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Efficacy of Combined Lateral Femoral Cutaneous Nerve Block with Pericapsular Nerve Group Block Versus Fascia Iliaca Block in Proximal Femoral Fractures

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ABSTRACT

Background: peripheral nerve blocks were introduced to offer analgesia in hip surgery.
Objective: This study compared the analgesic efficacy of combined lateral femoral cutaneous nerve (LFCN) block with pericapsular nerve group (PENG) block versus fascia iliaca block (FIB) for proximal femur surgery.
Patients and Methods: One hundred patients underwent proximal femoral fracture surgeries were equally randomized to either group I: FIB or group II: combined LFCN block with PENG block. The primary outcome was how long it took to perform spinal anesthesia. The secondary outcomes were the assessment of sensory block, VAS during spinal anesthesia, anesthesiologist satisfaction, time to first analgesic request, postoperative pain score and total morphine requirements.
Results: The VAS scores did not significantly differ from one another during positioning for spinal anesthesia between two groups. After 15 minutes and 30 min of blocks, VAS score at rest was reduced in group II compared to group I but with no significant difference. The median (VAS) score at rest immediately and one hour at post anesthesia care unit (PACU) was significantly lower in group II compared to group I. Time to first analgesic request, total morphine consumption in the postoperative 24 hours (h) showed no significant statistical difference between both groups.
Conclusions: PENG block is an effective and safe practice that could be an alternative to FIB for pain relief and comfort during positioning in patients with proximal femur fractures with preservation of motor function.
Keywords: PENG block, Femoral fracture, Fascia iliaca block.

INTRODUCTION

Elderly patients frequently experience proximal femoral fractures, which have high rates of morbidity and mortality [1]. Ineffective pain management results in delirium, extended hospital stays, and subpar functional outcomes [2]. Due to its superior opioid sparing properties, regional analgesia, which includes femoral nerve (FN) block, 3-in-1 FN block and FIB is a widespread analgesic method [3]. The obturator nerve (ON) is not covered; hence these blocks only provide modest analgesia [4].

The FN, ON and accessory obturator nerve (AON) innervate the anterior portion of the hip capsule, which is the portion of the joint that is most densely innervated [4-6]. The PENG block, a method for blocking these articular divisions to the hip, was created and considerably decreased pain scores [4]. PENG block and LFCN block were advised to be used as an auxiliary to cover the dermatomal incision for THA[7].

Few researches were concerned about the analgesic efficacy of PENG block in proximal femoral surgery. However, the present study compared the effect of combined LFCN block with PENG block versus FIB for proximal femur surgery. The primary outcome was the analgesic effect reflecting ease of the positioning of patients for spinal anesthesia before surgery via assessment of time of performance of spinal anesthesia (SA). The secondary outcomes included VAS during spinal anesthesia, anesthesiologist satisfaction, effective duration of analgesia, postoperative pain score, any complications or adverse effects.

PATIENTS AND METHODS

This randomized single-blinded study was carried out at Mansoura University Emergency Hospital from April 2020 to April 2021.

Patients:

Patients of both sex and aged from 50 to 90 years old, ASA physical status from I to III listed for elective and emergent proximal femoral fracture surgery were involved. Patient refused to participate, pregnancy, coagulopathy, hematological disorders, neuromuscular disorders, psychiatric disorders, multi-traumatized patients, local skin infection at site of the block, severely obese patients (BMI >40), history of allergy to anesthetic drugs and patients on opioids analgesics or opioid abuse were excluded.

All patients underwent preoperative evaluations. Upon the patient's admission to the preanesthetic room, under standard monitoring, peripheral venous cannula was secured and normal saline solution (6 ml/kg) was infused, VAS scale was explained to all patients and 0.01 to 0.03 mg/kg IV midazolam was given if needed.

Study design:

A randomly generated table produced by a computer was used to divide eligible 100 patients into two equal groups at random. Group assignments were kept secret by being placed in sealed, opaque envelopes. Group I (n=50): Patients received suprainguinal FIB with 30 ml of 0.25% bupivacaine before spinal anesthesia and group II (n=50): Patients received combined LFCN block (5 ml

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of 0.25% bupivacaine) with PENG block (25 ml of 0.25% bupivacaine) also before spinal anesthesia. All blocks were achieved by the same anesthesiologist in the preanesthetic room; another anesthesiologist who was blinded to group allocation evaluated the block, performed spinal anesthesia, provided intraoperative care and collected data.

Interventions:

Ultrasound guided suprainguinal FIB was applied while the patient in supine position; using a linear ultrasound probe in the sagittal plane, the anterior superior iliac spine (ASIS) was captured. After recognizing the “bow-tie sign” presenting the muscle fascia, a spinal needle was inserted 1 cm cephalad to the inguinal ligament (IL). With an in-plane approach, the fascia iliaca was pierced. Superficial to the fascia iliaca, the deep circumflex artery was used as a marker of successful diffusion. 30 mL of local anesthetic were administered as a total volume [8].

