ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

Journal of Dermatological Case Reports

Analgesic Efficacy of Pericapsular Nerve Group Block versus Femoral Nerve Block before Spinal Anaesthesia for Hip Surgery: A Randomized Trial

[1]Dr. Arun Kumar Gupta

[1]Associate Professor, Department of Anaesthesiology, RIMT Medical College & Hospital, Mandi, Gobindgarh, Punjab

Corresponding Author

Dr. Arun Kumar Gupta
Associate Professor,
Department of Anaesthesiology
RIMT Medical College & Hospital,
Mandi, Gobindgarh, Punjab

guptaarun71@gmail.com

Abstract:

Background

Positioning patients with painful hip fractures for spinal anaesthesia can be challenging. Femoral nerve block (FNB) provides analgesia but may incompletely cover hip capsular innervation and cause quadriceps weakness. The pericapsular nerve group (PENG) block may provide more comprehensive, motor-sparing analgesia. This study compared the analgesic efficacy of PENG block and FNB before spinal anaesthesia for hip surgery.

Methods

This prospective, randomized, assessor-blinded trial included 76 adults undergoing hip surgery under spinal anaesthesia. Participants were allocated equally to receive ultrasound-guided PENG block or FNB using 20 mL of 0.25% bupivacaine. Dynamic numerical rating scale (NRS) scores were recorded at baseline and 10, 20 and 30 minutes after block administration. The primary outcome was reduction in dynamic NRS at 30 minutes. Secondary outcomes included positioning pain and quality, spinal attempts, rescue fentanyl, postoperative analgesia, quadriceps weakness, ambulation and adverse events.

Results

Baseline characteristics were comparable between the groups. At 30 minutes, dynamic NRS was lower with PENG block than FNB (2.2±1.1 versus 3.8±1.4; $p<0.001$), with a greater reduction from baseline (6.1±1.2 versus 4.4±1.5; $p<0.001$). PENG block reduced positioning pain (2.5±1.2 versus 4.1±1.5; $p<0.001$) and positioning time (2.6±0.8 versus 3.8±1.1 minutes; $p<0.001$). Optimal positioning was more frequent (73.7% versus 44.7%; $p=0.019$), whereas rescue fentanyl use was lower (7.9% versus 31.6%; $p=0.019$). Time to first rescue analgesia was prolonged (8.9±2.6 versus 6.4±2.1 hours; $p<0.001$), and 24-hour tramadol consumption was reduced (71.1±45.8 versus 110.5±52.6 mg; $p=0.001$). Quadriceps weakness at 30 minutes occurred in 10.5% versus 42.1% of patients ($p=0.004$). Adverse events were comparable.

Conclusion

PENG block provided superior pre-spinal and postoperative analgesia, improved positioning conditions and better preserved quadriceps strength compared with FNB, without increasing complications.

Keywords:

Femoral nerve block; hip fracture; hip surgery; pericapsular nerve group block; spinal anaesthesia

Received : 03-07-2024 **Revised : 20-07-2024** **Accepted: 01-08-2024** **Published : 08-08-2024**

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

Introduction

Hip surgery, particularly for proximal femoral fractures, is commonly performed in older adults with multiple comorbidities. These injuries produce severe pain that is markedly aggravated by movement. Although spinal anaesthesia is frequently preferred, positioning the patient in the sitting or lateral position may cause intense pain, sympathetic activation, poor cooperation and difficulty in identifying spinal landmarks. Systemic opioids can facilitate positioning but may produce sedation, respiratory depression, nausea, delirium and haemodynamic instability, especially in frail patients. Peripheral nerve blocks provide opioid-sparing analgesia; a Cochrane review of 49 trials involving 3,061 participants reported a 2.5-point reduction in movement-related pain within 30 minutes compared with no block [1].

Femoral nerve block (FNB) is an established technique for analgesia before positioning for spinal anaesthesia. Clinical studies have demonstrated that FNB reduces pain, improves positioning quality and decreases the time required to administer spinal anaesthesia compared with intravenous opioids [2,3]. However, the sensory innervation of the hip is complex. The anterior capsule—the most richly innervated component—receives articular branches from the femoral, obturator and accessory obturator nerves [4]. Consequently, FNB may provide incomplete capsular analgesia because it principally targets the femoral nerve. It may also cause quadriceps weakness, potentially interfering with postoperative mobilisation and increasing fall risk.

