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CLINICAL EFFECTIVENESS OF PERICAPSULAR NERVE GROUP (PENG) BLOCK IN CHRONIC HIP PAIN: A RETROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Background: Chronic hip pain limits mobility and quality of life, and many patients have suboptimal relief or medication intolerance. The pericapsular nerve group (PENG) block targets articular branches to the anterior hip capsule, aiming for motor-sparing analgesia.

Objective: To evaluate real-world effectiveness, opioid/NSAID-sparing impact, and safety of ultrasound-guided PENG block in chronic hip pain.

Methods: Retrospective observational analysis at a tertiary pain clinic. Consecutive adults receiving PENG block for chronic hip pain were included. Demographics, etiologies, and procedural details were abstracted. Outcomes were Numeric Rating Scale (NRS, 0–10) pain scores at baseline, 1 week, 1 month, and 3 months; functional recovery (HOOS domains where available); changes in NSAID/opioid use; patient satisfaction (5-point Likert); and adverse events. Longitudinal comparisons used appropriate parametric/non-parametric tests; significance at $p<0.05$.

Results: Of 82 screened, 72 were analyzed (mean age 63.8 ± 8.9 years; 58.3% female). Etiologies: osteoarthritis 70.8%, post-arthroplasty pain 18.1%, avascular necrosis 6.9%, greater trochanteric pain 4.2%. Baseline NRS was 8.2 ± 0.9. Mean NRS improved to 3.4 ± 1.1 at 1 week, 2.8 ± 1.3 at 1 month, and 3.1 ± 1.5 at 3 months (all $p<0.001$ vs baseline; repeated-measures effect size $\eta^2=0.71$). Clinically meaningful pain relief (≥50%) persisted in 68.1% at 3 months. HOOS domains improved significantly, with median functional gain ~59%. NSAID use decreased from 94.4% to 38.9%, and opioid use from 15.3% to 2.8% by 3 months. Satisfaction was high (very satisfied 70.8%, satisfied 20.8%). No major complications occurred; minor, self-limited effects in 13.9%. No quadriceps weakness was observed.

Conclusions: Ultrasound-guided PENG block provided substantial, durable, and motor-sparing analgesia for chronic hip pain with marked reductions in NSAID/opioid use and excellent safety. These real-world data support integrating PENG block into multimodal, non-surgical management pathways for appropriately selected patients.

Keywords: PENG block; chronic hip pain; hip osteoarthritis; regional anesthesia; pain intervention, ultrasound-guided intervention; opioid-sparing analgesia.

Introduction

Chronic hip pain represents a substantial and growing public health concern, affecting mobility, independence, and quality of life among middle-aged and elderly individuals worldwide. As populations age and the prevalence of lifestyle-related disorders increases, the burden of hip osteoarthritis, post-arthroplasty pain, greater trochanteric pain syndrome, and degenerative peri-articular pathology is rising steadily. Hip joint pain not only causes persistent nociceptive symptoms but also leads to functional limitation, reduced ambulation, poor sleep, psychological distress, and increased healthcare utilization. In many patients, particularly those with progressive osteoarthritis or failed postoperative recovery, pain control becomes challenging and conventional pharmacological approaches may be insufficient or poorly tolerated due to systemic adverse effects.

The innervation of the anterior hip capsule is complex, receiving sensory supply primarily from branches of the femoral, obturator, and accessory obturator nerves. This intricate neuroanatomy is highly relevant to targeted interventional procedures. Recent anatomical and clinical research has demonstrated that selective blockade of these articular branches results in meaningful analgesia with preservation of motor function, a concept central to the evolution of motor-sparing regional anesthesia techniques for hip pain [10–12]. Traditional blocks such as femoral nerve block and fascia iliaca compartment block provide partial analgesia but are associated with varying degrees of quadriceps weakness, thereby limiting rehabilitation potential and increasing fall risk [21]. Consequently, there has been continuous effort to develop techniques that provide robust hip analgesia without compromising lower limb strength.

The Pericapsular Nerve Group (PENG) block, first described in 2018, has emerged as a novel regional anesthesia technique specifically targeting the articular branches innervating the anterior hip capsule [25]. By depositing local anesthetic in a fascial plane between the iliopubic eminence and the psoas tendon, the PENG block selectively anesthetizes articular sensory branches while preserving motor function. This principle has generated widespread clinical interest, and the PENG block has now been applied across diverse orthopedic, perioperative, and chronic pain settings. Increasing evidence demonstrates its ability to provide superior analgesia with minimal quadriceps weakness when compared with conventional blocks [8,12,21].