Ultrasound guided LFCN block was applied with the patient supine, the transducer was positioned parallel to the inguinal ligament and directly inferior to the (ASIS). The Sartorius muscle (SaM) and Tensor Fascia Lata Muscle (TFLM) were then recognized. Superficial to the SaM or in a short-axis view the nerve shows as a tiny hypoechoic oval structure with a hyperechoic rim. Between the TFLM and SaM, the needle was inserted. A 5 mL of local anesthetic was administered [9].

Ultrasound guided PENG block was done with the patient in the supine position. The probe was placed transversely over the anterior inferior iliac spine (AIIS) and then allied with the pubic ramus by rotating the probe counterclockwise about 45 degrees. The LA was delivered in 5-mL increments for a total amount of 25 mL after the needle was entered in an in-plane technique from lateral to medial to situate the tip in the plane between the psoas tendon anteriorly and the pubic ramus posteriorly[4].

Study outcomes:

Assessment of pain intensity by 10-cm visual analogue scale (VAS), with 0 denoting no discomfort and 10 denoting the greatest amount of pain. It was recorded at rest and on motion (attempted hip flexion to 15 degrees) before conducting a nerve block, 15 or30minutes (min) after performing a block, during position for SA, immediately and at one hour in the PACU, followed by 2, 4, 6, 12, 18, and 24 hours in the surgical ward.

Sensory blockade was evaluated pre-block, 15 min and 30 min after block administration with ice glass using cold perception loss in the lateral, anterior and medial part of the thigh corresponding LFCN, FN and ON sensory distributions, respectively. Sensation to cold was scored using a categorical scale from 0 to 2; (0=absence of cold sensation, 1=diminished cold sensation and 2=normal sensation) [10]. Following the administration of the block, the motor block was assessed 15 and 30 minutes later using the straight leg raise test to measure hip flexion at 15 degrees. Normal power was represented by +ve, while motor weakness was represented by –ve [11], and quadriceps femoris muscle strength by while the patient was instructed to extend their knee against resistance while holding their knee under the popliteal fossa [10]. To assess motor function of the ON, the leg was abducted and the patient was asked to adduct it toward the midline [8]. Block failure was defined as pain score (VAS) ≥ 4 during positioning for spinal anesthesia [12] and was excluded from the study.

After the evaluation of block at 30 min, patients were moved to the operating room. In a sitting position, a paramedian or median method was applied. One anesthesiologist, blinded to group assignment, performed SA, a 3 ml of bupivacaine 0.5% + 20 µg fentanyl was injected intrathecal.

Anesthesiology satisfaction for positioning was assessed as 3=optimal, 2=good, 1=satisfactory or 0=unsatisfactory. Time to perform SA (min) was measured from the start of positioning to the end of the intrathecal injection[12]. Intraoperative heart rate (HR), mean arterial blood pressure (MAP) and peripheral oxygen saturation (SPO_2) were recorded immediately after spinal anesthesia, 5, 15 then every 30 min till end of operation. Patients with prolonged operations that needed general anesthesia were excluded.

On arrival to post anesthesia care unit (PACU), patients were evaluated for pain with (VAS) at rest and on movement immediately on PACU arrival and after one hour then on the surgical ward at 2, 4, 6, 12, 18 and 24 h. Patients with VAS ≥ 4 received IM diclofenac sodium 75 mg/12 h. If patient was still complaining of pain after 30 minutes, a bolus dose of IV morphine 0.02 mg/kg was administered and repeated every 15 min if VAS persisted ≥ 4 [8]. Duration of analgesia was defined as the time period from nerve block to the first analgesic requirement. The total dose of analgesic consumed in the first 24-hours was recorded. Due to the patients' dressings from the level of the umbilicus to the knee, the extent of the sensory block could not be determined. The motor block resolution was measured at 2, 4, 6, 12 and 24 hours postoperatively[8]. Using a two-point scale, patients' satisfaction with the analgesic approach used before spinal anesthesia was assessed 24 hours after returning to the ward: 1 = good (if mandatory, I would repeat the procedure); 2 = bad (I would never repeat the procedure) [12]. The presence of postoperative nausea and vomiting (PONV), pruritus, presence of weakness in the operative limb was recorded.

