

## Comparison of the Efficacy between Femoral Nerve Block and Fascia Iliaca Compartment Block for Postoperative Analgesia in Patients after Knee Surgery

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## Abstract

## Original Research Article

**Background:** Moderate to severe pain develop after knee surgery results prolong hospital stay and delay return to normal daily activities. Various analgesic modalities have been used for postoperative analgesia in patients undergoing knee surgery. Both femoral nerve block (FNB) block and fascia iliaca compartment block (FIB) are used routinely for postoperative pain relief in patients undergoing knee surgery. **Objectives:** To compare the efficacy of postoperative analgesia of FNB & FIB in postoperative period among patients undergoing knee surgery under sub-arachnoid block. **Methods:** This Randomized Clinical Trial was performed in Combined Military Hospital (CMH), Dhaka from July 2020 to December 2020. Forty patients scheduled for routine knee surgery under sub-arachnoid block belonging to ASA class I, II and III were included in the study and randomly divided into two groups with 20 patients in each group. At the end of surgery, In Group A (n= 20) femoral nerve block was employed & in Group B (n=20) fascia iliaca compartment block was employed. **Results:** Significant relief of pain occurred in recovery room in group B than group A (3.67±0.802 vs 4.3±0.877; p<0.05). This improvement was noticed in group B at 6 and 24 hours follow up (p<0.05 in all follow up). Post-operative analgesic consumptions was also lower in group B at 1, 12 & 24 hours follow up (p<0.05 in all follow up). Demographic characteristics were similar across the two groups in terms of age, sex, BMI and ASA grading (p>0.05 in all cases). No significant difference was noted in both pre-operative, post-operative and recovery room heart rate (p>0.05) and mean arterial pressure (p>0.05). Complication was similar in both groups. **Conclusion:** Fascia iliaca compartment block (FIB) for management of post-operative analgesia in knee surgery is more effective than femoral nerve block (FNB).

**Keywords:** Fascia iliaca, Femoral nerve, Analgesic.

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## INTRODUCTION

Knee surgery is one of the most frequently performed interventions in orthopedic surgery. It is performed mainly to treat the dysfunction in a knee joint, deformity and intense knee pain [1]. Patients undergoing knee surgery generally suffer from postoperative severe pain or very severe pain which prolongs the recovery time and the length of hospital stay [2]. To treat the pain occurring after knee surgery, various medications such as non-opioid analgesics, opioids and local anesthetics, Intravenous (IV), epidural analgesia and peripheral nerve blocks are used [2, 3]. The systemic opioid medications used for pain

treatment have side effects such as nausea, vomiting, urinary retention, hypotension and respiratory depression. However there has been ongoing research to find the ideal analgesic method that has minimum side effects and that can enable early rehabilitation and discharge [4]. Currently, the use of anesthesia has begun to be concerned with the quality of life of patients. In this context, the quality of the post-anesthetic recovery time has been accepted as one of the most important parameters when evaluating the early postoperative health condition [5, 6]. For this reason, an effective management of anxiety and postoperative pain is seen as a key element for a high-quality recovery. Among the postoperative techniques

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of analgesia, peripheral nerve blockage has a prominent place. Recently, fascia iliaca compartment block (FIB) and femoral nerve block (FNB) have been frequently used to treat the pain that occurs after knee surgery. It is reported that the major advantage of a FIB compared to FNB is the low damage risk of either the nerve or the artery by the needle during practice [7, 8]. However, there are limited studies to inform which one of these methods is more effective in terms of postoperative analgesia [7-10]. With this background we had to find out whether or not FIB provide better postoperative analgesia, less opioids consumption and hemodynamic stability than FNB after knee surgery. The importance of quantifying and treating acute postoperative pain is not only because of how unpleasant it is, but also because, if poorly treated, there is a risk for the development of chronic pain and its incumbent morbidity. Moreover recurrent opioids administration for post-operative analgesia has some adverse effects like drowsiness, respiratory depression, post-operative nausea & vomiting. Therefore, this study has been designed to evaluate and compare the postoperative analgesic efficacy of fascia iliaca compartment block (FIB) with femoral nerve block (FNB) in patient undergoing knee surgery.

