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ORIGINAL RESEARCH

Post- operative analgesia and opioid-sparing efficacy of ultrasound- guided pericapsular nerve group (PENG) block versus quadratus lumborum block (QLB) in proximal femur fracture patients: a comparative study

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ABSTRACT

Background: Hip arthroplasty is frequently associated with significant postoperative pain, which can delay mobilization and recovery. Effective pain management is necessary for early recovery, improved functional outcomes & reduced complications in proximal femur fracture surgeries. Regional anaesthesia techniques, such as the Pericapsular Nerve Group (PENG) block and QuadratusLumborum Block (QLB), have gained prominence for their ability to provide targeted analgesia while minimizing opioid use. The PENG block selectively concentrates on the articular branches of lumbar plexus, preserving quadriceps strength and enabling early mobilization, whereas the QLB offers broader analgesia with variable motor involvement. Despite their growing use, comparative data on these techniques in proximal femur fracture surgeries are limited.This research sought to assess and compare the effectiveness of analgesia, opioid-sparing effect, quadriceps strength preservation & safety of the PENG and QLB techniques to optimize postoperative pain management strategies. **Materials and Methods**: This trial, which was prospective, randomized, double-blind, and controlled, involved 84 patients divided in three groups PENG group (n=28), QLB group (n=28) and control group (n=28) who were scheduled for surgery to treat proximal femur fractures.The primary objective aimed to compare pain ratings based on the Visual Analogue Scale (VAS) across the three groups at various time points: 30 minutes post-procedure, during spinal positioning, upon admission to the PACU, at discharge from PACU, and at 12, 24, and 48 hours post-surgery. Secondary objective was to compare the total consumption of opioids, time of first rescue analgesia, quadriceps strength, time of first standing, satisfactory score at time of discharge and incidence of block complications. **Results:** At 12 hours in the early postoperative phase, the PENG block group's VAS scores (2.61 ± 0.629) and QLB group's (3.36 ± 0.870) scores were considerably lower than those of the control group (3.79 ± 0.876), with a p-value of 0.0001. In comparison to the QLB group, the PENG group had lower VAS values. Regarding opioid consumption, the PENG group used significantly less tramadol (7.14 ± 17.817 mg), with over 90% of patients not needing rescue analgesia. In contrast, the QLB group required 41.07 ± 45.243 mg, with nearly 50% of patients needing additional analgesia ($p < 0.05$). The control group received 200 mg of tramadol during the first twenty-four hours, administered in divided doses as a part of conventional analgesia. The PENG group showed the highest preservation of quadriceps strength, with 82.1% (23/28) of patients maintaining intact strength at 24 hours. In comparison, 60.7% (17/28) patients in QLB group and 50% (14/28) in control group retained quadriceps strength, highlighting the PENG block's superior muscle strength preservation. **Conclusion:** The study concluded that the PENG block outperforms the QLB and control approaches in proximal femur fracture surgeries like hip arthroplasty, offering better pain relief, lower opioid use, and longer time to first rescue analgesia, while preserving quadriceps strength for early mobilization and faster recovery. The QLB also provided effective analgesia but with less consistent muscle strength preservation. Both blocks were safe, with no

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significant adverse events. The PENG block is recommended as the optimal choice for postoperative management of pain in hip arthroplasty.

Keywords: PENG block, QL block, bupivacaine, post-operative pain.

INTRODUCTION

Fractures in hip are a major health issue worldwide, particularly in older people with 70% of patients being over 80 years old. These patients often have frail health and multiple comorbidities, complicating care. Every year, approximately 1.5 million hip fractures occur worldwide, and this figure is predicted to rise sharply, reaching 7–21 million annually by 2050 due to the aging global population.[1,2] Anesthesiologists play a key role in managing perioperative pain in patients with hip fractures, improving comfort, reducing complications, and promoting early mobilization. Regional techniques such as FNB (femoral nerve block), FICB (fascia iliaca compartment block), and epidural analgesia are essential for pain relief, improving functional outcomes and reducing complications. However, infrainguinal blocks such as FNB and FICB may cause motor weakness, potentially delaying postoperative mobilization.[3]Emerging techniques like the PENG (pericapsular nerve group) and QL (quadratuslumborum) blocks offer effective pain relief with minimal impact on mobility, making them ideal for hip fracture patients, especially the elderly and frail. The PENG block, introduced in 2018, provides significant pain relief without motor impairment, supporting early mobilization and faster recovery.[4] Similarly, the QL block, initially developed for abdominal surgery, has shown promise in hip analgesia, with studies indicating lower pain scores and reduced opioid use following hip procedures like hemiarthroplasty.[5,6] Both blocks represent advancements in regional anesthesia, improving outcomes for hip fracture patients. As there were no existing studies in the literature comparing these blocks, This research was done for the purpose of comparing the effectiveness of PENG Block and QLB in proximal femur fracture surgeries. This study findings shed important light on the best regional analgesia strategies for treating pain in this particular patient group.

MATERIALS AND METHODS

This observational study was conducted at the Department of Anaesthesiology at B.LD.E's (Deemed to be University) Shri B.M. Patil Medical College from April 2023 to January 2025 with approval from the Institutional Ethics Committee (ref no: BLDE(DU)/IEC/955/2023-24). Each patient provided written informed consent prior to surgery.

Criteria for inclusion- patients regardless of sex, aged between 20-70 years with American Society of Anaesthesiologists (ASA) grade I or II posted for elective proximal femur fractures such as intertrochanteric fracture, fracture neck of the femur, hemi arthroplasty and hip surgeries.

Criteria for exclusion- Patient refusal, pregnant women, infection at the site of block, H/o heart & respiratory disorders, liver & kidney diseases, H/o convulsions & neurological impairements, Spinal deformities, patients on anticoagulants or coagulation disorders and Patients with cognitive impairment.

Sample size: A minimum sample size of 25 patients per group (75 total) was required to achieve 80% power and a 5% significance level (two-sided) for detecting differences in mean VAS scores using one-way ANOVA. After accounting for a 10% attrition rate, the final sample size was rounded to 28 per group, total of 84 participants.