The ultrasound-guided pericapsular nerve group (PENG) block was introduced in 2018 as a predominantly motor-sparing technique targeting the articular branches supplying the anterior hip capsule [5]. Local anaesthetic is deposited in the fascial plane between the psoas tendon and superior pubic ramus near the iliopubic eminence, producing targeted hip analgesia while theoretically preserving quadriceps strength [5,6]. Preliminary studies have demonstrated improved pain relief during spinal positioning and reduced postoperative analgesic requirements [6,7]. Randomized comparisons have also reported better early analgesia and greater preservation of quadriceps strength with PENG block than with FNB [8,9]. Nevertheless, differences in local-anaesthetic volume, assessment intervals and outcome definitions limit definitive conclusions. Therefore, the present randomized trial compared the analgesic efficacy of PENG block and FNB before spinal anaesthesia for hip surgery, including positioning pain, ease of positioning, rescue analgesic requirement and motor preservation.

Material and Methods

Study design and setting

This prospective, randomized, assessor-blinded, parallel-group clinical trial was conducted in the Department of Anaesthesiology at a tertiary-care teaching hospital in India over a period of 12 months between April 2022 to March 2023. Adult patients with proximal femoral fractures scheduled for operative fixation or hip arthroplasty under spinal anaesthesia were enrolled. The study was designed and reported according to the Consolidated Standards of Reporting Trials guidelines.

Ethical considerations

The study protocol was approved by the Institutional Ethics Committee and prospectively registered with the Clinical Trials Registry–India. Written informed consent was obtained from every participant or a legally authorised representative. Patient confidentiality was maintained throughout the study, and all procedures complied with the Declaration of Helsinki.

Participant selection

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

Patients aged 18–80 years, of either sex, with American Society of Anesthesiologists physical status I–III and scheduled for hip surgery under spinal anaesthesia were eligible. Patients were required to be conscious, haemodynamically stable and capable of understanding the 0–10 numerical rating scale (NRS). Exclusion criteria were refusal to participate, allergy to study drugs, coagulopathy or ongoing therapeutic anticoagulation, infection at the injection site, pre-existing peripheral neuropathy, neuromuscular disease, documented cognitive impairment, chronic opioid use, polytrauma, pathological fracture, previous surgery in the inguinal region, severe hepatic or renal dysfunction, and contraindications to spinal anaesthesia.

Sample size and randomization

The sample size was calculated using the expected difference in dynamic NRS scores 30 minutes after block administration, with a two-sided α error of 0.05, 80% power and allowance for attrition. Eligible patients were allocated in a 1:1 ratio to the PENG group (N=38) or FNB group (N=38) using a computer-generated random sequence. Allocation was concealed in sequentially numbered; opaque, sealed envelopes opened immediately before block administration. The anaesthesiologist performing the block could not be blinded; however, the investigator recording outcomes and the statistician remained unaware of group allocation.

Preoperative preparation

All patients underwent routine pre-anaesthetic evaluation. Standard monitoring, including non-invasive blood pressure, electrocardiography and pulse oximetry, was instituted. Intravenous access was secured, and oxygen was administered when clinically indicated. Baseline pain at rest and during passive elevation of the affected limb to approximately 15° was recorded using the NRS, where 0 represented no pain and 10 represented the worst imaginable pain. No sedative or opioid was administered before the primary pain assessment.

Block techniques

Blocks were performed under strict aseptic precautions using a low-frequency curvilinear ultrasound transducer. In the PENG group, the probe was placed transversely over the anterior inferior iliac spine and rotated to align with the superior pubic ramus. After identifying the iliopubic eminence, psoas tendon and femoral artery, a block needle was advanced in-plane from lateral to medial. Following negative aspiration, 20 mL of 0.25% bupivacaine was deposited between the psoas tendon and superior pubic ramus.

In the FNB group, a high-frequency linear transducer was positioned transversely at the inguinal crease. The femoral nerve was identified lateral to the femoral artery beneath the fascia iliaca. The needle was advanced in-plane, and 20 mL of 0.25% bupivacaine was injected circumferentially around the nerve after negative aspiration. Incremental injection and repeated aspiration were used in both groups. Patients were observed for vascular puncture, local-anaesthetic systemic toxicity and other immediate complications.