## MATERIALS & METHODS

This Randomized Clinical Trials (RCT) study was carried out in Department of Anaesthesia, Combined Military Hospital (CMH), Dhaka over the period of 6 months between 1<sup>st</sup> July 2020 to 30<sup>st</sup> December 2020. Around 40 adult patient admitted undergoing elective knee surgery (Total Knee Arthroplasty) This data-based study was done after taking proper permission from the concerned departments, and the local ethical committee for the fulfillment of the requirements for the dissertation of the FCPS (Part -II) Examination of Bangladesh College of Physicians and Surgeons (BCPS).

### Inclusion Criteria

- Adult patients undergoing elective knee surgery (Total Knee Arthroplasty).
- ASA-I, II & III graded patient.

### Exclusion Criteria

- Unwilling patient.
- Patients allergic to local anaesthetics.
- Coagulation or bleeding disorders.
- Active infection at site of injection.
- Haemodynamically unstable patient.
- Previous femoral bypass surgery.
- BMI>35kg/m<sup>2</sup>.

### Operational Definition

- The hemodynamic variability defined as variability in MAP, HR.
- Hypotension defined as systolic BP 25% below the base line.

- Hypertension defined as systolic BP 25% above the base line.
- Bradycardia defined as pulse rate below 50beats/minute.
- Time of rescue an analgesics according to VAS>4.

### Research Materials

- All the data were recorded in a preformed structured questionnaire.
- PHILIP INTELLIVUE MP40 monitor was provided continuous SBP, DBP, MAP, PULSE, HR, SpO<sub>2</sub>, ECG monitoring.
- Peripheral Nerve Stimulator.
- Ultrasonogram (ESAOTE SPA, Firenze, IT).

### Data Collection Procedure

After institutional research ethical committee approval, the patient was explained in details about the procedure, benefits and complications of the study and obtains informed written consent on the preoperative day. Forty (40) patients of ASA grade I, II & III were selected and divided into 2 (two) groups. Group A received femoral nerve block (FNB) and Group B received fascia iliaca block (FIB). Twenty (20) in each group by random card sampling. Both groups were medicated with Diazepam 5 mg orally at night before operation and was kept nil by mouth for 08 hours before surgery. On arrival at the operation theatre, base-line was recorded noninvasively.

For Group A (FNB): after full aseptic precaution the inguinal ligament was identify by using ultrasound probe which was placed on the inguinal ligament at a transverse plane of the patients. Bupivacaine 0.25% 20 mL bolus was applied and the distribution of local anesthetic around the femoral nerve was observed and confirmed by ultrasound. A pin-prick test was used to evaluate the block.

For Group B (FIB): after proper aseptic precautions, a high frequency (6-14 MHz) linear probe was placed transversely to identify the femoral artery at the inguinal crease. The iliopsoas muscle with the overlying fascia iliaca was identified. Bupivacaine 0.25%, 20 ml bolus doses was applied. The drug spread was seen between the fascia iliaca and iliacus muscle and into the iliac fossa.

Pain intensity was measured by using VAS scale at at 02,04,06,12 & 24 hourly after surgery. For both group the patient received no analgesics when VAS is 0-3, if VAS is  $\geq 4$  then patient was received Inj Pethidine at 1mg/kg IM. Total 24 hours Opioids consumption was noted.

Data were collected in questionnaire. Data processing work was consisted of registration schedules, editing computerization, preparation of dummy table, analysing and matching of data. After

collection of all information, these data were checked, verified for consistency and edited for finalized result. After editing and coding, the coded data directly entered into the computer by using SPSS. Data was processed and analyzed using SPSS (Statistical Package for Social Sciences) software version 22. The summarized data was present in the table and chart.

