

Peripheral nerve blocks as an alternative for total hip endoprosthesis surgery in elderly patients with femoral fracture

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Abstract

Proximal femoral fractures represent a significant anesthetic challenge in the geriatric population. Advanced age, frailty, and multiple comorbidities are associated with increased perioperative risk, particularly in the context of general anesthesia, while neuraxial techniques may be limited by the frequent use of anticoagulant therapy. Ultrasound-guided peripheral nerve blocks (PNBs) combined with light sedation may offer a potential alternative approach in selected high-risk patients. We report two elderly female patients (aged 91 and 99 years) with proximal femoral fractures who underwent total hip endoprosthesis surgery. Anesthetic management consisted of a lumbar erector spinae plane (L-ESP) block combined with a fascia iliaca compartment block (FICB). Sedation was administered via target-controlled infusion (TCI) of propofol, and depth of sedation was continuously monitored using the Conox system (Fresenius Kabi, Bad Homburg, Germany). Both procedures were completed without conversion to general or neuraxial anesthesia. Intraoperative hemodynamic parameters remained within acceptable ranges, and postoperative analgesia was adequate. No episodes of postoperative delirium or major perioperative complications were observed. These cases suggest that the combined use of L-ESP and FICBs, supplemented with light TCI-guided sedation, may represent a feasible anesthetic alternative in carefully selected elderly patients undergoing total hip endoprosthesis surgery for femoral fracture. Further investigation in larger cohorts is warranted to better define its role in this setting.

Graphical abstract

Peripheral Nerve Blocks as an Alternative for Total Hip Endoprosthesis Surgery in Elderly Patients with Femoral Fracture

High-Risk Elderly Patients

- Aged 91 and 99 years
- Proximal femoral fractures
- Multiple comorbidities (COPD, valvular heart disease, use of DOACs)
- Contraindications to general or neuraxial anesthesia

Regional Anesthetic Strategy

- Ultrasound-guided lumbar ESP block (L4–L5 ± L5–S1)
- Ultrasound-guided fascia iliaca block
- Propofol TCI (effect-site concentration 0.8 µg/mL)
- Conox monitoring (Qcon 75 80; Qnox 40–50)

Outcomes

- Hemodynamic stability
- Adequate surgical anesthesia
- Postoperative NRS ≤3
- Early mobilization (12 h)
- No major complications

Combined lumbar ESP and fascia iliaca blocks may represent a feasible anesthetic alternative in carefully selected high-risk elderly patients undergoing hip fracture surgery.

COPD, chronic obstructive pulmonary disease; DOACs, direct oral anticoagulants; ESP, erector spinae plane; TCI, target-controlled infusion; NRS, Numerical Rating Scale.

Key words: ultrasound lumbar erector spinae plane block; ultrasound fascia iliaca block; hip fracture; total hip endoprosthesis surgery; opioid-sparing analgesia.

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Introduction

Elderly patients frequently undergo total hip endoprosthesis surgery for femoral fracture, with reported mortality rates ranging from 17% to 25%.^{1,2} Mortality is significantly reduced when surgery is undertaken within 36-48 hours;¹ however, this limited time-frame often does not allow optimal preoperative stabilization. Many patients present with substantial comorbidities, and up to 40% exhibit cognitive impairment.^{2,3} Anesthetic management is therefore particularly challenging, especially when conventional techniques are contraindicated.

The two principal anesthetic strategies are neuraxial and general anesthesia; however, evidence regarding their relative impact on mortality remains inconclusive.³ Peripheral nerve blocks (PNBs) are widely employed for perioperative analgesia in femoral fractures,⁴ yet their use as the primary anesthetic technique remains uncommon despite encouraging reports.^{5,6} PNBs offer several advantages, including reduced opioid consumption and minimization of opioid-related adverse effects such as sedation, nausea, vomiting, and hypotension.³

The innervation of the hip joint is complex and extends beyond the lumbar plexus. It includes contributions from the lateral cutaneous branch of the ilioinguinal nerve, the lateral cutaneous branch of the subcostal nerve, the superior and inferior gluteal nerves, the nerve to quadratus femoris, and the superior cluneal nerve.⁷

The fascia iliaca compartment block (FICB; Figure 1) targets the femoral, obturator, and lateral femoral cutaneous nerves within the fascial plane overlying the iliacus and psoas muscles and typically requires relatively large volumes of local anesthetic (20-40 mL).^{4,8}

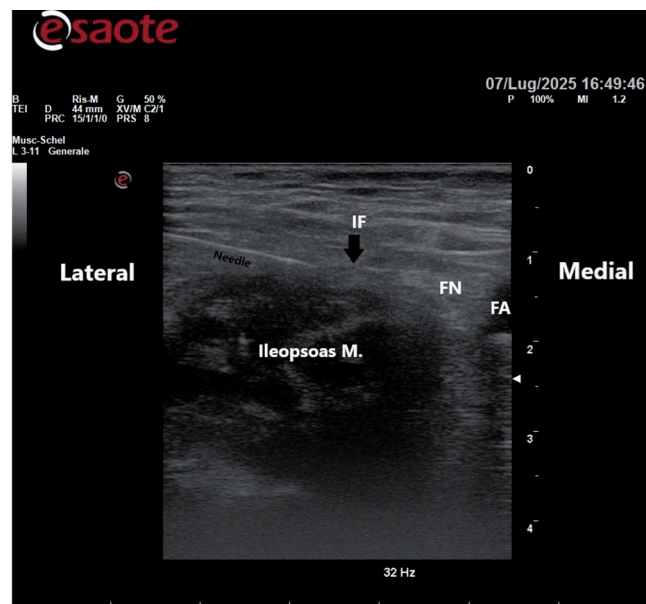
The lumbar erector spinae plane (L-ESP) block (Figure 2), first described for hip applications in recent years, has been increasingly reported in perineal, anorectal, hip, and lower limb procedures.^{6,9,10} Injection of local anesthetic into the fascial plane between the erector spinae muscle and the transverse process results in craniocaudal spread with possible extension toward the paravertebral and epidural spaces, potentially influencing the lumbar plexus (L1-L4).^{6,9}