Spinal anaesthesia and outcome assessment

Dynamic NRS scores were recorded at 10, 20 and 30 minutes after block administration. At 30 minutes, patients were positioned sitting or lateral, according to the attending anaesthesiologist's preference, for spinal anaesthesia. Positioning pain, time required to achieve the spinal position, number of spinal attempts and ease-of-positioning score were documented. An ease-of-positioning score of 0 indicated inability to position, 1 inadequate positioning, 2 satisfactory positioning and 3 optimal positioning. Spinal anaesthesia was administered using hyperbaric bupivacaine according to body habitus and anticipated surgical duration.

The primary outcome was the reduction in dynamic NRS score from baseline to 30 minutes. Secondary outcomes included pain during spinal positioning, positioning quality, time and attempts required for

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

spinal anaesthesia, need for rescue fentanyl, duration of postoperative analgesia, 24-hour rescue-analgesic consumption, quadriceps weakness and block-related adverse events. Postoperative rescue analgesia consisted of intravenous paracetamol, with tramadol administered when NRS remained greater than 4.

Statistical analysis

Data were analysed using SPSS version 20.0 Continuous variables were assessed for normality using the Shapiro–Wilk test and compared using the independent-samples t test or Mann–Whitney U test. Repeated pain measurements were analysed using repeated-measures analysis of variance or an appropriate non-parametric test. Categorical variables were compared using the chi-square or Fisher's exact test. Results were expressed as mean±standard deviation, median with interquartile range, or frequency and percentage. A two-sided p value <0.05 was considered statistically significant, and analysis followed the intention-to-treat principle.

Results

The two groups were comparable at baseline. Mean age was 67.2±10.1 years in the PENG group and 68.5±9.4 years in the FNB group (p=0.563), while females constituted 55.3% and 60.5%, respectively. No significant differences were observed in body mass index, ASA physical status, hypertension, diabetes mellitus or interval between fracture and surgery (all p>0.05). Intertrochanteric fracture was the most common fracture in both groups (47.4% versus 44.7%), and proximal femoral nailing was the predominant procedure (52.6% versus 50.0%). Baseline dynamic NRS scores were also comparable (8.3±1.1 versus 8.2±1.2; p=0.706) (Table 1).

Table 1. Baseline demographic and clinical characteristics of patients receiving PENG block or FNB before spinal anaesthesia.

Characteristic	PENG group (n=38)	FNB group (n=38)	p value
	Frequency (%)/Mean ± SD		
Age, years	**67.2 ± 10.1**	**68.5 ± 9.4**	**0.563**
Gender			
Male	**17 (44.7)**	**15 (39.5)**	**0.817**
Female	**21 (55.3)**	**23 (60.5)**	
Body mass index, kg/m²	**23.8 ± 3.2**	**24.1 ± 3.5**	**0.698**
ASA physical status			
ASA I	**13 (34.2)**	**11 (28.9)**	**0.869**
ASA II	**20 (52.6)**	**21 (55.3)**	
ASA III	**5 (13.2)**	**6 (15.8)**	
Hypertension	**19 (50.0)**	**21 (55.3)**	**0.819**
Diabetes mellitus	**10 (26.3)**	**12 (31.6)**	**0.801**
Time from fracture to surgery, days	**3.1 ± 1.5**	**3.3 ± 1.7**	**0.588**
Type of fracture			
Femoral neck fracture	**12 (31.6)**	**13 (34.2)**	**0.966**
Intertrochanteric fracture	**18 (47.4)**	**17 (44.7)**	

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

Subtrochanteric fracture	**8 (21.1)**	**8 (21.1)**	
Planned surgical procedure			
Proximal femoral nailing	**20 (52.6)**	**19 (50.0)**	**0.964**
Hemiarthroplasty	**10 (26.3)**	**11 (28.9)**	
Dynamic hip screw/other fixation	**8 (21.1)**	**8 (21.1)**	
Baseline dynamic NRS score	**8.3 ± 1.1**	**8.2 ± 1.2**	**0.706**

ASA: American Society of Anesthesiologists; FNB: femoral nerve block; NRS: numerical rating scale; PENG: pericapsular nerve group.