## RESULT

Total 40 patients, scheduled for knee surgery under regional anesthesia belonging to ASA grade I, ASA grade II and ASA grade III were included in this study and randomly divided into two groups with 20 patients in each group A and group B. 20 Patients, received femoral nerve block (FNB) were assigned as group A and 20 Patients, received fascia iliaca compartment block (FIB) were in group B. The main aim of the study was to assess the effectiveness of FIB as post-operative analgesia in comparison with FNB. Findings of the study are presented here in detail:

**Table-I: Characteristics of the patients. (n=40)**

Characteristics	Group A (n=20)	Group B (n=20)	P value
Age (years)	46.75±10.41	45.90±8.57	0.965**
<b>Sex</b>			0.417*
Male	15(75%)	16(80%)	0.112
Female	06(25%)	04(20%)	0.223
Weight (kg)	60.90±5.7	61.55±5.3	0.585**
Height (cm)	169.35±5.95	168.40±4.84	0.468**
<b>ASA</b>			0.066*
Grade I	6(30%)	5(25%)	0.079
Grade II	12(60%)	14(70%)	0.082
Grade III	2(10%)	1(5%)	0.077

**Group A:** received femoral nerve block (FNB), **Group B:** received fascia iliaca nerve block (FIB)

**Table-II: Heart rate of the patients. (n=40)**

Heart rate (beat/min)	Group-A (n=20)	Group-B (n=20)	P value
Preoperative	76.37±7.91	73.87±7.74	0.221**
Per-operative	67.10±5.02	65.64±4.17	0.213**
Recovery room(0hour)	64.30±4.98	63.97±4.12	0.779**
(After) 30minutes	64.27±7.86	64.17±3.19	0.949**
01 hour	68.20±4.23	67.40±3.72	0.44**
02 hours	68.23±3.22	67.90±3.74	0.713**
04 hours	68.33±3.32	67.97±3.69	0.687**
06 hours	69.00±3.69	68.33±2.81	0.435**
12 hours	70.07±4.32	69.20±3.32	0.387**
24hours	75.73±7.21	73.33±6.47	0.18**

**Group A:** received femoral nerve block (FNB), **Group B:** received fascia iliaca nerve block (FIB)

**Table-III: Mean arterial pressure of the patients. (n=40)**

Mean arterial pressure (mmHg)	Group A (n=20)	Group B (n=20)	P value
Preoperative	79.53±5.14	77.57±5.99	0.178**
Per-operative	78.47±4.42	76.77±4.49	0.144**
Recovery room	78.77±4.73	76.83±4.43	0.107**
30 minutes	79.67±3.59	78.43±4.02	0.215**
01 hour	77.97±3.25	77.53±3.04	0.596**
02 hours	78.97±3.94	76.93±4.64	0.072**
04 hours	80.87±4.07	79.8±4.04	0.312**
06 hours	79.70±3.77	79.6±2.98	0.91**
12 hours	80±3.83	78.2±4.01	0.081**
24hours	79.67±4.16	78.4±4.32	0.252**

**Group A:** received femoral nerve block (FNB), **Group B:** received fascia iliaca nerve block (FIB)

**Table-IV: Visual analogue scale (VAS) score of the patients (n=40)**

VAS score	Group A (n=20)	Group B (n=20)	P value
Preoperative	3.53±1.432	3.33±1.348	0.580**
Recovery room (0 hour)	4.3±0.877	3.67±0.802	0.005**
02 hours	3.73±0.74	3.67±0.802	0.739**
04 hours	4.0±0.91	4.1±0.96	0.680**
06 hours	3.83±0.986	3.3±0.877	0.031**
12 hours	3.77±0.935	3.13±0.819	0.007**
24hours	3.23±0.817	2.6±0.675	0.002**

**Group A:** received femoral nerve block (FNB), **Group B:** received fascia iliaca nerve block (FIB)

**Table-V Total opioid consumption of the patients (n=40)**

	Group A (n=20)	Group B (n=20)	P value
Total opioid consumption (mg)	67±26.92	37±15.12	<0.001**

**Group A:** received femoral nerve block (FNB), **Group B:** received fascia iliaca nerve block (FIB)

**Table-VI Complication of the patients (n=40)**

	Group A (n=20)	Group B (n=20)	P value
Complication developed	9(22.50%)	10(25.00%)	0.005
PONV	5(25%)	4(20%)	0.024
Leg weakness	0	1(5%)	1.00
Urinary retention	1(5%)	1(5%)	0.601
Shivering	1(5%)	2(10%)	0.353
Hematoma	2(10%)	1(5%)	0.195
Convulsion	1(5%)	0(0%)	0.540