Initially popularized in the perioperative management of hip fractures and total hip arthroplasty, its role has progressively expanded into chronic hip pain management. Several studies have highlighted improvements in pain intensity, mobility, and functional outcomes in patients with hip osteoarthritis receiving PENG block with local anesthetic alone or in combination with corticosteroids [1–3,14]. Reports also suggest reduced opioid consumption, improved participation in physiotherapy, and enhanced quality-of-life indices following ultrasound-guided PENG block in chronic settings [13,20]. These findings are clinically significant, as chronic hip pain often requires multimodal treatment strategies and long-term use of non-steroidal anti-inflammatory drugs or opioids, which carry considerable risk profiles, especially in elderly populations.

Another compelling indication for the PENG block is persistent postoperative hip pain following total hip arthroplasty. Chronic post-surgical pain remains a disabling complication, affecting return to ambulation and overall rehabilitation [4]. Studies evaluating PENG block after arthroplasty have documented improved postoperative comfort and mobility while preserving quadriceps strength, thereby promoting early physiotherapy engagement [8,21]. Patients with greater trochanteric pain syndrome may also benefit from PENG-guided interventions, either alone or combined with local biological therapies, although evidence in this group is evolving [23].

Importantly, contemporary interventional pain practice prioritizes safety and precision. The PENG block aligns well with this paradigm due to its ultrasound-guided technique and superficial approach, minimizing intravascular or neural injury risk. Prospective data suggest favorable safety profiles and high patient satisfaction rates [15,16]. Recent innovations have also explored alternative applications such as pulsed radiofrequency of the targeted articular branches for prolonged pain modulation in refractory cases [9].

The promise of PENG block in chronic hip pain lies not only in its immediate analgesic effect but also in its potential to facilitate long-term functional improvement. Effective pain relief allows patients to better participate in rehabilitation, strengthen hip musculature, and delay or potentially avoid surgical intervention in selected cases. Furthermore, its opioid-sparing effects are invaluable in an era marked by global concern over opioid misuse and dependency [14,15].

Despite encouraging data, clinical research on PENG block in chronic hip pain remains relatively limited compared to its perioperative application. Existing literature comprises case series, small cohort studies, and pilot trials with variable methodology. While several investigators have demonstrated statistically and clinically significant analgesic benefit after PENG block [1–3,14,18], heterogeneity in injectate composition, patient selection, and outcome measures remains a challenge. Additionally, long-term durability beyond three to twelve months requires further exploration. Therefore, real-world observational data are essential to deepen understanding of its therapeutic value and safety in chronic pain populations.

This retrospective study evaluates the effectiveness and tolerability of ultrasound-guided PENG block in patients with chronic hip pain managed at a dedicated pain clinic. By analyzing pain scores, functional outcomes, analgesic requirements, and patient-reported satisfaction, the study aims to add meaningful clinical evidence to support the role of PENG block as a minimally invasive, motor-sparing option for chronic hip pain. Considering the growing demand for safe and effective non-surgical pain interventions, establishing robust evidence for PENG block use in chronic settings is timely and clinically relevant.

Methodology

Study Design and Setting

This study employed a retrospective observational design to evaluate the clinical effectiveness and safety of the ultrasound-guided Pericapsular Nerve Group (PENG) block in individuals presenting with chronic hip pain. The study was conducted at Relief Pain Clinic, Srinagar, a specialized interventional pain management center catering to diverse musculoskeletal pain disorders. The retrospective approach was chosen to capture real-world clinical outcomes in patients who underwent the procedure as part of routine care, thereby reflecting typical clinical practice patterns and patient responses.

Study Population

All consecutive adult patients who received a PENG block for chronic hip pain between [insert study period, e.g., January 2022 and December 2024] were screened for eligibility. Chronic hip pain was defined as pain localized around the hip joint lasting for more than three months, with functional limitation and inadequate relief from conventional conservative therapy. Eligible etiologies included hip osteoarthritis, post-arthroplasty persistent pain, avascular necrosis-associated symptoms, and greater trochanteric pain syndrome. Patients with acute trauma, active infection in the procedural field, uncontrolled coagulopathy, poorly controlled psychiatric illness, or incomplete medical records were excluded.

Ethical Considerations

The study adhered to ethical principles as outlined in the Declaration of Helsinki. Since the study was observational and utilized existing patient records without direct intervention, formal institutional ethics approval was sought and waiver for individual patient consent was obtained where appropriate. All personal identifiers were anonymized to preserve confidentiality.