Although baseline dynamic NRS scores were comparable, pain decreased more rapidly following PENG block. At 10 minutes, mean NRS was 5.1±1.3 in the PENG group compared with 6.0±1.4 in the FNB group (p=0.005). The corresponding scores at 20 minutes were 3.4±1.2 and 4.8±1.3, respectively (p<0.001), and at 30 minutes were 2.2±1.1 and 3.8±1.4 (p<0.001). The mean reduction from baseline to 30 minutes was significantly greater with PENG block than with FNB (6.1±1.2 versus 4.4±1.5 points; mean difference 1.70, 95% CI 1.08–2.32; p<0.001) (Table 2).

Table 2. Comparison of dynamic pain scores before and after PENG block or FNB.

Assessment time	**PENG group (n=38)**	**FNB group (n=38)**	**Mean difference (95% CI)**	**p value**
	Mean ± SD			
Baseline	**8.3 ± 1.1**	**8.2 ± 1.2**	**0.10 (−0.43 to 0.63)**	**0.706**
10 minutes after block	**5.1 ± 1.3**	**6.0 ± 1.4**	**−0.90 (−1.52 to −0.28)**	**0.005**
20 minutes after block	**3.4 ± 1.2**	**4.8 ± 1.3**	**−1.40 (−1.97 to −0.83)**	**<0.001**
30 minutes after block	**2.2 ± 1.1**	**3.8 ± 1.4**	**−1.60 (−2.18 to −1.02)**	**<0.001**
Reduction from baseline to 30 minutes	**6.1 ± 1.2**	**4.4 ± 1.5**	**1.70 (1.08 to 2.32)**	**<0.001**

Dynamic pain was assessed during approximately 15° passive elevation of the affected limb using an 11-point NRS. CI: confidence interval; FNB: femoral nerve block; NRS: numerical rating scale; PENG: pericapsular nerve group.

During positioning for spinal anaesthesia, the PENG group had a significantly lower mean NRS score than the FNB group (2.5±1.2 versus 4.1±1.5; p<0.001). The mean ease-of-positioning score was higher with PENG block (2.63±0.54 versus 2.18±0.65; p=0.002), and optimal positioning was achieved in 73.7% versus 44.7% of patients (p=0.019). PENG block also reduced positioning time (2.6±0.8 versus 3.8±1.1 minutes; p<0.001) and the number of spinal attempts (1.18±0.39 versus 1.47±0.69; p=0.028). First-attempt success was higher (81.6% versus 57.9%; p=0.045), whereas rescue fentanyl use was lower (7.9% versus 31.6%; p=0.019) (Table 3).

Table 3. Pain severity and procedural outcomes during positioning for spinal anaesthesia.

Outcome	**PENG group (n=38)**	**FNB group (n=38)**	**p value**
	Frequency (%)/Mean ± SD		
NRS score during positioning	**2.5 ± 1.2**	**4.1 ± 1.5**	**<0.001**

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

Ease-of-positioning score	**2.63 ± 0.54**	**2.18 ± 0.65**	**0.002**
Optimal positioning achieved	**28 (73.7)**	**17 (44.7)**	**0.019**
Time required to achieve position, minutes	**2.6 ± 0.8**	**3.8 ± 1.1**	**<0.001**
Number of spinal attempts	**1.18 ± 0.39**	**1.47 ± 0.69**	**0.028**
Successful spinal anaesthesia on first attempt	**31 (81.6)**	**22 (57.9)**	**0.045**
Rescue fentanyl required before spinal anaesthesia	**3 (7.9)**	**12 (31.6)**	**0.019**
Patient satisfaction score, 0–10	**8.7 ± 1.0**	**7.9 ± 1.2**	**0.002**

Ease-of-positioning scores ranged from 0 (unable to position) to 3 (optimal positioning). FNB: femoral nerve block; NRS: numerical rating scale; PENG: pericapsular nerve group.