**Group A:** received femoral nerve block (FNB), **Group B:** received fascia iliaca nerve block (FIB)

## DISCUSSION

Pain control is essential for improvement of the quality of patient care. Regional nerve block techniques offer a great degree of post-operative pain relief, thus facilitating early ambulation and discharge [11]. This study showed that analgesic consumption after 4 hour was lower in patients with FNB, however it was lower in the FIB group after the 1<sup>st</sup>, 12<sup>th</sup> to 24<sup>th</sup> hours. The VAS level at the 6<sup>th</sup> & 24<sup>th</sup> hour was lower in the FIB group. In recent years, peripheral nerve blocks have gained more attention because of the discovery of new and more trustworthy anesthesia medications and developments in technology and anesthesia. When IV patient controlled analgesia and peripheral nerve block were compared in terms of effectiveness on postoperative analgesia in a lower extremity surgery, studies have indicated that peripheral nerve blocks are more efficient. At the same time, because the need for opioid drops in patients with a peripheral nerve block, the side effects related to opioids may also decrease. Studies have shown FNB patients who underwent knee surgery had decreased postoperative VAS values and analgesic consumption. Several studies showed the efficacy of peripheral nerve catheter, FIB and FNB on postoperative pain treatment; there was no significant difference between these techniques on opioid consumption and VAS levels. The FNB procedure also took longer than FIB and had a higher cost compared. FIB was reported as a safer and easier method [10]. Wallace et al., administered 0.5% ropivacaine (40 mL) in 60 patients who underwent knee arthroplasty. The

authors recommended FNB for rapid onset and FIB for a longer an algesic effect. In the current study, FNB was similar effective in the first period (2<sup>nd</sup>-6<sup>th</sup> hour) after the operation. After the 6<sup>th</sup> hour upto 24 hour, FIB performed better than FNB. Patients feel worried about their postoperative nausea and vomiting (PONV), which may lead to anxiety. PONV prolongs the duration of early discharge and increases hospital costs by impairing the quality of recovery. Using a peripheral block as a postoperative analgesia can reduce opioid consumption. In the current study, it was demonstrated that neither FNB nor FIB provides more for a benefit for PONV but FIB decreased opioid consumption, as indicated in previous studies [10]. In both types of blocks, temporary or permanent nerve injury may occur. Also, there is risk for vascular damage and intravascular injection. However, a limited amount of neurological damage has been reported for FIB. McMeniman et al., reported that a neurological deficit occurred in one out of 47 patients, and the patient with damage recovered in six weeks; while in FNB group, a limited amount of neurological damage was reported. Kong et al., stated that a neurological deficit was observed in three patients of the FNB group (N=25), but recovery was noticed after 48 hours. Recently, complication rates have decreased as new imaging methods have come into use. Using ultrasound guided nerve block, a decrease of nerve damage and vessel injury was noted. For this reason, it is recommended to use ultrasound during peripheral block interventions to prevent these possible problems. Swenson et al., and Dolan et al., found that the success rates of FIB with

ultrasound and the loss of resistance method was 47% and 82%, respectively. Deniz *et al.*, found that the success rates in FIB and FNB blocks with USG were at 87%, and they concluded this success to the use of USG. Recently, developments in the quality of anesthesia have focused on decreasing complications related to anesthesia, such as illness and death. In the literature, there was no study measuring the quality of recovery in patients with FNB and FIB block types; however, the current study showed that QoR-40 levels are higher in patients who underwent FIB [5]. This result shows that the FIB technique provides a sufficient level of analgesia in the long-term postoperative period, and hence improving the quality of recovery.

## CONCLUSION

In the postoperative period of knee surgery VAS score, frequency of analgesics demand and total opioid consumption were less in FIB group than FNB group. So FIB provides more efficient pain control than FNB. Hemodynamic parameter was more stable in FIB group than FNB group. Postoperative complications like PONV was also less in FIB group

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