Methodology

Patients were randomly assigned to one of three groups (28 patients each) through chit picking, with the assignments sealed in envelopes by an individual not involved in the study. The three groups included the PENG block (PENG group), QuadratusLumborum Block (QLB group), and in patients where no block given (control group) received 1000mg injparacetamol in ward itself as conventional multimodal analgesia. The sealed envelopes were opened by a specialist administering the block just before the procedure. Anaesthetist who was not participated or aware of the study involved in the data collection. Patients were givenpremedication with 0.01 mg/kg of intravenousinj Midazolam for anxiolysis and 0.15 mg/kg of intravenous injOndansetron to prevent postoperative nausea and vomiting. Oxygen was administered at a rate of 5 L/min to maintain adequate oxygenation throughout the procedure in preoperative area.

For the PENG Block, the patient was kept in supine, and groin area was prepared and draped under aseptic conditions. Cutaneous anaesthesia was achieved with 2 mL of 2% lignocaine.A linear Sonosite M-Turbo ultrasonic probe (2–5 MHz) was used to guide needle placement. The probe was positioned transversely over the anterior inferior iliac spine (AIIS) and adjusted for optimal imaging of target structures. The orientation mark was kept on the lateral side to identify the pubic ramus and iliopubic eminence. Ultrasound settings were adjusted to clearly visualize the AIIS and surrounding anatomy. The ultrasound probe was then turned anticlockwise by 45° to line up with the pubic ramus, providing clear visualization of the iliopsoas plane, femoral artery, and target nerves. Key structures, including the pectineus muscle, femoral artery, iliopubic eminence, and iliopsoas muscle were visualized as in figure 1. Adjustments to

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the probeenhanced the visibility of the iliopsoas notch, muscle, and tendon, while ensuring the femoral artery and nerve were identified to avoid injury during needle insertion. The insertion of a 22-gauge, 80-mm needle was done in-plane from lateral to medial approach, targeting musculofascial plane between psoas tendon and pubic rami. Negative aspiration was performed before injecting 20 mL of 0.25% bupivacaine with 8mg dexamethasone in 5 mL increments, monitored under ultrasound for proper spread. The solution's spread lifted the psoas tendon from the pubic ramus, confirming correct placement as in figure 2. If resistance occurred, the needle was repositioned, and further advancement was made if the solution entered the iliopsoas muscle.

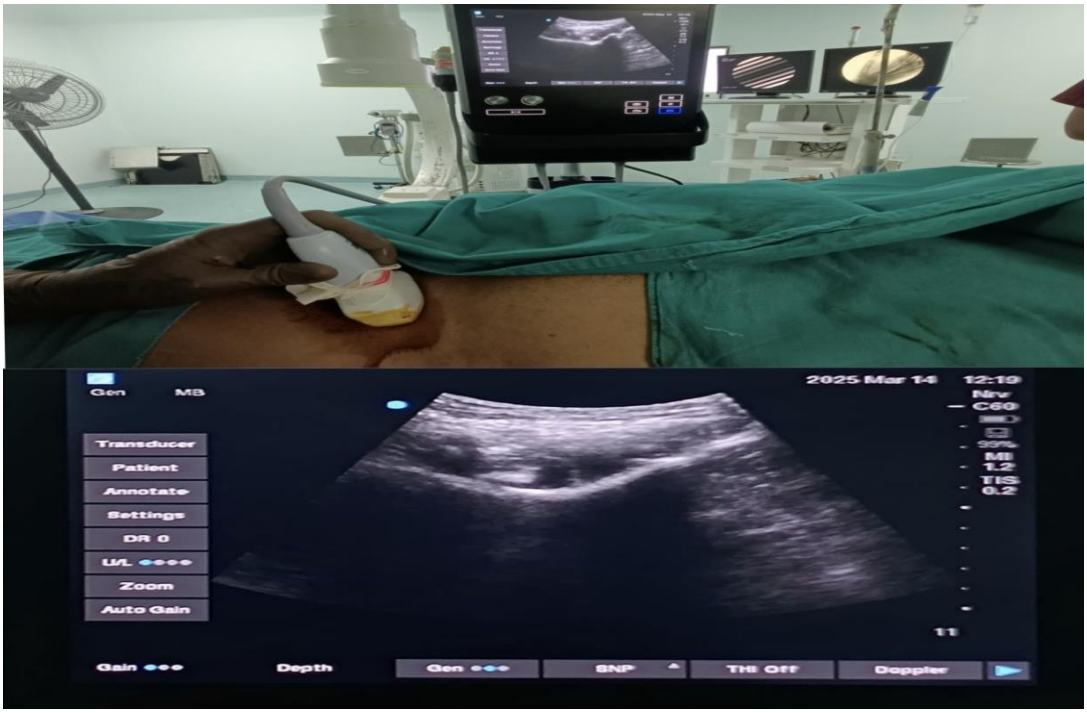

Figure 1 patient and probe positioning in USG for peng block; PE-pectineus muscle; FA- femoral artery; IPE- ilio pubic eminence; AIIS- anterior inferior iliac spine