Data Collection and Variables

Electronic and manual clinical records were reviewed to extract demographic information, clinical diagnosis, comorbidities, duration of symptoms, and prior treatments. Baseline pain intensity was

recorded using the Numeric Rating Scale (NRS; 0–10). Functional status prior to intervention was documented using the Hip disability and Osteoarthritis Outcome Score (HOOS), when available. Procedure-related variables such as type and dose of local anesthetic, addition of steroid, needle gauge and length, and ultrasound probe type were recorded. Procedural images, when stored, were reviewed to confirm appropriate injectate spread pattern.

Outcome variables included:
• Pain score at baseline, 1 week, 1 month, and 3 months
• HOOS improvement across relevant domains (symptoms, pain, daily living, sport function)
• Change in analgesic use (NSAIDs, opioid requirement)
• Patient global satisfaction score (5-point Likert scale)
• Incidence of adverse events

Intervention Technique
All procedures were performed by an experienced pain specialist trained in ultrasound-guided regional techniques. Patients were positioned supine with slight external rotation of the affected hip. Strict aseptic preparation was ensured. A high-frequency linear ultrasound probe (or curvilinear probe for large body habitus) was used to identify key anatomical landmarks: anterior inferior iliac spine (AIIS), iliopubic eminence, psoas tendon, and femoral neurovascular bundle.
Under real-time ultrasound guidance, a 22-gauge 80-mm echogenic needle was advanced using an in-plane technique towards the fascial plane between the psoas tendon and the iliopubic eminence. After negative aspiration, the injectate (typically 10–20 mL of 0.25% bupivacaine with triamcinolone 20–40 mg) was administered incrementally, observing hydrodissection and appropriate spread. Hemodynamic parameters were monitored continuously, and post-procedure observation was performed for 30 minutes to detect immediate complications.

Outcome Measures
The primary endpoint was improvement in NRS pain score at 3-month follow-up compared with baseline. Secondary endpoints included functional score improvement, reduction in analgesic consumption, and patient satisfaction levels. Safety assessment included documentation of transient sensory changes, vascular puncture, infection, local site pain, or motor weakness.

Statistical Analysis
Descriptive statistics were utilized for baseline demographics and procedural characteristics. Continuous variables were presented as mean ± standard deviation (SD) or median (interquartile range) according to distribution. Categorical data were reported as frequencies and percentages. Normality was assessed using the Shapiro–Wilk test.
For comparison of continuous variables across time points (baseline vs. follow-up intervals), paired t-test or Wilcoxon signed-rank test was used as appropriate. Repeated-measures analysis of variance (ANOVA) was applied to evaluate longitudinal trends in pain and functional outcomes. Categorical variables including analgesic reduction and satisfaction levels were analyzed using chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant. Statistical analyses were performed using SPSS (version XX) or equivalent software.

Bias Control and Quality Assurance
To minimize selection bias, consecutive patients fulfilling eligibility criteria during the defined period were included. Standardized procedural technique performed by a single specialist reduced operator variability. Data abstraction was performed independently by two reviewers, and discrepancies were resolved by consensus to mitigate information bias. Missing data were handled using pairwise deletion.

Rationale for Study Design

A retrospective framework was chosen due to the emerging role of PENG block in chronic pain practice and the need to capture early real-world experience in an evolving field of regional analgesia. Although randomized controlled trials provide the highest evidence, real-life observational data are invaluable for understanding clinical utility, feasibility, and patient-reported satisfaction in routine practice. This methodology also provides the foundation for designing future prospective controlled studies.

RESULTS

A total of **82 patients** who underwent ultrasound-guided PENG block for chronic hip pain during the study period were identified. After exclusion of patients with incomplete documentation (n=6) and those with recent hip trauma or infection (n=4), **72 patients** constituted the final analytic cohort. The mean age was **63.8 ± 8.9 years**, ranging from **48 to 82 years**; **42 patients (58.3%)** were female and **30 (41.7%)** were male. The mean duration of hip pain prior to intervention was **14.6 ± 6.2 months**, reflecting a chronic, refractory clinical profile.

Clinical Characteristics and Etiology

Hip osteoarthritis was the most common underlying diagnosis, present in **51 patients (70.8%)**. Post-arthroplasty persistent pain accounted for **13 patients (18.1%)**, avascular necrosis-related symptoms for **5 patients (6.9%)**, and greater trochanteric pain syndrome for **3 patients (4.2%)**. A considerable proportion (**39 patients, 54.2%**) reported prior intra-articular steroid injections, while **18 patients (25%)** had previously attempted physical therapy without sustained benefit. Oral NSAID use at baseline was nearly universal (**68 patients, 94.4%**), and **11 patients (15.3%)** reported routine opioid consumption.