Ethical considerations:

The study was approved by the International Review Board (IRB) of Mansoura University with a code number; MD.20.02.280. It was registered in March 2020 in Clinical Trials.gov with registry

number NCT04309539. An informed written consent was signed by every patient before being allocated into the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

Using Power Analysis and Sample Size software program (PASS) version 15.0.5, sample size was calculated. Based on a previous study [12], mean ± SD of the time to perform spinal anesthesia in proximal femur fracture after FIB in minutes was 6.9± 2.7. Assuming □□error 0.05, □□error 0.2 (power = 0.8), with a mean difference between both groups of (1.7) less than 25%. 40 cases were needed in each group. Allowing 20% dropout, 100 cases were needed as a total number (50 cases in each group). The Statistical Package for the Social Science (SPSS) programme version 22 was used to execute the statistical analysis of the data. Only significant data were subjected to the Shapiro-Wilk test, which indicated nonparametric data. If the unpaired student t test's presumptions were met, it was employed for numerical variable comparisons across groups; otherwise, the Mann-Whitney test was used for non-parametric comparisons. For quantitative data, the data were described using the mean, standard deviation (SD), median, and interquartile (IQ) range, and for qualitative data, frequency and percentage were used. For qualitative data, the Chi-square test or Fisher's exact test was utilized. At a 95% confidence level, any difference or change with probability (P) less than 0.05 was deemed statistically significant.

RESULTS

Of the 113 patients evaluated for eligibility, 13 were excluded. Thus, 100 patients were enrolled. One was excluded due to prolonged operation that needed general anesthesia and another one due to failed block in group I. two were excluded due to prolonged operation that needed general anesthesia and another two due to failed block in group II (Figure 1).