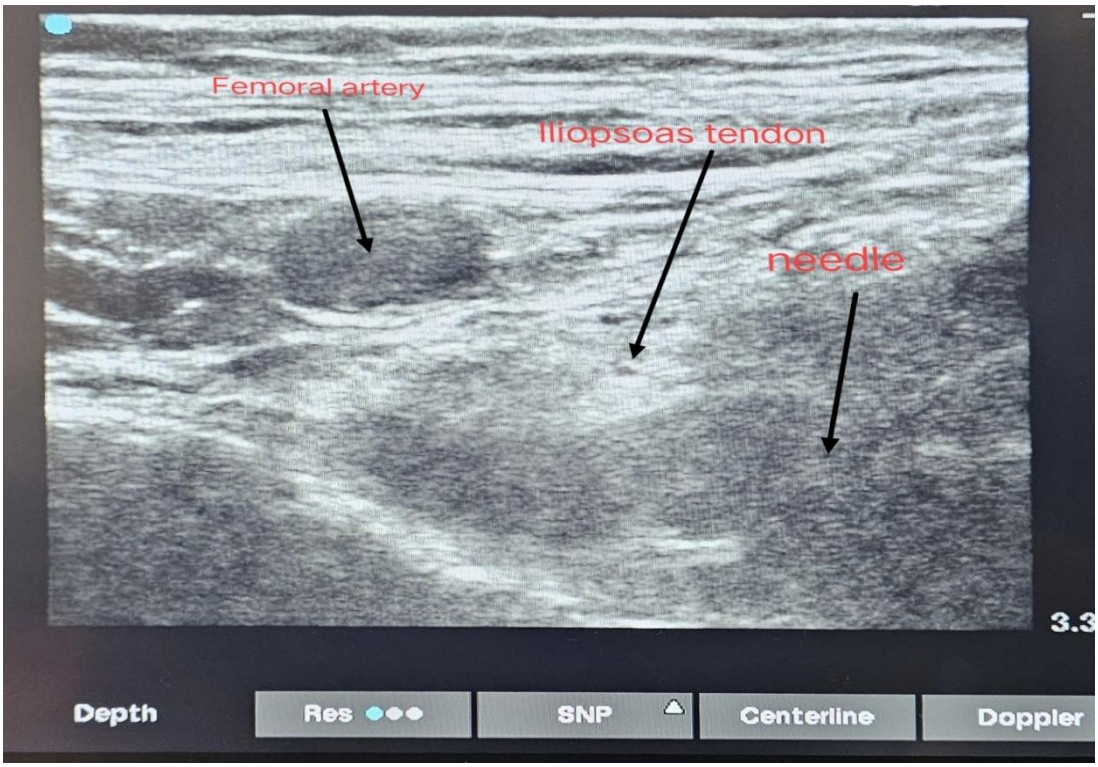

Figure 2 USG image showing spread of drug below psoas tendon; FA- femoral artery

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For quadratuslumborum block, the iliac crest, costal margin, and posterior/midaxillary lines served as key anatomical landmarks. With the surgical side up, the patient was placed in the lateral decubitus position and legs flexed for optimal ergonomics and improved ultrasound visualization of the relevant structures. While the supine position works for lateral QL blocks (QL1 and QL2), it hinders the visualization of the neuraxial and paravertebral structures. A 2-5 MHz low-frequency convex ultrasound probe was used, initially placed transversely above the iliac crest along the anterior axillary line to visualize the three abdominal muscle layers: external oblique (EO), internal oblique (IO), and transversusabdominis (TA) as in figure 3.

The posterior movement of the probe was made until the internal and external oblique muscles transitioned into aponeurosis, revealing the latissimusdorsi and quadratuslumborum (QL) muscles. Further posterior movement of the probe showed the following structures, forming the shamrock sign: the TP of the lumbar vertebra (stem), quadratuslumborum (anterior leaf), psoas major (posterior leaf), and erector spinae (posterior leaf) as in figure 4.

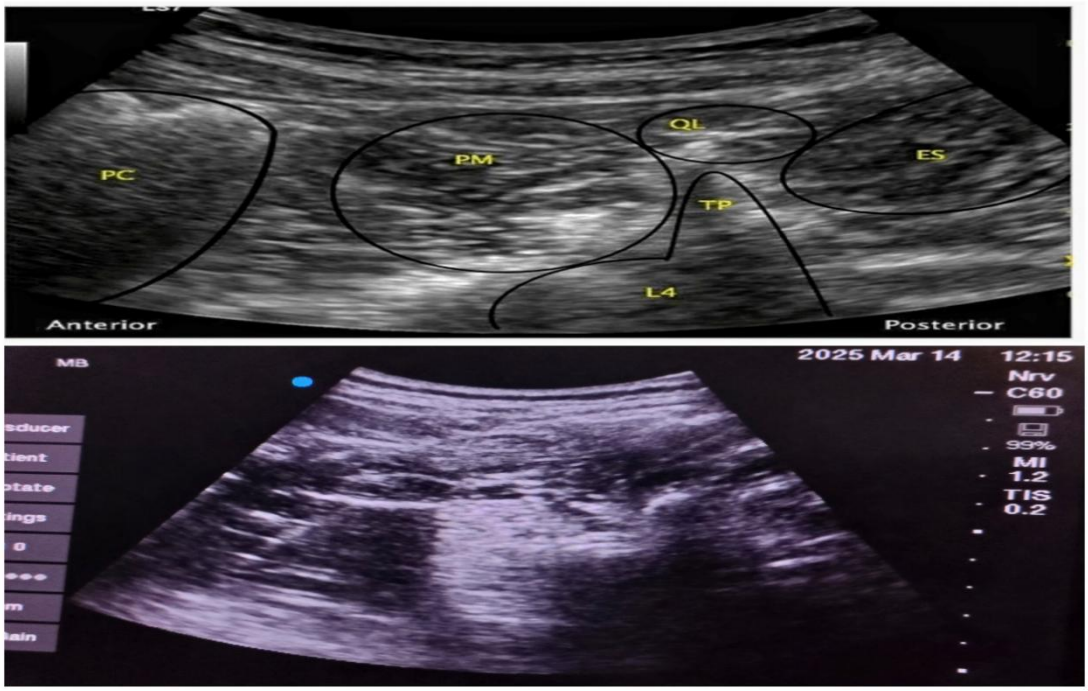

Figure 3 The "shamrock sign" The muscles of the erector spinae (ES), fourth lumbar vertebra (L4), transverse process (TP), peritoneal cavity (PC), psoas muscle (PM), and quadratuslumborum (QL)white line representing trajectory of needle

A 22-gauge, 80mm needle is used for deeper targets like the quadratuslumborum (QL) muscle, inserted from posterior to anterior for better visualization. The needle is placed in-plane and advanced towards the QL muscle, with the tip positioned between the psoas muscle and the QL fascial space. After confirming the position with negative aspiration, 25ml of 0.25% bupivacaine mixed with 8mg dexamethasone is injected in 5ml increments, while observing for posterior spread on ultrasound. The success of the QL block is confirmed by the ultrasound showing the fascial layers separating, ensuring accurate deposition of the local anesthetic.