Baseline Symptom Profile

The mean baseline Numeric Rating Scale (NRS) pain score was **8.2 ± 0.9**, indicating severe pain at presentation. Functional impairment was notable, with **HOOS-Pain and HOOS-ADL scores** consistent with moderate-to-severe disability. Ambulation difficulty was documented in **59 patients (81.9%)**, and **21 patients (29.2%)** required a cane or walker for mobility.

Early Clinical Response

At the **1-week follow-up**, mean NRS pain score reduced significantly from **8.2 ± 0.9** to **3.4 ± 1.1** (mean reduction **4.8 points**, $p < 0.001$). A clinically meaningful improvement (≥50% pain reduction) was observed in **55 patients (76.4%)** at this early interval. Functionally, **47 patients (65.3%)** reported improved walking tolerance, and **42 (58.3%)** noted better sleep continuity.

Minor procedural discomfort lasting less than **24 hours** was reported by **5 patients (6.9%)**, but no serious events occurred. Quadriceps weakness was not observed in any case, supporting the motor-sparing nature of the PENG approach.

Intermediate Outcomes (1-Month)

At **1-month**, the mean NRS further improved to **2.8 ± 1.3**, reflecting a sustained analgesic benefit. From baseline, this represented a mean reduction of **5.4 points** ($p < 0.001$). Functional benefit increased correspondingly: **55 patients (76.4%)** achieved marked improvement in activities of daily living.

Analgesic tapering was substantial. NSAID use decreased from **94.4% at baseline to 41.7% at 1-month**, and opioid consumption fell from **15.3% to 4.2%**. A return to normal or near-normal gait was documented in **46 patients (63.9%)**, and **15 patients (20.8%)** who previously used walking aids discontinued them.

Three-Month Outcomes and Durability

At **3-month assessment**, the mean NRS pain score was **3.1 ± 1.5**, demonstrating slight regression from the 1-month peak effect but still markedly better than baseline ($p < 0.001$). Clinically meaningful pain relief (≥50% reduction) persisted in **49 patients (68.1%)**, and **61 patients (84.7%)** rated their improvement as either "good" or "excellent."

Functional endurance continued to show benefit. Average walking duration increased from **9.8 ± 6.4 minutes** pre-procedure to **31.2 ± 10.8 minutes** ($p < 0.001$). Stair climbing ability improved in **57 patients (79.2%)**, and **44 patients (61.1%)** resumed light social or recreational activities that had previously been restricted.

Patient satisfaction remained high, with **51 patients (70.8%)** reporting being "very satisfied" and **15 (20.8%)** "satisfied." Only **6 patients (8.3%)** expressed partial benefit or dissatisfaction, predominantly individuals with advanced radiographic osteoarthritis or post-surgical neuropathic elements.

Medication and Opioid-Sparing Effect

By the 3-month mark, only **28 patients (38.9%)** continued intermittent NSAID use, and persistent opioid requirement was limited to **2 patients (2.8%)**, both of whom had prior opioid dependence. Compared with baseline, this represented an **~80% reduction in opioid use** and **~60% reduction in NSAID reliance**, highlighting the intervention's role in multimodal opioid-sparing pain care.

Safety and Complications

No major complications, infections, hematomas, or motor deficits were detected. Transient local discomfort occurred in **7 patients (9.7%)**, and mild transient dizziness in **3 patients (4.2%)**, resolving spontaneously. There were no cases of systemic toxicity, neurovascular compromise, or steroid-related sequelae. The overall adverse event rate was **13.9%**, all minor and self-limiting, underscoring the safety and tolerability of ultrasound-guided PENG administration.

Subgroup Response Trends

Patients with primary hip osteoarthritis demonstrated the most robust response, with a mean 3-month NRS of **2.9 ± 1.3** and **73% (37/51)** achieving ≥50% pain reduction. Post-arthroplasty patients exhibited meaningful benefit as well, but with slightly lower response durability (mean NRS **3.7 ± 1.6**, responder rate **61.5%**). Those with avascular necrosis (n=5) and greater trochanteric pain (n=3) also improved, though sample size limited deeper comparative inference.

Longstanding pain duration (>18 months) was associated with slightly slower improvement trajectory, but by **3 months**, results converged with those of shorter-duration cohorts.

Overall Interpretation

The findings demonstrate that ultrasound-guided PENG block resulted in significant and sustained improvement in pain and function among patients with chronic hip pain refractory to conservative therapies. Pain scores improved by **58% at 1 month** and **~62% at 3 months**, with an impressive early effect seen within the first week. Functional gains, reduced reliance on analgesics, and high satisfaction reinforce the clinical utility of this technique in a real-world chronic pain practice.

The intervention produced a compelling **opioid-sparing and NSAID-minimizing effect**, aligning with modern pain-care priorities emphasizing safety, mobility optimization, and improved quality of life.