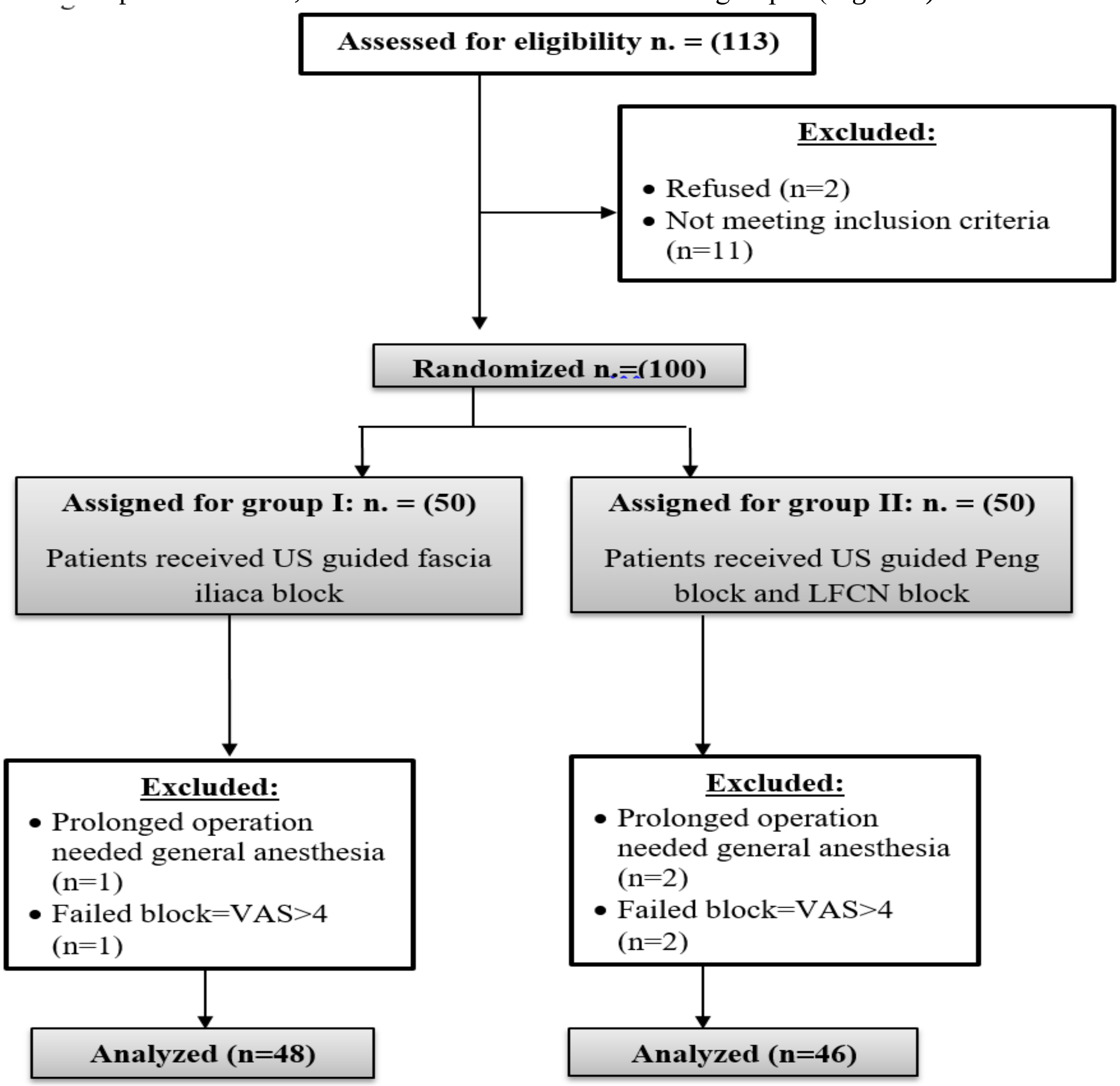

Figure 1. Consolidated standards of reporting trials (CONSORT) flowchart

There was no significant statistical difference between the two groups as regard demographic data (age, sex, weight, height, BMI and ASA status of the patients). Fracture type, type or duration of the surgical procedures showed no significant statistical difference between two groups.

As regard block performance time in minutes, it showed no significant statistical difference between studied groups. The onset of sensory block for LFCN was significantly faster in group II compared to group I, while, sensory and motor block of both FN and ON were significantly different 30 min after the block in group I compared to group II (Table 1).

Table 1: preoperative block features

	Group I (n=48)	Group II (n=46)	P-value
Block performance time (min)	4 (2-16)	4 (2-15)	0.461
Sensory block onset			
15 minutes after block:			
LFCN	5 (10.4%)	20 (43.5%)	**0.001***
Femoral n.	5 (10.4%)	2 (4.3%)	0.436
Obturator n.	2 (4.2%)	2 (4.3%)	1.00
30 minutes after block:			
LFCN	48 (100.0%)	46 (100.0%)	1.00
Femoral n.	48 (100.0%)	4 (8.7%)	**0.001***
Obturator n.	31 (64.6%)	3 (6.5%)	**0.001***
Motor block onset			
15 minutes after block			
Femoral n.	3 (6.3%)	1 (2.2%)	0.617
Obturator n.	9 (18.8%)	2 (4.3%)	0.051
30 minutes after block			
Femoral n.	48 (100.0%)	4 (8.7%)	**0.001***
Obturator n.	31 (64.4%)	3 (6.5%)	**0.001***

Data are expressed as number (percentage) or median (min-max). *: P is significant.
Group I: FIB group. Group II: Peng block plus LFCN block group.
LFCN: lateral femoral cutaneous nerve, min: minute, n: nerve.

In the current study, a number of patients in group II reported concomitant knee pain. Regarding the quality of positioning for SA in the form of; time to perform SA (min), VAS score during positioning, anesthesiologists' satisfaction score for position and patient' satisfaction score, it didn't reveal any significant statistical difference between the two groups (Table 2). Perioperative heart rate and mean arterial blood pressure did not significantly differ statistically between the two groups.

Table 2: Quality of positioning for spinal anesthesia

	Group I (n=48)	Group II (n=46)	P-value
Time to perform SA (min)	2 (2-3)	2 (1-3)	0.057
VAS score during positioning	1 (1-2)	1 (0-2)	0.060
Anesthesiologists' satisfaction score for position			
0=unsatisfied	1 (2.1%)	1 (2.2%)	0.791
1=satisfied	5 (10.4%)	3 (6.5%)	
2=good	11 (22.9%)	8 (17.4%)	
3=optimal	31 (64.6%)	34 (73.9%)	
Patient satisfaction score			
1=good	39 (81.3%)	40 (78.0%)	0.450
2=bad	9 (18.8%)	6 (13.0%)	

Data are expressed as mean±SD, median (IQ range) or number (percentage).
Group I: FIB group. Group II: Peng block plus LFCN block group.

The median VAS score at rest was significantly reduced 15 min and 30 min after block performance compared with preblock VAS score in each group. However, it was lower in group II at 15 min and 30 min after block performance compared with group I with no significant difference. The median VAS score at rest immediately and one hour at PACU was significantly lower in group II (Table 3).

Table 3: Visual analogue scale (VAS) score at rest

	Group I (n=48)	Group II (n=46)	P-value
Preblock	4 (2-8)	4 (2-9)	0.909
15 min after block	3 (2-7)#	3 (2-6)†	0.069
30 min after block	1 (0-5)#	1 (0-4)†	0.142
Immediately at PACU	0 (0-4)	0 (0-3)	**0.038***
1 h at PACU	0 (0-4)	0 (0-1)	**0.025***
2 h	1 (0-4)	0 (0-3)	0.349
4 h	2 (0-4)	1 (0-3)	0.925
6 h	1 (0-4)	1 (0-5)	0.534
12h	1 (0-4)	1 (0-3)	0.774
18 h	0 (0-3)	1 (0-4)	0.065
24 h	1 (0-3)	1 (0-2)	0.552

Data are expressed as median (range).
*: P is significant between both groups.
P-value is significant when compared with pre-block in group I.
† P-value is significant when compared with pre-block in group II.
Group I: FIB group. Group II: Peng block plus LFCN block group.