After the procedure, patients were monitored for hypotension, bradycardia, and local anesthetic toxicity. Pain scores were recorded at baseline and on movement before block, and 30 minutes post-block by a non-participating anaesthesiologist. The patient was then moved to the operating theater, where spinal anesthesia was administered. Pain scores were checked during positioning, and additional fentanyl was given if the Visual Analog Scale (VAS) reached ≥4. Under aseptic conditions, 2 mL of 2% lidocaine was infiltrated at the L3-L4 or L4-L5 space, followed by 3mL of 0.5%Bupivacaine with 25 mcg Fentanyl via a 25-gauge Quincke spinal needle. The patient was monitored in the supine position for 10 minutes, with hemodynamic parameters checked every 3 minutes. An adequate block was confirmed with a sensory block of ≥T10 and a motor block score of 1. If spinal anesthesia was insufficient, general anesthesia was administered, and the patient was excluded from the study. Bradycardia (HR <50bpm)was treated with atropine, and low MAP (mean arterial pressure<65) was managed with ephedrine. Thirty minutes before the end of surgery, all group patients received 1000 mg of IV Paracetamol and 75 mg of IV infusion Diclofenac. Postoperatively all 3 group pateints received conventional multimodal analgesia injparacetamol 1000mg 8th hrly and inj Diclofenac 75mg IV infusion 12thhrly and depending upon VAS pain scores rescue analgesia weregiven. Aditionally

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all control group patients received 100mg inj tramadol 12th hourly as first rescue analgesia irrespective of VAS scores. If the VAS pain score was ≥4 or upon patient request, 100 mg of Inj. Tramadol was given as the first rescue analgesia. If pain persisted (VAS ≥4), 0.5 mcg/kg of Inj. Fentanyl was administered every 10 minutes, up to a total of 2 mcg/kg, as the second rescue analgesia.

Primary and secondary outcome measurement:-After surgery, the resting VAS score was recorded, and the patient's were transferred to the PACU, where the VAS score was also noted at discharge. In the ward, VAS pain scores were documented at 12, 24, and 48 hours, along with the time of first rescue analgesia, total tramadol use in the first 24 and 25-48 hours, quadriceps strength at 12, 24, and 48 hours, time of first standing with support, discharge time, and satisfaction score at discharge.Quadriceps motor function was assessed using hip and knee flexion tests at 45° and 90°, respectively. The results were recorded as: absent (no muscle contraction), intact (muscle contraction with normal joint movement), reduced (muscle contraction without joint movement), or unable to assess (due to pain).All patients were monitored for complications, including nausea, vomiting, pruritus, and block-related issues such as hematoma, myositis, and nerve injuries.

STATISTICAL ANALYSIS

Microsoft Excel was used to enter the data, and SPSS (version 20) was used for analysis. The findings were displayed using graphs, counts, percentages, and mean ± SD. Continuous variables that were regularly distributed were subjected to ANOVA, whereas non-normally distributed variables were subjected to the Kruskal-Wallis test. Two groups' category variables were compared using the chi-square test. Every test was two-tailed, and a p-value < 0.05 was considered significant.

RESULTS

The study included patients aged 21-70, with mean ages of 55.50 ±13.49 in the PENG group, 59.43 ±10.32 in the QLB group, and 59.07 ±10.73 in the control group (p=0.554). Of the 84 patients, 39 were men and 45 were women, with a slightly higher proportion of females (table 1).

Table 1: Demographics data

Variable	PENG (n=28)	QLB	Control group	P value
Age (years)	55.50±13.489	59.43±10.322	59.07±10.732	0.554
Sex (M/F)	14/14	12/16	13/15	0.866
ASA (I/II)	17/11	15/13	14/14	0.714

The mean VAS scores at rest & on movement pre block, and at 24 hours were comparable across all groups (p>0.05). However, both the PENG and QLB groups had significantly lower VAS scores than the control group at most time points. At 30 minutes post-block, the PENG group had a mean score of 3.21 ±0.63 (p=0.0002) and the QLB group had 4.61 ±0.57. During spinal anesthesia, the PENG group had 2.46 ±0.744 (p=0.0001), and the QLB group had 3.86 ±0.705. At PACU discharge, the PENG group had 1.00 ±0.816 (p=0.0001) and the QLB group had 1.36 ±0.731 (table 2 and graph 1).

Table 2 Mean VAS scores

VAS scores at different time intervals	PENG group		QLB group		Control group		P value
	Mean	SD	Mean	SD	Mean	SD	
At rest	5.64	±0.951	6.07	±0.979	5.79	±0.957	0.339
On movement pre-block	7.61	±0.832	7.29	±0.976	7.21	±1.031	0.259
30 min	3.21	±0.630	4.61	±0.567	6.29	±0.763	0.0002
During spinal	2.46	±0.744	3.86	±0.705	5.18	±0.612	0.0001
Admission to PACU	0.39	±0.629	0.61	±0.737	0.93	±0.979	0.094
Discharge at PACU	1.00	±0.816	1.36	±0.731	2.46	±0.637	0.0001
12 hrs	2.61	±0.629	3.36	±0.870	3.79	±0.876	0.0001
24hrs	3.32	±0.863	3.71	±1.049	3.39	±0.994	0.302
48 hrs	2.25	±0.701	2.89	±0.786	2.68	±0.670	0.008