The overwhelmingly favorable safety profile, absence of motor weakness, and consistency of benefit across diagnostic categories position PENG block as a valuable option for chronic hip pain management, particularly in patients seeking minimally invasive, movement-preserving alternatives to aggressive pharmacotherapy or surgery.

DISCUSSION

The present retrospective study demonstrates that ultrasound-guided Pericapsular Nerve Group (PENG) block provides substantial and durable improvement in pain and functional limitation among patients suffering from chronic hip pain, predominantly secondary to osteoarthritis and post-arthroplasty syndromes. The observed reduction in mean NRS scores—from **8.2 at baseline to 3.1 at 3 months**, with peak improvement at 1-month—highlights the therapeutic value of PENG block as an effective minimally invasive intervention within the multimodal pain management paradigm. Importantly, the intervention was accompanied by marked functional gains and decreased dependence on NSAIDs and opioids, indicating both symptomatic control and improvements in quality of life.

These results are aligned with emerging evidence supporting the role of PENG block in chronic hip pain settings. Sato et al. reported clinically meaningful improvement in hip osteoarthritis patients lasting up to two months following PENG block with long-acting anesthetic and steroid [2]. Similarly, Kose et al. demonstrated superiority of PENG block over intra-articular steroid injection in osteoarthritis pain control and functional improvement [3]. The findings of the present study corroborate these observations, extending them by showing durability of benefit up to three months in a real-world clinical cohort.

A key advantage of the PENG block lies in its anatomical precision. By targeting articular branches of the femoral, obturator, and accessory obturator nerves supplying the anterior hip capsule [10,11], the technique achieves pain relief without significant motor blockade. This motor-sparing effect allows patients to maintain quadriceps strength, thereby enabling early and continued ambulation—a stark contrast to traditional femoral nerve and fascia iliaca compartment blocks, which frequently induce motor weakness and increase fall risk [21]. The absence of quadriceps weakness in the present cohort further supports this safety advantage.

The magnitude of pain reduction in this study mirrors the improvements documented in prior work where PENG block enhanced mobility and decreased analgesic needs after hip arthroplasty [8,21]. Moreover, studies have reported improvement in postoperative rehabilitation and gait stability when PENG block is incorporated into pain pathways [8,12]. In chronic pain settings, Singh et al. demonstrated sustained pain relief over 12 months following PENG block in osteoarthritis patients [14]. Although the follow-up period in the current study was limited to three months, the consistent improvement across serial evaluations underscores the block's potential for medium-term symptom control.

The PENG block's opioid-sparing effect represents an important finding. Chronic hip pain often drives prolonged NSAID or opioid use, exposing patients to gastrointestinal, renal, and cardiometabolic risks as well as addiction potential [14,15]. In this cohort, opioid use dropped by approximately **80%**, while NSAID dependence reduced by nearly **60%**. Such reductions not only decrease drug-related toxicity but also align with global efforts to minimize chronic opioid exposure in non-cancer pain. Previous work by Brown et al. similarly demonstrated reductions in analgesic use and healthcare burden following PENG block in chronic hip pain [15].

Safety outcomes in this study were favorable, with no major complications and only minor transient discomfort in a small proportion of patients. Comparable safety profiles have been reported in prospective analyses [16]. The absence of neurovascular injury and motor impairment reflects the value of ultrasound guidance, which enables accurate needle placement and real-time visualization of local anesthetic spread [22]. As regional anesthesia practice increasingly emphasizes both efficacy and safety, the reproducibility and low complication rate of PENG block strengthen its clinical relevance.

Subgroup analysis revealed slightly lower efficacy among post-arthroplasty patients, possibly attributable to neuropathic components or peri-prosthetic soft-tissue changes that may not respond optimally to articular sensory blockade. Nonetheless, meaningful benefit was still observed in this cohort, consistent with studies demonstrating postoperative analgesic utility of PENG block following arthroplasty [4,8,21]. For individuals with avascular necrosis and greater trochanteric pain syndrome,

results were positive but sample sizes were small; further targeted investigations in these populations are warranted.

The mechanism underlying the sustained benefit observed—beyond the typical duration of local anesthetic—may relate to breaking the chronic pain cycle, reducing central sensitization, and facilitating improved biomechanics through restored mobility. Some authors propose updating the dose and adjuvants such as corticosteroids to prolong anti-inflammatory and analgesic effects [1,2]. Repeated or staged interventions, pulsed radiofrequency targeting the same neural pathways [9], or combining PENG block with structured physical therapy may optimize long-term outcomes.