The PENG block required more time to perform than FNB (6.1±1.2 versus 4.8±1.0 minutes; p<0.001), but it produced a faster onset of analgesia (10.4±3.1 versus 12.9±3.7 minutes; p=0.002). Block success was achieved in 94.7% of the PENG group and 84.2% of the FNB group, although this difference was not statistically significant (p=0.262). Intrathecal bupivacaine dose, duration of surgery and additional intraoperative fentanyl requirements were comparable. The incidences of hypotension (18.4% versus 21.1%; p=1.000) and bradycardia (5.3% versus 7.9%; p=1.000) were similar, and no patient required conversion to general anaesthesia (Table 4).

Table 4. Block-performance characteristics and intraoperative outcomes in the two study groups.

Variable	**PENG group (n=38)**	**FNB group (n=38)**	**p value**
	Frequency (%)/Mean ± SD		
Time required to perform block, minutes	**6.1 ± 1.2**	**4.8 ± 1.0**	**<0.001**
Analgesic onset time, minutes	**10.4 ± 3.1**	**12.9 ± 3.7**	**0.002**
Successful block at 30 minutes	**36 (94.7)**	**32 (84.2)**	**0.262**
Intrathecal hyperbaric bupivacaine, mg	**13.9 ± 1.2**	**14.0 ± 1.3**	**0.729**
Duration of surgery, minutes	**91.2 ± 20.3**	**94.1 ± 22.0**	**0.552**
Additional intraoperative fentanyl required	**2 (5.3)**	**4 (10.5)**	**0.674**
Intraoperative hypotension	**7 (18.4)**	**8 (21.1)**	**1.000**
Bradycardia requiring atropine	**2 (5.3)**	**3 (7.9)**	**1.000**
Conversion to general anaesthesia	**0**	**0**	**—**

Successful block was defined as a ⩾50% reduction in dynamic NRS at 30 minutes. FNB: femoral nerve block; NRS: numerical rating scale; PENG: pericapsular nerve group.

Postoperative NRS scores at two hours were comparable between the PENG and FNB groups (1.2±0.8 versus 1.4±0.9; p=0.309). Thereafter, pain scores were significantly lower with PENG block at four hours (1.8±0.9 versus 2.5±1.0; p=0.002), six hours (2.6±1.0 versus 3.5±1.1; p<0.001) and 12 hours (3.2±1.1 versus 4.2±1.2; p<0.001). The time to first rescue analgesia was longer with PENG block (8.9±2.6 versus 6.4±2.1 hours; p<0.001). Fewer patients required two or more rescue doses (21.1% versus 52.6%; p=0.008), and 24-hour tramadol consumption was lower (71.1±45.8 versus 110.5±52.6 mg; p=0.001) (Table 5).

Table 5. Postoperative pain and rescue-analgesic requirements during the first 24 hours.

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

Outcome	PENG group (n=38)	FNB group (n=38)	p value
	Frequency (%)/Mean ± SD		
NRS score at 2 hours	1.2 ± 0.8	1.4 ± 0.9	0.309
NRS score at 4 hours	1.8 ± 0.9	2.5 ± 1.0	0.002
NRS score at 6 hours	2.6 ± 1.0	3.5 ± 1.1	<0.001
NRS score at 12 hours	3.2 ± 1.1	4.2 ± 1.2	<0.001
Patients requiring rescue analgesia	23 (60.5)	31 (81.6)	0.075
Time to first rescue analgesia, hours	8.9 ± 2.6	6.4 ± 2.1	<0.001
Patients requiring ≥2 rescue doses	8 (21.1)	20 (52.6)	0.008
Cumulative tramadol consumption at 24 hours, mg	71.1 ± 45.8	110.5 ± 52.6	0.001

Postoperative pain was assessed at rest using the NRS. FNB: femoral nerve block; NRS: numerical rating scale; PENG: pericapsular nerve group.

Quadriceps weakness 30 minutes after block administration was significantly less frequent in the PENG group than in the FNB group (10.5% versus 42.1%; p=0.004). Residual weakness after regression of spinal anaesthesia was also lower with PENG block (13.2% versus 36.8%; p=0.032). Consequently, the mean time to first assisted ambulation was shorter in the PENG group (18.4±4.2 versus 21.3±5.0 hours; p=0.008). Postoperative nausea or vomiting occurred in 5.3% and 13.2% of patients, respectively (p=0.430). One vascular puncture occurred in the FNB group; no injection-site haematoma, local-anaesthetic systemic toxicity or postoperative fall was recorded in either group (Table 6).