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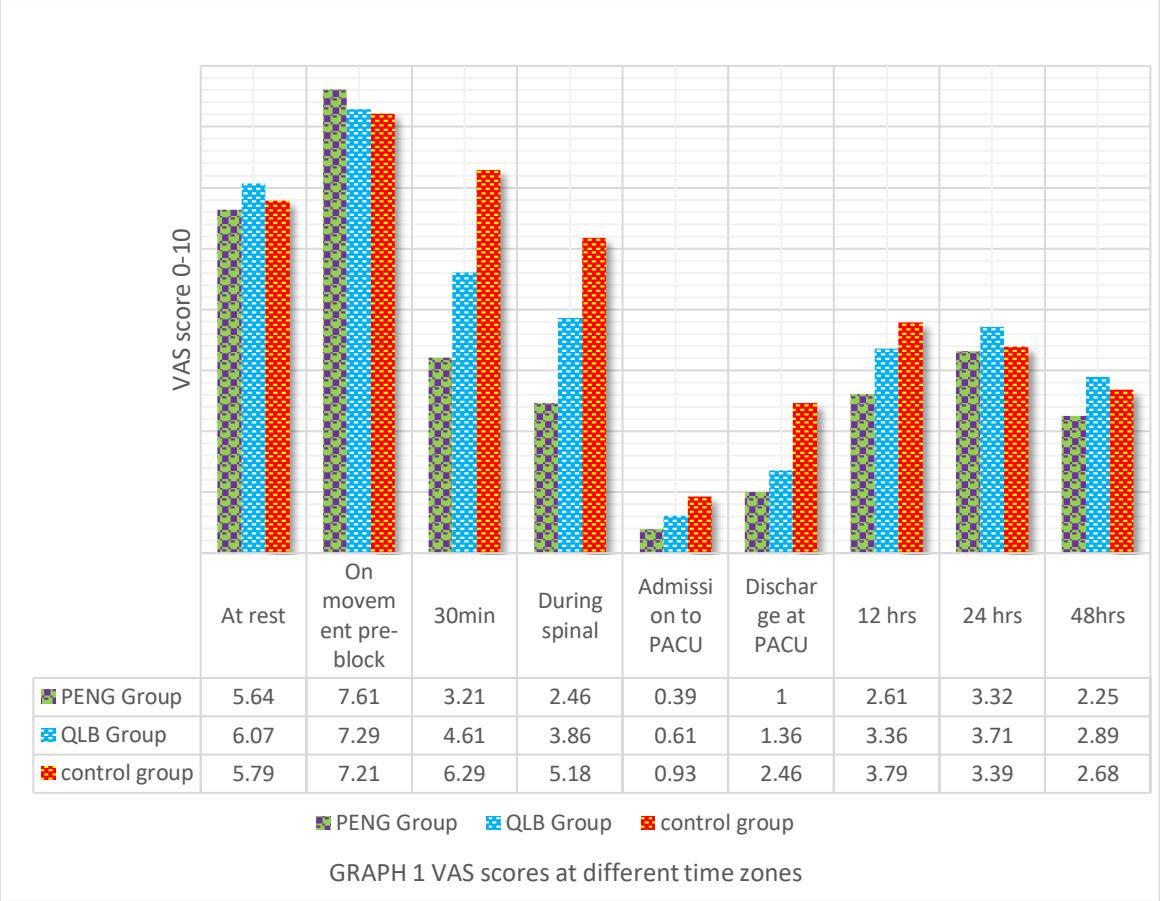

GRAPH 1 VAS scores at different time zones

In the first 12 hours postoperatively, 7.14% of patients in the PENG group, 46.42% in the QLB group, and 100% in the control group required first rescue analgesia due to VAS scores >3. From 13-24 hours, 35.71% of PENG and 42.85% of QLB patients needed rescue analgesia. In the 25-48 hour period, 10.71% of both groups required it. Notably, 46.2% of PENG patients did not need any rescue analgesia over 48 hours as (table 3).

Table 3 Timing and number of patients requiring rescue analgesia

Time (hrs)	PENG		QLB		Control group	
	No of patients	%	No of patient	%	No of patients	%
0-12	2	7.14	13	46.42	28	100
13-24	10	35.71	12	42.85	0	0.0
25-48	3	10.71	3	10.71	0	0.0
Didn't require analgesia in 48 hrs	13	46.42	0.0	0.0	0	0.0
Total	28	100%	28	100%	28	100%

In the first 24 hours, the PENG group consumed 7.14 ± 17.82 mg of tramadol, with over 90% not needing rescue analgesia, while the QLB group consumed 41.07 ± 45.24 mg ($p<0.05$). In the 25-48 hour period, PENG consumption increased to 26.79 ± 25.39 mg, while QLB consumption rose to 112.50 ± 52.04 mg ($p<0.05$). The control group received 200 mg of tramadol in both the first and second 24 hours (table 4 and graph 2&3).

Table 4 Mean opioid consumption

Study group	Total opioid consumption in mg					
	First 24 hrs			25-48 hrs		
	Mean	SD	P value	Mean	SD	P value
PENG group	7.14	17.817	0.0001	26.79	25.394	0.0001
QLB group	41.07	45.243		112.50	52.042	