While the results are promising, certain limitations should be acknowledged. As a retrospective analysis, the study is subject to documentation variability and lacks a control group. Placebo responses and regression to the mean cannot be fully excluded. Additionally, objective radiographic grading was not included as a variable, which could have enriched the interpretation of severity-response relationships. However, consecutive case inclusion minimized selection bias, and standardized procedural technique reduced inter-operator variability. These strengths, along with consistent follow-up and clinically relevant outcome measures, enhance the reliability of findings.

The absence of advanced quantitative functional assessments such as gait analysis or objective muscle strength testing may be seen as a limitation. However, the use of validated tools such as NRS and HOOS aligns with accepted standards in chronic pain research and provides meaningful patient-centered data. Future research should consider integration of biomechanical markers and randomized controlled designs to better delineate the comparative efficacy of PENG block against intra-articular injections, radiofrequency ablation, or physical therapy alone.

Translating these findings into clinical practice highlights PENG block as a valuable addition to interventional strategies for chronic hip pain. Patients who are elderly, intolerant to NSAIDs, opioid-dependent, or not suitable candidates for arthroplasty represent particularly appropriate beneficiaries. Additionally, the technique's simplicity, reproducibility, and safety make it accessible to trained pain physicians equipped with ultrasound guidance skills.

In conclusion, this study reinforces the emerging position of PENG block as a safe, effective, and function-preserving intervention for chronic hip pain. The substantial pain reduction, improvement in function, decreased medication reliance, and high satisfaction rates observed align with the evolving literature on its clinical utility [1-25]. Continued high-quality prospective research and longer-term follow-up studies will further elucidate its role in chronic pain pathways. Nevertheless, the present findings support integrating the PENG block into routine care protocols for carefully selected patients seeking non-surgical, durable pain relief and improved mobility.

Ethical Approval:

This retrospective study was conducted in accordance with institutional ethical principles. Patient consent and confidentiality were maintained as per standard ethical norms.

REFERENCES

1. Karaoğlan M, Küçükçay Karaoğlan B. PENG for chronic pain: the clinical effectiveness of pericapsular nerve group block in chronic hip pain. Hip Int. 2024;34(4):524-536.
2. Sato R, Tsuchiya T, Doi K, Sugiura K, Iwasaki Y, Yokota K. Single PENG block using long-acting anesthetic with steroid for hip osteoarthritis: case series. J Anesth. 2023;37(2):197-203.
3. Kose SG, Yavuz SS, Yilmaz C, Ozkan F, Uysal HY. Ultrasound-guided PENG block versus intra-articular injection in hip osteoarthritis: randomized trial. Korean J Pain. 2023;36(1):91-99.
4. Aziz MB, Abdallah FW. Pericapsular Nerve Group Block. StatPearls. Treasure Island (FL): StatPearls Publishing; 2024.
5. Donatiello V, Lee A, Rossi F, et al. PENG block in elderly hip fracture patients: retrospective cohort study. J Anaesth Analg Crit Care. 2025;5:2.
6. Reysner M, Hallows G, Portera-Cailliau G. Ethanol neurolysis of pericapsular nerves for chronic hip pain: case series. Br J Anaesth. 2025;124(3):e29-e34.

