[8] Studies have demonstrated higher complication rates including increased intraoperative blood loss, greater need for perioperative blood transfusion, increased rates of venous thromboembolism, cardiorespiratory complications, neurologic complications, wound breakdown, deep infection, and mortality associated with sim BTKA. A staged bilateral TKA (staBTKA) may decrease the potential complication rate but has been shown to be associated with higher hospitalization costs.^[9,10]

PNBs provide effective and synergistic pain relief when used as part of a multimodal regimen, they are considered to be an essential part of the current multimodal pain management protocol following TKA.^[11] Given excellent pain relief and the opioid sparing effect, femoral nerve block (FNB) is commonly used as an analgesic modality and is considered the standard PNB in patients undergoing TKA.^[12] However, FNB is followed by a significant decrease in quadriceps muscle strength, resulting in delayed mobilization, which is associated with the potential risk of falling.^[13] Recently, as the length of stay (LOS) in hospital has been shortened by the performance of TKA on an outpatient basis, a potent analgesia that preserves motor strength during early rehabilitation is becoming increasingly accepted as an essential part of the current perioperative protocol following TKA.^[14]

We enrolled 20 males and 15 females in group A and 16 males and 19 female in group B. It was seen in this study that mean weight of patients in group A patients was 75.2 Kgs and in group B was 81.4 kgs, height

was 165.2 cm in group A and 170.4 cm in group B. Jaeger et al,^[15] conducted a double-blind controlled study of patients scheduled for TKA with spinal anesthesia. The patients were randomized to receive either a continuous ACB or an FNB via a catheter. Muscle strength was assessed with a handheld dynamometer and it was observed that Quadriceps strength as a percentage of baseline was significantly higher in the ACB group compared with the FNB group: (52% [31-71] versus 18% [4-48]). There was no difference between the groups regarding morphine consumption ($P = 0.94$), pain at rest ($P = 0.21$), pain during flexion of the knee ($P = 0.16$), or adductor muscle strength ($P = 0.39$); neither was there a difference in morphine-related adverse effects or mobilization ability ($P > 0.05$).

It was found that duration of surgery 84.2 minutes in group A and 71.3 minutes in group B, blood loss was 40.5 ml in group A and 25.7 ml in group B. Armanious et al,^[16] conducted a study on 80 patients and found that quadriceps strength was significantly lower in the FNB group compared with ACB group especially at 12 postoperative hour (2 versus 4), respectively, p value < 0.05 . There was no difference between the groups regarding postoperative VAS at rest except at 24 h was significantly lower in FNB group with p value 0.003. The gait disturbance and the number of falls were significantly lower in the ACB group than the FNB group (2 compared to 9), respectively. There was no difference between groups regarding postoperative nausea, vomiting, and itching.

The result of the study showed that preoperative VAS pain score at rest, mm was 28 in group A and 22 in group B, preoperative VAS pain score at 45 degrees flexion of the knee, mm was 16 in group A and 12 in group B. We also observed that

habitual analgesics was paracetamol used by 32% in group A and 14% in group B, weak opioids in 10% in group A and 17% in group B and none 58% in group A and 69% in group B. Grevstad et al,^[17] in their study on 50 patients who underwent TKA with severe movement-related pain defined as having visual analog scale pain score greater than 60 mm during active flexion of the knee, reported that ACB provides a clinically pertinent and statistically significant rise in the quadriceps muscle strength for patients in

severe pain after TKA. After block, the quadriceps maximum voluntary isometric contraction increased to 193% of the baseline value in the ACB group and decreased to 16% in the FNB.

CONCLUSION

Adductor canal block was found to be superior as compared to femoral nerve block. ACB preserved quadriceps muscle strength better than FNB.

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