The median VAS score on movement was significantly reduced 15 min and 30 min after block performance compared with preblock VAS score in each group. Also, it was significantly lesser in group II at 15 min after block performance compared with group I. However, it was non significantly lesser in group II at 30 min after block performance compared with group I. Moreover, the median (range) VAS score on movement15 min after block, immediately and one hour at PACU was significantly lower in group II (Table 4).

Table 4: Visual analogue scale (VAS) score on movement

	Group I (n=48)	Group II (n=46)	P-value
Pre-block	8 (4-9)	9 (5-9)	0.356
15 min after block	6 (2-8)#	5 (3-8)†	**0.004***
30 min after block	4 (1-6)#	4 (1-6)†	0.481
Immediately at PACU	0 (0-6)	0 (0-5)	**0.003***
1 h at PACU	1 (0-5)	0 (0-3)	**0.015***
2h	2 (0-5)	2 (0-5)	0.251
4 h	3 (1-6)	3 (0-5)	0.975
6 h	3 (1-5)	2 (1-6)	0.684
12h	2 (1-6)	2 (1-5)	0.676
18 h	2 (1-5)	2 (1-4)	0.117
24 h	2 (1-4)	2 (1-4)	0.201

Data are expressed as median (range).
*: P is significant between both groups.
P-value is significant when compared with pre-block in group I.
† P-value is significant when compared with pre-block in group II.
Group I: FIB group. Group II: Peng block plus LFCN block group.

Time to first analgesic request and 24 h morphine consumption showed no significant statistical difference between both groups (Table 5).

Table 5: Time to first request of analgesia, and total morphine consumption in postoperative 24 h:

	Group I (n=48)	Group II (n=46)	P-value
Time to first request of analgesia (h.)	6.51±1.99	7.33±3.38	0.155
Total morphine consumption in postoperative 24 h (mg)	2 (0-6)	0 (0-6)	0.479

Data are expressed as mean±SD or median (min-max).
*P-value <0.05 is significant.
Group I: Fascia iliaca block group.
Group II: Peng block plus LFCN block group.
h: hour, mg: milligram.

As regards postoperative motor weakness (femoral and obturator nerves) weakness was significantly detected at 2 h postoperatively in 48 and 30 cases, respectively in group I compared to 4 and 3 cases, respectively in group II (Figure 2).

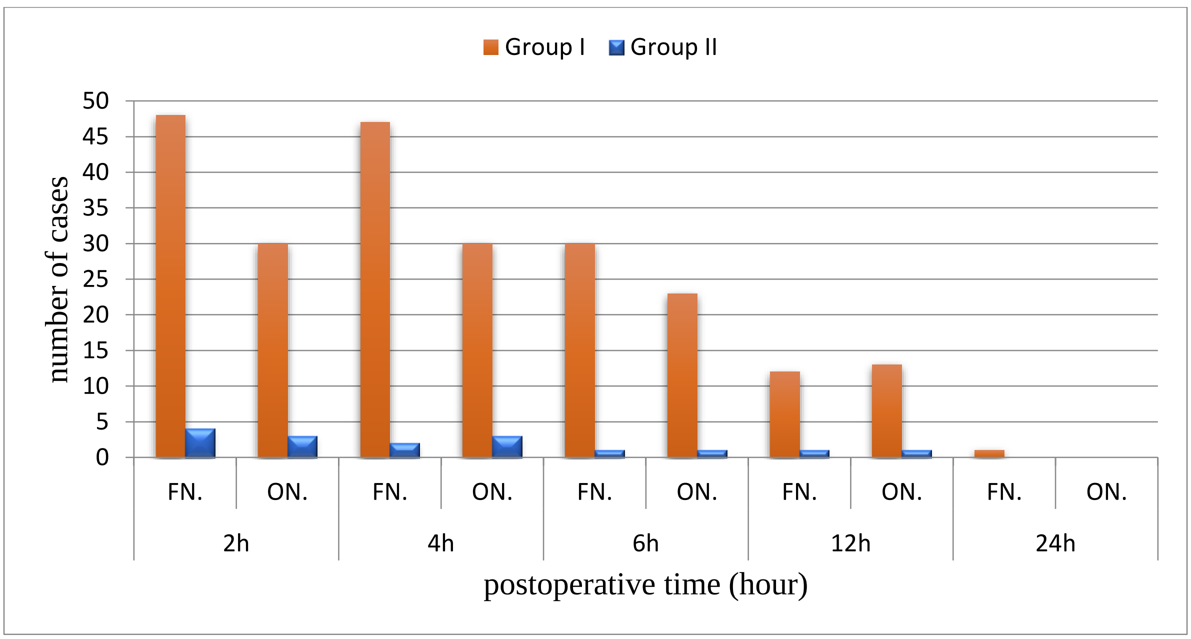

Figure 2: Postoperative muscle weakness presented by nerve affected
FN. Femoral nerve, ON. Obturator nerve, h. hour.
Group I: FIB group. Group II: Peng block plus LFCN block group.