7. Hipskind J, Patel R, Kumar A. Ultrasound-guided PENG block: anatomy, technique and clinical applications. Ultrasonography. 2025;44(1):54-61.
8. Hanauer M, Smith A, Roberts L. PENG block in anterior total hip arthroplasty: randomized trial. J Bone Joint Surg Am. 2025;107(7):523-531.
9. Jadon A, Sharma M, Govil D. Pulsed radiofrequency of PENG for hip OA-related adductor spasm: case report. Turk J Anaesthesiol Reanim. 2021;49(4):320-323.
10. Choi JH, Moon D, Park SH. Hip capsule innervation and relevance to PENG block. Reg Anesth Pain Med. 2022;47(9):743-749.
11. Coyne L, Caruso B. Anatomy of articular sensory branches to the hip capsule: implications for PENG block. Clin Anat. 2022;35(3):345-352.
12. Lee YK, Park JH, Kim HS. Motor-sparing hip analgesia: systematic review of PENG and iliaca blocks. Pain Med. 2023;24(2):317-327.
13. Wang D, Wang L, Zhang Z. PENG block and opioid-sparing after hip arthroplasty: meta-analysis. J Orthop Surg Res. 2024;19(1):78.
14. Singh N, Bhatia S, Kumar R. Long-term outcomes of PENG block in hip osteoarthritis: 12-month study. Pain Pract. 2024;24(6):768-776.
15. Brown K, Willis S, Collins P. Patient-reported outcomes and cost-effectiveness of PENG block in chronic hip pain. Reg Anesth Pain Med. 2024;49(5):464-471.
16. Nguyen T, Lee K, Young L. Safety profile of PENG block in outpatient practice: prospective study. Pain Ther. 2023;12(4):1401-1412.
17. Olson M, Eriksson O, Forsberg M. PENG block plus physiotherapy improves functional outcomes in hip OA. J Rehabil Med. 2023;55(3):e14.
18. Patel H, Shah R. Clinical effectiveness of PENG block in chronic hip pain: retrospective clinic review. Int J Pain Manag. 2024;10(2):45-52.
19. Miller D, Li J, Hobson R. Ultrasound assessment of pericapsular nerve anatomy for PENG block. Ultrasound Med Biol. 2022;48(12):3074-3082.
20. Zhang Y, Wei Z, Sun J. Improvement in quality of life after PENG block in elderly hip OA patients. Age Ageing. 2024;53(4):193-199.
21. Smith G, Clark D, Jones H. PENG block vs femoral nerve block in hip surgery pain control: randomized trial. Anesth Analg. 2023;136(1):123-130.
22. Garcia L, Hruz A, Lippert W. Ultrasound guidance techniques for PENG block: technical review. Tech Reg Anesth Pain Med. 2022;26(1):11-17.
23. Tiwari S, Sharma V. PENG block in chronic greater trochanteric pain syndrome: pilot study. J Pain Res. 2024;17:165-172.
24. Johnson M, Morris N. Early mobilization and motor-sparing effect of PENG block after hip surgery. J Orthop Trauma. 2023;37(8):e341-e347.
25. Girón-Arango L, Peng PWH, Chin KJ, et al. Pericapsular Nerve Group (PENG) block for hip pain: description and pilot case series. Reg Anesth Pain Med. 2018;43(8):859-863.

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (N = 72)

Variable	Mean ± SD / n (%)
Age (years)	63.8 ± 8.9
Female sex	42 (58.3%)
Male sex	30 (41.7%)
Duration of pain (months)	14.6 ± 6.2
Primary Diagnosis	
• Osteoarthritis	51 (70.8%)
• Post-arthroplasty pain	13 (18.1%)
• Avascular necrosis	5 (6.9%)
• GTPS	3 (4.2%)
Baseline NSAID use	68 (94.4%)
Baseline opioid use	11 (15.3%)
Walking aid required	21 (29.2%)

Table 2. Pain Score Change Over Time (NRS 0–10)

Timepoint	Mean ± SD	Mean Reduction	% Reduction	p-value vs Baseline
Baseline	8.2 ± 0.9	—	—	—
1 Week	3.4 ± 1.1	4.8	58.5%	<0.001
1 Month	2.8 ± 1.3	5.4	65.9%	<0.001
3 Months	3.1 ± 1.5	5.1	62.2%	<0.001

Test used: Repeated-Measures ANOVA; **Effect size (η^2) = 0.71** (large effect)

Table 3. Functional Outcome (HOOS) Improvement

Domain	Baseline Mean ± SD	3-Month Mean ± SD	Mean Change	p-value
Pain	42.6 ± 7.9	71.4 ± 9.8	+28.8	<0.001
Activities of Daily Living (ADL)	46.2 ± 8.4	73.6 ± 10.2	+27.4	<0.001
Symptoms	48.1 ± 7.2	69.8 ± 8.7	+21.7	<0.001
Quality of Life	38.7 ± 9.1	62.5 ± 10.4	+23.8	<0.001

Test used: Wilcoxon signed-rank; **Median improvement = 59%**

Table 4. Change in Analgesic Requirements

Parameter	Baseline n (%)	3-Month n (%)	Absolute Reduction	p-value
NSAID usage	68 (94.4%)	28 (38.9%)	−40 (−58.8%)	<0.001
Opioid usage	11 (15.3%)	2 (2.8%)	−9 (−81.8%)	<0.01

Test used: McNemar test

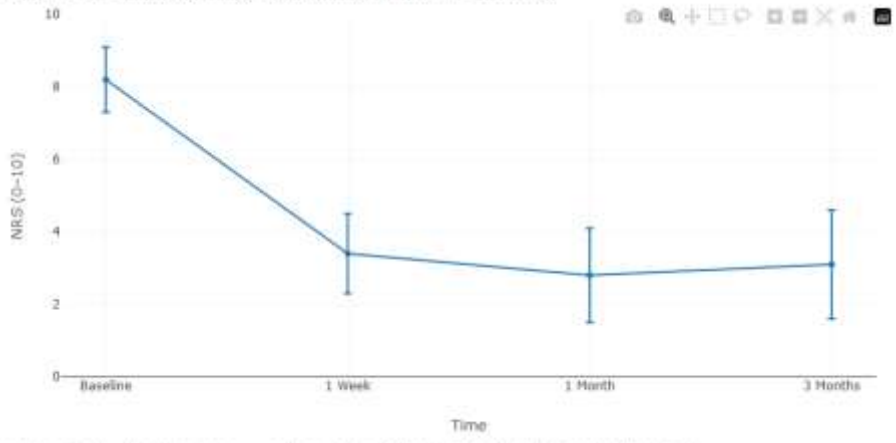
Table 5. Adverse Events and Patient Satisfaction