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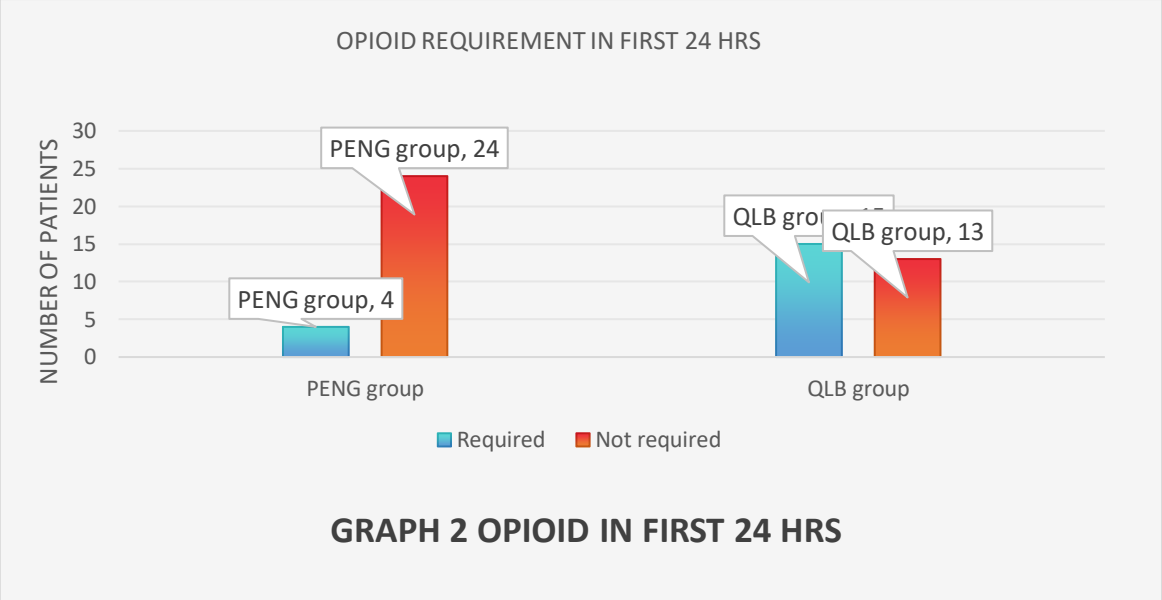
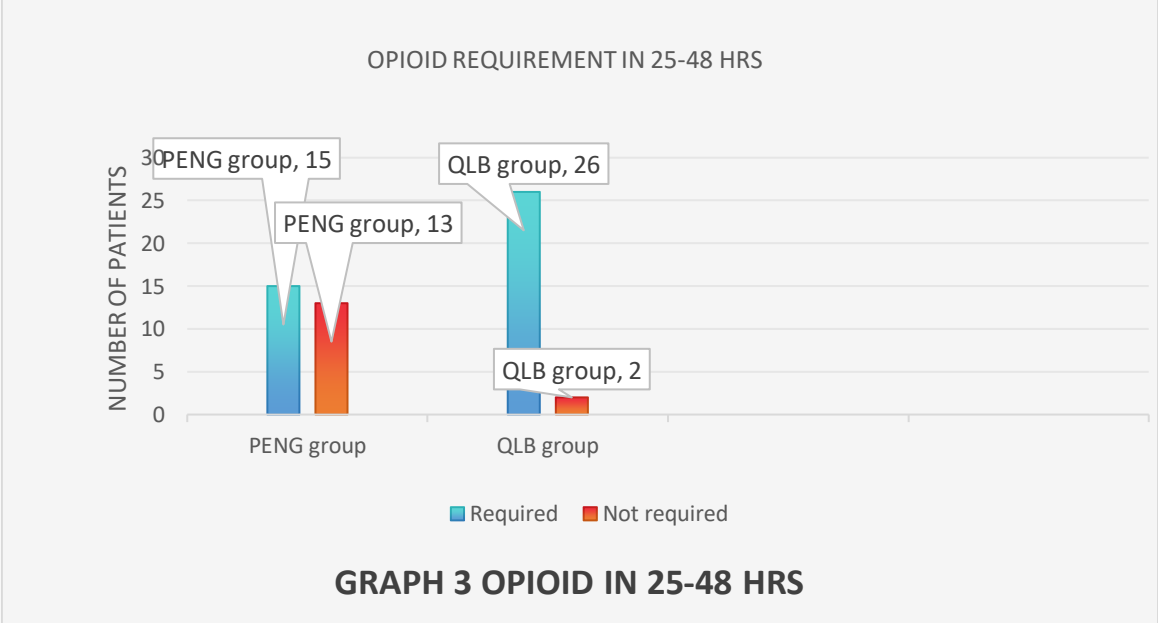


GRAPH 2 OPIOID IN FIRST 24 HRS



GRAPH 3 OPIOID IN 25-48 HRS

At 12 hours postoperatively, most PENG patients (15/28) preserved quadriceps strength, compared to 11/28 in the QLB group and 1/28 in the control group. Nine patients had no quadriceps strength, with the majority in the control group. By 24 hours, 82.1% of PENG patients maintained intact strength, the highest among the groups, followed by 60.7% in QLB and 50% in the control group (graph 4& 5). By 48 hours, all patients in all groups had intact quadriceps strength, showing overall recovery.