In our work, postoperative complications including; PONV and pruritus weren't significant statistically different between both groups (Table 6).

Table 6: Postoperative complications:

	Group I (n=48)	Group II (n=46)	P-value
• **PONV**	14 (29.2%)	13 (28.3%)	0.923
• **Pruiritis**	8 (16.7%)	7 (15.2%)	0.848

Data are expressed as number (%).
*P-value <0.05 is significant.
Group I: Fascia iliaca block group.
Group II: Peng block plus LFCN block group.
PONV: postoperative nausea and vomiting.

DISCUSSION

Fractures of the proximal femur are painful and incapacitating. These fractures occur in about 8% of ground falls in people over the age of 70, generating severe morbidity and mortality [(13)].

The hip joint is supplied by divisions of the FN, ON, and sciatic nerve (SN). The LFCN should be covered if the surgical incision extends to the lateral thigh dermatome [(8)]. The PENG block was created as a secure and more efficient substitute for FN block and FIB for hip fractures after recent anatomical studies [(4, 6, 14-16)].

This current study demonstrated that, there were no significant differences in block effectiveness, incidence of complication and patient satisfaction between FIB versus combined LFCN block with PENG block. However, motor weakness was significantly avoided in PENG block. The hip operations also encompass the dermatomal pain for lateral thigh innervated by the LFCN due to the skin incision and subcutaneous dissection, hence **Roy *et al.*** described the value of the combination of PENG block with LFCN block that offers superior pain relief than PENG block alone [(7)].

In our study, sensory loss was noted in the LFCN was significantly faster (at 15 min after block performance) in group II compared to group I, while 30 min after the block, significant sensory loss and motor weakness of both femoral and obturator nerves were reported in group I compared to group II. Similarly, a previous study by **Bhattacharya and his colleagues**, with 25 patients in each arm, 50 patients with neck of femur fracture underwent a FIB with 20 ml levobupivacaine or PENG. In comparison to the fascia iliaca group, they discovered that the PENG group had a significantly speedier onset of effect [(17)].

In the current study, a number of patients in group II reported concomitant knee pain with hip pain relief, this could be explained by **Miura *et al.*** who stated that dorsal root ganglion neurons with dichotomizing axons from L2 to L4 project to the skin of the knee and the hip joint [(18)].

In our present work, regarding the quality of positioning for SA; in group II showed shorter time to perform SA (min), lower VAS score during positioning, better anesthesiologists' satisfaction score for position and comparable patient satisfaction score, but with no significant statistical difference when compared with group I. Similarly, in a study by **Jadon *et al.*** on 66 patients with hip fracture arranged for operation under SA randomly assigned to either S-FICB or PENG block. In all groups, 3% of patients expressed dissatisfaction while 97% expressed high levels of satisfaction or satisfaction (P = 0.897). Patients in the PENG group, however, felt substantially more at ease while being positioned for SA than those in the S-FICB group [(19)].

PENG block, was designated by **Girón-Arango *et al.*** [(4)], targeting the FN, ON, and AON. Since the anterior capsule of the hip joint is the area of the joint that is most densely innervated and because nociceptive fibers are primarily found in the anterior and superolateral parts of the capsule, FNs and ONs may be to blame for hip joint discomfort [(6)]. **Vermeylen and his colleagues** determined the spread of LA with MRI in the anatomical location where the ON is attainable with a FICB as a surrogate for the clinical evaluation of an ON block. They verified that in 80% of the subjects, LA was found in the anatomical location of the ON after a suprainguinal-FICB compared with 10% after an infrainguinal-FICB [(10)]. This can explain the non-significant difference in quality of positioning in our present study between both groups.

In the current study, the median VAS score at rest and on movement was significantly reduced 15 min and 30 min after block compared with preblock VAS score in each group. However, it was lower at rest in group II at 15 min and 30 min after block compared with group I but with no significant difference, while significantly decreased on movement in group II at 30 min after block performance compared with group I. In the same way, **Mosaffa *et al.*** assessed 52 hip fracture patients randomly divided in A FICB group and PENG block group. VAS score in the PENG block group significantly decreased after 15 minutes of blocks compared to the FICB group [(20)]. Moreover, in a previous clinical trial by **Jadon and his colleagues**, thirty minutes post block, the NRS score was reduced significantly in PENG group and S-FICB group at rest and movement[(19)].