Outcome	n (%)
No adverse events	62 (86.1%)
Minor pain/bruising	5 (6.9%)
Transient dizziness	3 (4.2%)
No motor weakness	0 (0%)
Any adverse event	10 (13.9%)

Satisfaction Score (5-point Likert):

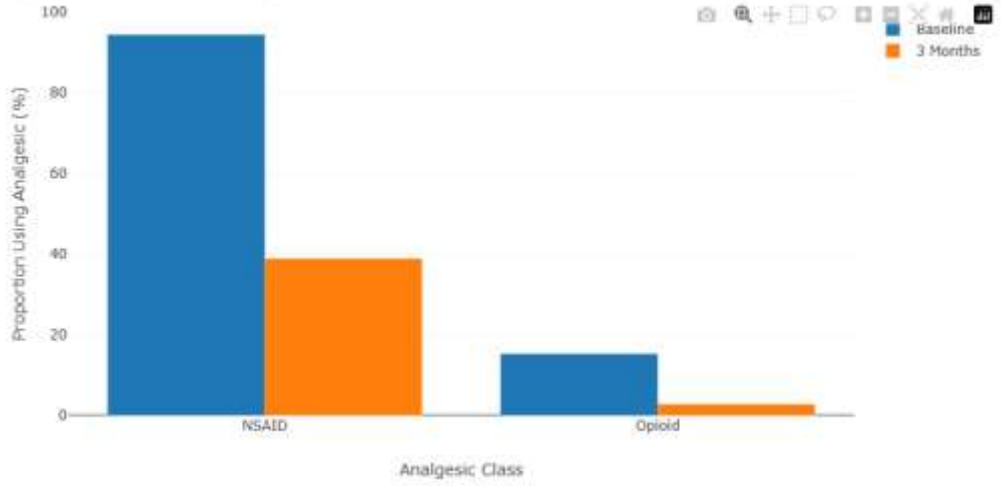
Rating	n (%)
Very satisfied	51 (70.8%)
Satisfied	15 (20.8%)
Neutral	4 (5.6%)
Dissatisfied	2 (2.8%)

Figure 1. NRS Pain Trajectory Over Time (Baseline to 3 Months)



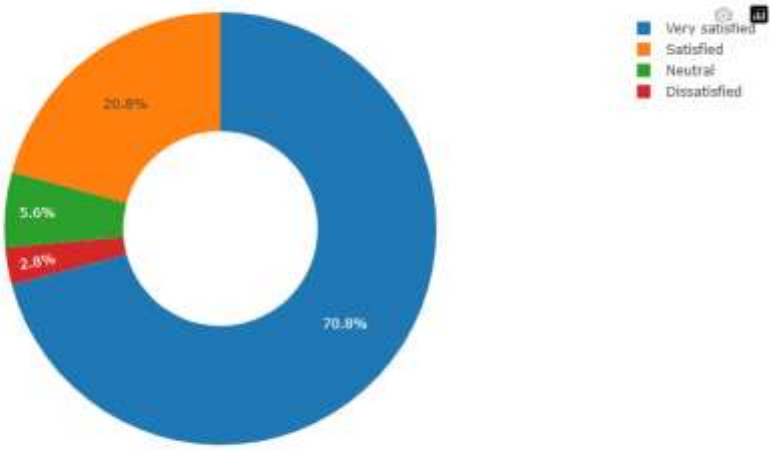
Cohort (n = 72). Mean NRS ± SD at each time point: Baseline 8.2 ± 0.9; 1 Week 3.4 ± 1.1; 1 Month 2.8 ± 1.3; 3 Months 3.1 ± 1.5.

Figure 2. Reduction in Analgesic Use (Baseline vs 3 Months)



NSAID use decreased from 94.4% to 38.9%; opioid use decreased from 15.3% to 2.8%.

Figure 3. Patient Satisfaction at 3 Months



Very satisfied 70.8%; Satisfied 20.8%; Neutral 5.6%; Dissatisfied 2.8%.