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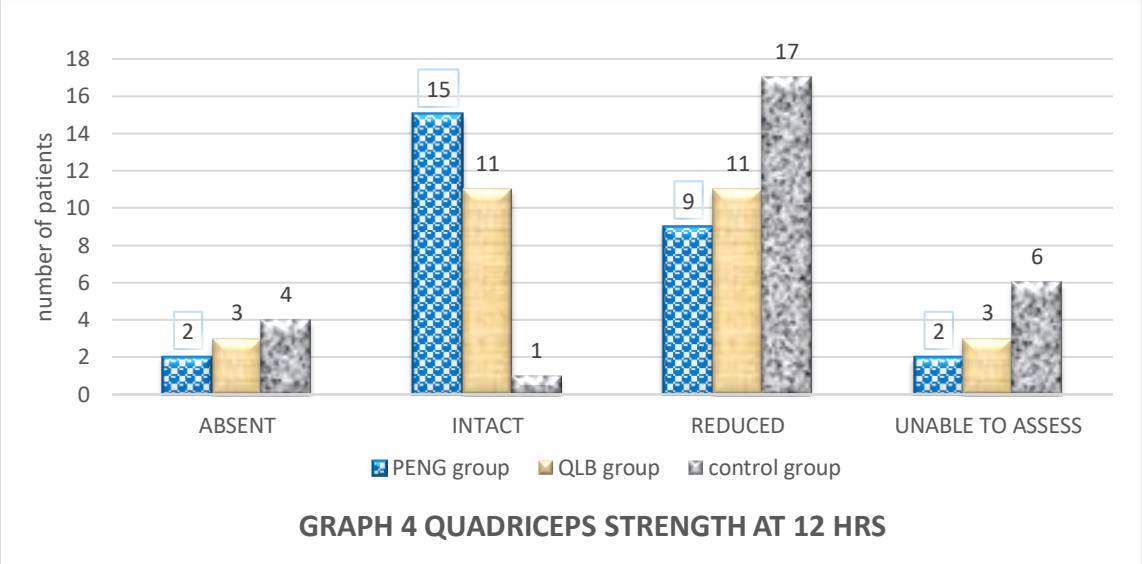
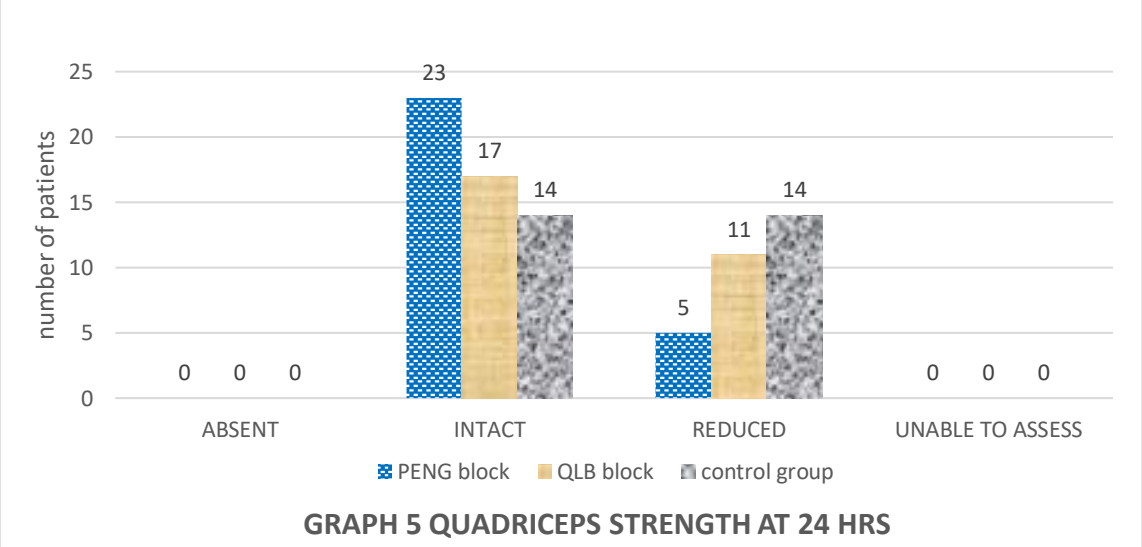
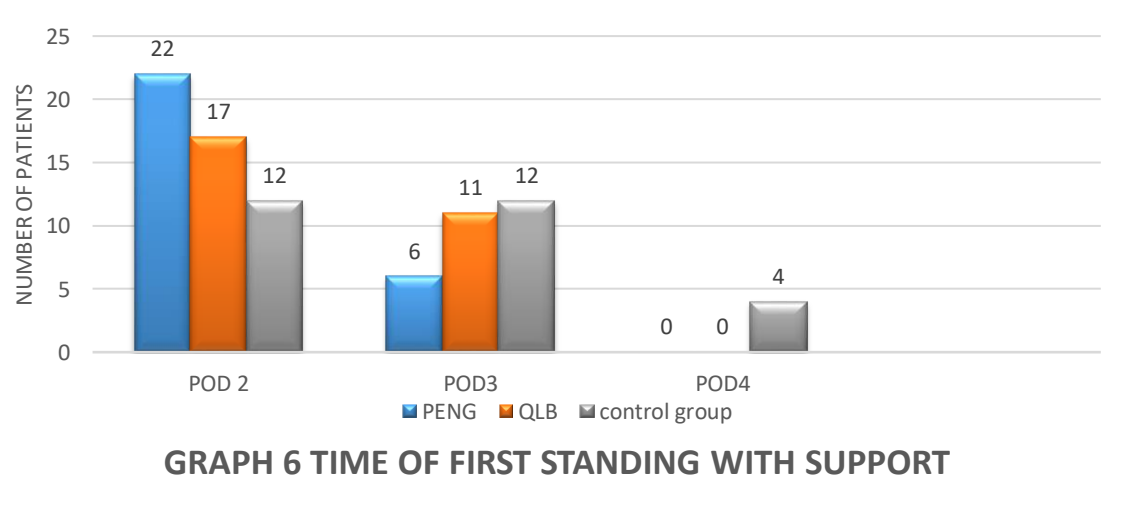


GRAPH 4 QUADRICEPS STRENGTH AT 12 HRS



GRAPH 5 QUADRICEPS STRENGTH AT 24 HRS

By postoperative day 2, 22 PENG patients, 17 QLB patients, and 12 control patients could stand with support. By day 3, more patients in all groups could stand, but 4 control patients had delayed standing due to slower recovery of quadriceps strength, likely caused by pain and immobility from the lack of a block (graph 6).



GRAPH 6 TIME OF FIRST STANDING WITH SUPPORT

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The PENG group had a significantly shorter discharge time (5.43 days) compared to the QLB (5.93 days) and control groups (5.96 days) with a p-value of 0.007 represented in table 5. Most patients were satisfied with their care, with the PENG group reporting the highest satisfaction. Satisfaction levels were similar between the QLB and control groups as in table 6.

Table 5 Mean discharge time

	Discharge time in days		
	Mean	**SD**	**P value**
PENG	5.43	0.836	0.007
QLB	5.93	1.245	
Control group	5.96	1.294	

Table 6 Satisfactory scoring score 0=ambivalent; score 1=unsatisfied; score 2= satisfied

Satisfactory scoring	**PENG group**		**QLB group**		**Control group**	
	No.of patients	**%**	**No.of patients**	**%**	**No. of patients**	**%**
Score 0	2	7.1%	4	14.3%	4	14.3%
Score 1	0	0.00%	1	3.6%	3	10.7%
Score 2	26	92.9%	23	82.1%	21	75.0%
Total	28	100	28	100	28	100

SAFETY AND ADVERSE EVENTS

No patient falls or adverse events, such as nausea, vomiting, hematoma, pruritus, or urinary retention, occurred in any group. There were no nerve injuries or signs of local anesthetic toxicity.

DISCUSSION

Proximal femur fractures are common in older adults and often involve co-morbidities that complicate pain management. Excessive opioid use can cause side effects like delirium, urinary retention, and constipation, which can prolong hospital stays and delay recovery. Reducing opioid use improves outcomes and minimizes these complications.[7]This study compared the effectiveness of PENG and QLB blocks with a control group in managing postoperative pain and recovery in proximal femur fracture patients undergoing nailing or arthroplasty. By assessing pain scores, quadriceps strength, opioid use, and time to stand, the study aimed to identify a strategy that provides effective pain relief with minimal opioid-related side effects, highlighting the importance of regional analgesia in optimizing recovery for this high-risk group.