In the current study, the median (range) (VAS) score at rest and on movement immediately and one hour at PACU was significantly lesser in group II compared to group I. In the same way, in another trial by **Lin *et al.*** on 60 patients planned for hip surgery who were given either a femoral nerve block (FNB) or PENG block; the PENG group had less pain than the FNB group on day zero following surgery (recovery) p=0.04) [(21)]. Additionally, **Allard and colleagues** conducted a comparative observational study on who arrived with femoral neck fractures. 42 patients in a row total were used, and were divided into femoral block group and PENG block group. The postoperative VAS did not differ between the two groups [(22)]. **Jadon *et al.*** reported that the median NRS scores were evaluated at rest and on movement in both the groups and it was significantly lower at 12 h at rest and at 24 h on movement in PENG group compared to FIB group [(19)].

The non-significant difference in VAS in postoperative intervals in our findings may be explained as suprainguinal FIB approach provide a more proximal spread of LA [(8)]. As such, we might expect a more reliable block of the nerves, as they are topographically more closely interconnected in their proximal pathway.

In the current trial, time to first analgesic request and 24 h morphine consumption in the showed no significant statistical difference between two groups. Parallel to our findings, **Aliste *et al.*** reported no clinically significant intergroup differences in the ability to consume cumulative opioids, or adverse effects [(23)]. Moreover, **Jadon *et al.*** reported that the mean doses of tramadol and time to first analgesic request (in hours) were comparable in the S-FICB group and the PENG group [(19)].

In the present study, as regards motor weakness (femoral and obturator nerves) was significantly detected at 2 h postoperatively in 48 and 30 cases, respectively in group I compared to 4 and 3 cases, respectively in group II, while PONV and pruritus weren't significant statistically different between two groups. **Aliste *et al.*** found that at 3 hours and 6 hours, quadriceps motor block occurred less frequently with PENG block than with suprainguinal FIB. Additionally, hip adduction after 3 hours was better preserved due to PENG block (p=0.023), and sensory block at all measurement intervals was reduced (p=0.014) [(23)]. Similarly, **Lin *et al.*** reported that quadriceps strength was better conserved with the PENG block compared with the FNB group [(21)].

Perhaps The PENG block may be more susceptible to FN blocking by tracking back along its high branches due to volume effects, which may also cause more distal dissemination to the lower branches [(24)]. The iliac fascia's iliopectineal fascia, which forms the medial end of the iliac fascia, may act as a roadblock in the LA's path to the deep pectineus muscle's obturator nerve. But given that the iliopectineal fascia runs briefly in the craniocaudal direction, it is possible to infer that a large volume LA in conjunction with a PENG block causes a subpectineal ON block [(25)].

There are few restrictions on this work. First, rather of asking for demand analgesia, it would have been wiser to employ patient-controlled analgesia to acquire a sense of 24-hour opioid usage. However, this was made up for by continuing to provide patients with sufficient nurse care. Second, evaluation of motor functions following surgery would have allowed us to determine whether PENG block is truly motor sparing; however, this could be impacted by patients' concern of pain, therefore we advise future trials to include electromyography.

CONCLUSION

PENG block is an effective and safe technique that could be an alternative to suprainguinal FIB for pain relief and ease of positioning during SA in patients with proximal femur fractures, and it introduced better preservation of motor function.

Conflict of interest:
The authors declare that they have no competing interests.