Table 6. Motor-function recovery and block-related safety outcomes.

Outcome	PENG group (n=38)	FNB group (n=38)	p value
	Frequency (%)/Mean ± SD		
Quadriceps weakness 30 minutes after block	4 (10.5)	16 (42.1)	0.004
Residual quadriceps weakness after regression of spinal block	5 (13.2)	14 (36.8)	0.032
Time to first assisted ambulation, hours	18.4 ± 4.2	21.3 ± 5.0	0.008
Postoperative nausea or vomiting	2 (5.3)	5 (13.2)	0.403
Vascular puncture during block	0	1 (2.6)	1.000
Injection-site haematoma	0	0	—
Local-anaesthetic systemic toxicity	0	0	—
Postoperative fall within 24 hours	0	0	—

Quadriceps weakness was defined as inability to extend the knee against gravity or reduced strength relative to the contralateral limb. FNB: femoral nerve block; PENG: pericapsular nerve group.

Discussion

The present randomized trial demonstrated that ultrasound-guided PENG block provided superior pre-spinal analgesia compared with FNB in patients undergoing hip surgery. Baseline demographic, fracture and surgical characteristics were comparable, supporting the likelihood that the observed differences were attributable to the block technique. At 30 minutes, dynamic NRS decreased by 6.1±1.2 points following PENG block compared

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

with 4.4±1.5 points following FNB, producing an adjusted clinical difference of 1.70 points ($p<0.001$). The PENG group also experienced less pain during spinal positioning (2.5±1.2 versus 4.1±1.5; $p<0.001$). Erten et al. similarly reported lower pain with PENG block during lateral positioning ($p=0.001$), hip flexion ($p<0.001$) and lumbar flexion ($p=0.001$) than with FNB [10]. Conversely, Allard et al. found comparable postoperative pain between the techniques, although their small observational cohort and postoperative rather than positioning-focused assessment may explain the difference [11].

Superior analgesia with PENG block translated into clinically meaningful procedural advantages. Optimal positioning was achieved in 73.7% of PENG recipients compared with 44.7% following FNB ($p=0.019$), positioning time was reduced by 1.2 minutes, and first-attempt spinal success increased from 57.9% to 81.6% ($p=0.045$). Rescue fentanyl was correspondingly less frequent (7.9% versus 31.6%; $p=0.019$). Aygun et al. also demonstrated significantly lower positioning pain, opioid consumption and higher satisfaction following PENG block [12]. Effective blockade of the femoral, obturator and accessory obturator articular branches reduces nociception from the richly innervated anterior capsule. This permits greater hip and lumbar flexion with less reflex muscle guarding, thereby facilitating landmark identification and needle placement. Although PENG block took longer to perform than FNB (6.1 versus 4.8 minutes; $p<0.001$), this modest increase was offset by faster analgesic onset and easier spinal administration. The additional performance time probably reflects the deeper target, need for a curvilinear transducer and careful identification of the iliopubic eminence and psoas tendon.

Postoperative findings further supported a prolonged analgesic effect. Pain scores were comparable at two hours, likely because of persisting spinal anaesthesia, but were significantly lower with PENG block at 4, 6 and 12 hours. Time to first rescue analgesia increased from 6.4 to 8.9 hours ($p<0.001$), while 24-hour tramadol consumption decreased from 110.5±52.6 to 71.1±45.8 mg ($p=0.001$). Similar benefits have been reported by Kong et al., who observed better postoperative analgesia and less quadriceps weakness with PENG than fascia iliaca block in intertrochanteric fractures [13], and by Senthil et al. in hip-fracture surgery [14]. Trials by Pascarella et al. and Zheng et al. also demonstrated reduced pain or opioid consumption and improved early recovery after total hip arthroplasty [15,17]. However, Allard et al. detected no difference in 48-hour morphine consumption between PENG and FNB (20 versus 10 mg; $p=0.478$) [11], while Aliste et al. reported better motor preservation but comparable analgesia relative to suprainguinal fascia iliaca block [16]. Such variation may arise from differences in surgical approach, local-anaesthetic dose, adjuvants and multimodal analgesic regimens.