In our study, the mean age was 55.50 ±13.49 years in the PENG group, 59.43 ±10.32 years in the QLB group, and 59.07 ±10.73 years in the control group, with no significant age difference (p=0.554). Consistent with M. Lorentzon et al.'s findings, which link higher susceptibility to proximal femur fractures in postmenopausal women due to osteoporosis, our study also had a higher prevalence of female patients (53.5%).[8] Laura GironArango et al., and Ashok Jadon et al., used 20 ml of 0.25% bupivacaine for the PENG block in hip surgeries.[4,9] For the QL block, PromilKukreja et al. used 25 ml of 0.25% bupivacaine, and Christopher L. Mucrum et al., used 20-30 ml of 0.5% ropivacaine in hip arthroscopy.[10,11]Therefore, we administered 20 ml of 0.25% bupivacaine for the PENG block and 25 ml of 0.25% bupivacaine for the QL block.

In this study, the PENG group had significantly lower VAS scores than the QLB and control groups, especially at 30 minutes (3.21 ± 0.63) and during spinal anesthesia (2.46 ± 0.74, $p < 0.05$). The PENG group also showed better pain relief at PACU discharge (1.00 ± 0.82), 12 hours (2.61 ± 0.63), and 48 hours (2.25 ± 0.70, $p < 0.05$). No significant differences were found at rest, pre-block movement, PACU admission, or 24 hours ($p > 0.05$). These results are consistent with Q.-R. Wang et al., (2021-22), who also reported superior pain relief in PENG blocks after THA with VAS scores48.4±8.8, QLB 50.2±10.1 ($p < 0.05$) using 20ml 0.5% ropivacaine in PENG block and30ml 0.3%ropivacaine in QLB.[12]However,Tayfun et al.,[13]used 0.5% bupivacane20ml in peng block, 30ml in QLB andAbdelsalam et al.,[14] used 0.25% bupivacaine of 20 ml in both PENG block & QLB. They bothconcluded that QLB and PENG blocks showed similar trends in VAS scores and provided comparable analgesia for hip arthroplasty.

In this study, the PENG group required significantly less rescue analgesia in the first 12 hours (7.14%) compared to the QLB group (46.42%) and the control group (100%). Over 48 hours, 46.2% of the PENG group did not need any analgesia. Opioid consumption was also lower in the PENG group (7.14 ± 17.817 mg in the first 24 hours and 26.79 ± 25.394 mg in 25–48 hours) compared to the QLB group (41.07 ± 45.243 mg and 112.50 ± 52.042 mg, respectively, $p < 0.05$). These findings support the PENG block's efficacy in reducing opioid use post-hip arthroplasty. Similar results were reported by G. Pascarella et al., Han Wu et al., and PromilKukreja et al., who found reduced opioid consumption with the

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PENG and QLB blocks compared to the control group.[15,16,6]

Our results show that the PENG group had superior quadriceps strength preservation, with 15 out of 28 patients maintaining intact strength at 12 hours and 23 out of 28 at 24 hours. The QLB group showed moderate preservation (11/28 at 12 hours, 17/28 at 24 hours), while the control group had the lowest (1/28 at 12 hours, 14/28 at 24 hours). By 48 hours, all groups showed full recovery. The PENG group demonstrated the best early muscle strength preservation, followed by the QLB group, with the control group showing the least benefit. Reflecting on our results, Tayfun et al. found similar trends in quadriceps strength preservation across the PENG and QLB blocks. In their study, 80% of patients in the PENG block group maintained quadriceps strength at 12 hours postoperatively, compared to 73.3% in the QLB group.23 These findings are consistent with our study, where 53.6% of patients in the PENG group and 39.3% in the QLB group preserved quadriceps strength at 12 hours. This reinforces the effectiveness of the PENG block in preserving quadriceps strength, especially in the early postoperative period, and indicates a positive recovery trend for both techniques.A study by D-Yin Lin et al. compared the PENG block with femoral nerve block (FNB) in hip surgeries and found that quadriceps strength was better preserved in the PENG group, with 60% of patients maintaining intact strength postoperatively, compared to none in the FNB group.[17]The PENG block, which targets the hip joint with a local anesthetic while sparing the femoral nerve motor fibers that control the quadriceps, provides effective pain relief without significantly impairing motor function. This selective blockade helps preserve quadriceps strength better than other techniques like the QLB and FNB, making it especially beneficial for hip surgeries where maintaining muscle strength is crucial for early rehabilitation and mobility.

By postoperative day 2, most patients in the PENG group could stand with support, followed by the QLB group and control group. On day 3, standing with support improved across all groups, with delayed recovery observed in some control group patients due to severe pain, muscle inhibition, immobility, and high opioid use. This delayed recovery highlights the importance of regional blocks in early mobilization. Our findings align with studies by Pascarella et al., Lin et al., and Aliste J et al., showing that the PENG block promotes faster recovery, better pain control, and preserves quadriceps strength, crucial for functional outcomes and early ambulation after hip surgery.[15,17,18] The PENG group had a shorter discharge time compared to the QLB and control groups, though discharge timing is influenced by factors like surgeon's judgment, patient preferences, and financial considerations. As such, discharge time may not fully reflect recovery. Regarding patient satisfaction, while the PENG group reported the highest satisfaction, factors such as hospital environment and staff interactions also play a role. Thus, satisfaction results should be interpreted with caution, as they are influenced by multiple factors beyond the anesthetic technique.

CONCLUSION

The study concluded that the PENG block is superior to the QLB and control groups in managing postoperative pain in hip arthroplasty. The PENG block provided better pain relief, reduced opioid use, delayed the need for rescue analgesia, and preserved quadriceps strength, promoting early mobilization and faster recovery. While the QLB also provided adequate pain relief, it was less consistent in preserving quadriceps strength. Both techniques were safe, with no significant adverse events. Overall, the PENG block is an optimal choice for effective, functional, and safe pain management in hip arthroplasty.

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