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REFERENCES

1. **Brauer C (2009)**: Incidence and mortality of hip fractures in the United States. JAMA., 302(14):1573.
2. **Lystad R, Cameron C, Mitchell R (2017)**: Mortality risk among older Australians hospitalised with hip fracture: a population-based matched cohort study. Archives of Osteoporosis, 12(1):67.
3. **Unneby A, Svensson O, Gustafson Y *et al.* (2017)**: Femoral nerve block in a representative sample of elderly people with hip fracture: A randomised controlled trial. Injury, 48(7):1542-9.
4. **Girón-Arango L, Peng P, Chin K *et al.* (2018)**: Pericapsular nerve group (PENG) block for hip fracture. Regional Anesthesia & Pain Medicine, 43(8):859-63.
5. **Gerhardt M, Johnson K, Atkinson , *et al.* (2012)**: Characterisation and classification of the neural anatomy in the human hip joint. HIP International, 22(1):75-81.
6. **Short A, Barnett J, Gofeld M *et al.* (2018)**: Anatomic study of innervation of the anterior hip capsule: implication for image-guided intervention. Regional Anesthesia & Pain Medicine, 43(2):186-92.
7. **Roy R, Agarwal G, Pradhan C *et al.* (2019)**: Total postoperative analgesia for hip surgeries, PENG block with LFCN block. Regional Anesthesia & Pain Medicine, 44:684.
8. **Desmet M, Vermeylen K, Van Herreweghe I *et al.* (2017)**: A longitudinal supra-inguinal fascia iliaca compartment block reduces morphine consumption after total hip arthroplasty. Regional Anesthesia & Pain Medicine, 42(3):327-33.
9. **Tumber P, Bhatia A, Chan V (2008)**: Ultrasound-guided lateral femoral cutaneous nerve block for meralgia paresthetica. Anesthesia & Analgesia, 106(3):1021-2.
10. **Vermeylen K, Desmet M, Leunen I *et al.* (2019)**: Supra-inguinal injection for fascia iliaca compartment block results in more consistent spread towards the lumbar plexus than an infra-inguinal injection: a volunteer study. Regional Anesthesia & Pain Medicine, 44(4):483-91.
11. **Yu H, Moser J, Chu A *et al.* (2019)**: Inadvertent quadriceps weakness following the pericapsular nerve group (PENG) block. Regional Anesthesia & Pain Medicine, 44(5):611-613.
12. **Yun M, Kim Y, Han M *et al.* (2009)**: Analgesia before a spinal block for femoral neck fracture: fascia iliaca compartment block. Acta anaesthesiologica scandinavica, 53(10):1282-7.

13. **Luftig J, Dreyfuss A, Mantuani D *et al.* (2020)**: A new frontier in pelvic fracture pain control in the ED: Successful use of the pericapsular nerve group (PENG) block. The American Journal of Emergency Medicine, 38(12):2761. e5-. e9.
14. **Mistry T, Sonawane K (2019)**: Gray zone of pericapsular nerve group (PENG) block. Journal of clinical anesthesia, 58:123-4.
15. **Orozco S, Muñoz D, Jaramillo S *et al.* (2019)**: Pericapsular Nerve Group (PENG) block for perioperative pain control in hip arthroscopy. Journal of clinical anesthesia, 59:3-4.
16. **Tran J, Agur A, Peng P (2019)**: Is pericapsular nerve group (PENG) block a true pericapsular block? Regional anesthesia and pain medicine, 44(2):257-257.
17. **Bhattacharya A, Bhatti T, Haldar M (2019)**: ESRA19-0539 pericapsular nerve group block–is it better than the rest for pain relief in fracture neck of femur? Regional Anesthesia and Pain Medicine, 44(Suppl 1):A116-A.
18. **Miura Y, Ohtori S, Nakajima , *et al.* (2011)**: Dorsal root ganglion neurons with dichotomizing axons projecting to the hip joint and the knee skin in rats: possible mechanism of referred knee pain in hip joint disease. Journal of Orthopaedic Science, 16(6):799-804.
19. **Jadon A, Mohsin K, Sahoo R *et al.* (2021)**: Comparison of supra-inguinal fascia iliaca versus pericapsular nerve block for ease of positioning during spinal anaesthesia: A randomised double-blinded trial. Indian Journal of Anaesthesia, 65(8):572.
20. **Mosaffa F, Taheri M, Rasi A *et al.* (2021)**: Comparison of pericapsular nerve group (PENG) block with fascia iliaca compartment block (FICB) for pain control in hip fractures: A double-blind prospective randomized controlled clinical trial. Orthopaedics & Traumatology: Surgery & Research, 108 (1):103135.
21. **Lin D-Y, Morrison C, Brown B *et al.* (2021)**: Pericapsular nerve group (PENG) block provides improved short-term analgesia compared with the femoral nerve block in hip fracture surgery: a single-center double-blinded randomized comparative trial. Regional Anesthesia & Pain Medicine, 46(5):398-403.
22. **Allard C, Pardo E, de la Jonquière C *et al.* (2021)**: Comparison between femoral block and PENG block in femoral neck fractures: A cohort study. Plos one, 16(6):e0252716.
23. **Aliste J, Layera S, Bravo D *et al.* (2021)**: Randomized comparison between pericapsular nerve group (PENG) block and suprainguinal fascia iliaca block for total hip arthroplasty. Regional Anesthesia & Pain Medicine, 46(10):874-8.
24. **Endersby R, Moser J, Ho E *et al.* (2021)**: Motor blockade after iliopsoas plane (IPB) and pericapsular nerve group (PENG) blocks: A little may go a long way. Acta Anaesthesiologica Scandinavica, 65(1):135-6.
25. **Ahiskalioglu A, Aydin M, Celik M *et al.* (2020)**: Can high volume pericapsular nerve group (PENG) block act as a lumbar plexus block? Journal of clinical anesthesia, 61:109650.