Motor preservation was another important finding. Quadriceps weakness at 30 minutes occurred in 10.5% of PENG patients compared with 42.1% after FNB ($p=0.004$); residual weakness after spinal regression was also lower (13.2% versus 36.8%; $p=0.032$), permitting earlier assisted ambulation (18.4 versus 21.3 hours; $p=0.008$). Allard et al. reported a median quadriceps strength of 5/5 after PENG versus 2/5 after FNB ($p<0.001$) [11], while Aliste et al. found motor block at six hours in 25% versus 85% after suprainguinal fascia iliaca block [16]. PENG primarily targets sensory articular branches while avoiding the main femoral motor trunk. Nevertheless, the 10.5% weakness rate confirms that it is not invariably motor-sparing. Yu et al. described inadvertent quadriceps weakness caused by spread towards the femoral nerve [18], and anatomical reviews implicate medial needle placement, iliopectineal bursal spread and larger injectate volumes [20]. Huang et al. likewise demonstrated that motor blockade varies with ropivacaine volume and concentration [19].

Both techniques had comparable haemodynamic and adverse-event profiles, with no systemic local-anaesthetic toxicity, haematoma, falls or conversion

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

to general anaesthesia. Meta-analyses by Huda and Ghafoor and Li et al. support the opioid-sparing, positioning and motor-recovery benefits of PENG block, while emphasizing heterogeneity among available trials [21,22]. Collectively, the present findings suggest that PENG block offers a favourable balance between effective perioperative analgesia and preservation of motor function, although meticulous technique and appropriate injectate volume remain essential.

Limitations

This study has several limitations. It was conducted at a single centre with a relatively small sample, limiting external validity and subgroup analyses by fracture or surgical type. The anaesthesiologist performing the block could not be blinded, introducing potential performance bias. Follow-up was restricted to 24 hours, and functional recovery beyond first ambulation was not assessed. Additionally, block success and quadriceps strength were evaluated using clinically based measures.

Conclusion

Ultrasound-guided PENG block provided more effective analgesia than FNB before spinal anaesthesia for hip surgery. It produced a greater reduction in dynamic pain, improved positioning quality, shortened positioning time, increased first-attempt spinal success and reduced rescue fentanyl requirement. Its benefits extended into the postoperative period, with longer analgesia, lower pain scores and reduced 24-hour tramadol consumption. PENG block also preserved quadriceps strength and facilitated earlier assisted ambulation without increasing haemodynamic instability or block-related complications. Although technically more time-consuming than FNB, its combined analgesic and motor-sparing advantages support its use as a component of multimodal perioperative analgesia for patients undergoing hip surgery.

References

1. Guay J, Kopp S. Peripheral nerve blocks for hip fractures in adults. Cochrane Database Syst Rev. 2020;11(11):CD001159.
2. Iamaroon A, Raksakietisak M, Halilamien P, Hongsawad J, Boonsararuxsapong K. Femoral nerve block versus fentanyl: analgesia for positioning patients with fractured femur. Local Reg Anesth. 2010;3:21–26.
3. Jadon A, Kedia SK, Dixit S, Chakraborty S. Comparative evaluation of femoral nerve block and intravenous fentanyl for positioning during spinal anaesthesia in surgery of femur fracture. Indian J Anaesth. 2014;58(6):705–708.
4. Short AJ, Barnett JJG, Gofeld M, Baig E, Lam K, Agur AMR, et al. Anatomic study of innervation of the anterior hip capsule: implication for image-guided intervention. Reg Anesth Pain Med. 2018;43(2):186–192.
5. Girón-Arango L, Peng PWH, Chin KJ, Brull R, Perlas A. Pericapsular nerve group (PENG) block for hip fracture. Reg Anesth Pain Med. 2018;43(8):859–863.
6. Sahoo RK, Jadon A, Sharma SK, Peng PWH. Pericapsular nerve group block provides excellent analgesia in hip fractures and positioning for spinal anaesthesia: a prospective cohort study. Indian J Anaesth. 2020;64(10):898–900.
7. Alrefaey AK, Abouelela MA. Pericapsular nerve group block for analgesia of positioning pain during spinal anesthesia in hip fracture patients: a randomized controlled study. Egypt J Anaesth. 2020;36(1):234–239.
8. Lin DY, Morrison C, Brown B, Saies AA, Pawar R, Vermeulen M, et al. Pericapsular nerve group block provides improved short-term analgesia compared with the femoral nerve block in hip fracture surgery. Reg Anesth Pain Med. 2021;46(5):398–403.
9. Chaudhary K, Bose N, Tanna D, Chandnani A. Ultrasound-guided pericapsular nerve group block versus femoral nerve block for positioning during spinal anaesthesia in proximal femur

ISSN : (Online): 3008-038X
Abbreviation: J Derm Cse Rep
DOI: 10.61705/jdcr.17.1.2024.102.111

fractures. Indian J Anaesth. 2023;67(10):913–919.

10. Erten E, Kara U, Şimşek F, Eşkin MB, Bilekli AB, Öcal N, et al. Comparison of pericapsular nerve group block and femoral nerve block in spinal anesthesia position analgesia for proximal femoral fractures in geriatric patients: a randomized clinical trial. Ulus Travma Acil Cerrahi Derg. 2023;29(12):1368–1375.
11. Allard C, Pardo E, de la Jonquière C, Wyniecki A, Soulier A, Faddoul A, et al. Comparison between femoral block and PENG block in femoral neck fractures: a cohort study. PLoS One. 2021;16(6):e0252716.
12. Aygun H, Tulgar S, Yigit Y, Tasdemir A, Kurt C, Genc C, et al. Effect of ultrasound-guided pericapsular nerve group block on pain during patient positioning for central nervous blockade in hip surgery: a randomized controlled trial. BMC Anesthesiol. 2023;23(1):316.
13. Kong M, Tang Y, Tong F, Guo H, Zhang XL, Zhou L, et al. The analgesic efficacy of pericapsular nerve group block in patients with intertrochanteric femur fracture: a randomized controlled trial. PLoS One. 2022;17(10):e0275793.
14. Senthil KS, Kumar P, Ramakrishnan L. Comparison of pericapsular nerve group block versus fascia iliaca compartment block as postoperative pain management in hip fracture surgeries. Anesth Essays Res. 2021;15(4):352–356.
15. Pascarella G, Costa F, Del Buono R, Pulitanò R, Strumia A, Piliego C, et al. Impact of the pericapsular nerve group block on postoperative analgesia and functional recovery following total hip arthroplasty: a randomised, observer-masked, controlled trial. Anaesthesia. 2021;76(11):1492–1498.
16. Aliste J, Layera S, Bravo D, Jara Á, Muñoz G, Barrientos C, et al. Randomized comparison between pericapsular nerve group block and suprainguinal fascia iliaca block for total hip arthroplasty. Reg Anesth Pain Med. 2021;46(10):874–878.
17. Zheng J, Pan D, Zheng B, Ruan X. Preoperative pericapsular nerve group block for total hip arthroplasty: a randomized, placebo-controlled trial. Reg Anesth Pain Med. 2022;47(3):155–160.
18. Yu HC, Moser JJ, Chu AY, Montgomery SH, Brown N, Endersby RVW. Inadvertent quadriceps weakness following the pericapsular nerve group block. Reg Anesth Pain Med. 2019;44(5):611–613.
19. Huang Y, Lu Y, Wang J, Lu Q, Bao HF, Liu L, et al. Effect of pericapsular nerve group block with different concentrations and volumes of ropivacaine on functional recovery in total hip arthroplasty: a randomized, observer-masked, controlled trial. J Pain Res. 2024;17:677–685.
20. Yeoh SR, Chou Y, Chan SM, Hou JD, Lin JA. Pericapsular nerve group block and iliopsoas plane block: a scoping review of quadriceps weakness after two proclaimed motor-sparing hip blocks. Healthcare (Basel). 2022;10(8):1565.
21. Huda AU, Ghafoor H. The use of pericapsular nerve group block in hip surgeries is associated with a reduction in opioid consumption, less motor block, and better patient satisfaction: a meta-analysis. Cureus. 2022;14(9):e28872.
22. Li S, An J, Qian C, Wang Z. Efficacy and safety of pericapsular nerve group block for hip fracture surgery under spinal anesthesia: a meta-analysis. Int J Clin Pract. 2024;2024:6896066.