Case Reports

Case 1

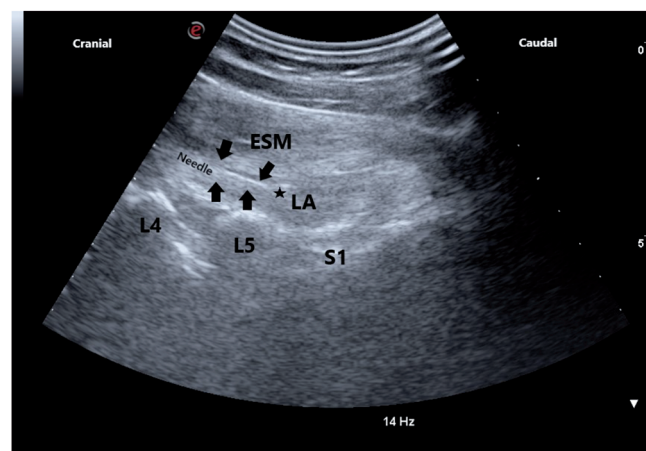
A 91-year-old woman (70 kg) was admitted following an accidental fall. Initial evaluation revealed a subcapital fracture of the left femur and an acute subdural hematoma that did not require surgical intervention. Her medical history was notable for hypertension, iron-deficiency anemia, bipolar disorder, and chronic ischemic cognitive impairment. At the time of admission, she was disoriented but had maintained partial independence in activities of daily living prior to the fall.

Following multidisciplinary assessment, total hip endoprosthesis surgery via a lateral surgical approach was indicated and performed 48 hours after hospital admission. Light sedation was administered using a continuous target-controlled infusion (TCI) of propofol at an effect-site concentration of 0.8 $\mu\text{g}/\text{mL}$.



FN, femoral nerve; FA, femoral artery; Ileopsoas M, ileopsoas muscle.

Figure 1. Iliac fascia block. Ultrasound scan obtained using a convex probe.



ESM, erector spinae muscle; LA, local anesthetic.

Figure 2. Erector spinae plane block. Ultrasound scan obtained using a convex probe showing the transverse processes of L4, L5, and S1. Arrows indicate the needle through which the local anesthetic is deposited at the target point (asterisk).

Case Report

An L-ESP block combined with an FICB was performed under ultrasound guidance. Adequate sensory blockade was confirmed by cutaneous testing 30 minutes after completion of the blocks.

The surgical procedure was uneventful, and hemodynamic stability was maintained throughout. Both intraoperative and postoperative analgesia were excellent. Postoperatively, the patient demonstrated a satisfactory recovery, with pain scores never exceeding 1 on the Numerical Rating Scale (NRS). She was discharged after 8 days without any evidence of neurological deterioration.

Case 2

A 99-year-old woman sustained a subcapital fracture of the left femur following a domestic fall. Her medical history was significant for myocardial infarction treated with coronary stenting and ongoing clopidogrel therapy, which had been discontinued 48 hours prior to surgery, as well as hypertension, bronchial asthma, and chronic kidney disease.

Total hip endoprosthesis surgery was performed 24 hours after admission. After written informed consent had been obtained, regional anesthesia was selected as the primary anesthetic approach.

With the patient in the supine position, an ultrasound-guided FICB was performed using a mixture of 0.5% levobupivacaine (50 mg) and 1% lidocaine (200 mg), for a total volume of 30 mL. Subsequently, the patient was repositioned in the lateral decubitus position, and ultrasound-guided ESP blocks were performed at the L4-L5 and L5-S1 levels using the same anesthetic solution. Adequate sensory blockade was confirmed by cutaneous testing 30 minutes after completion of the blocks.

Sedation was maintained using TCI of propofol at an effect-site concentration of 0.8 $\mu\text{g/mL}$ and continuously monitored with the Conox system (Fresenius Kabi, Bad Homburg, Germany). The Conox system is a processed electroencephalography-based monitor that provides two independent indices: Qcon and Qnox. The Qcon index (range 0-100) reflects the level of hypnosis derived from Electroencephalography (EEG) signal analysis, with values between 70 and 85 typically corresponding to light to moderate sedation. The Qnox index (range 0-100) estimates the probability of response to noxious stimulation based on EEG-derived parameters and signal processing algorithms. Lower Qnox values are associated with a reduced likelihood of nociceptive responsiveness. Qcon values between 75 and 80 and Qnox values between 40 and 50 were recorded intraoperatively, consistent with adequate sedation and absence of nociceptive response.

The surgical procedure lasted approximately 60 minutes, during which the patient remained hemodynamically stable. Perioperative management included administration of 1,000 mL of Ringer's lactate, dexamethasone 4 mg, and acetaminophen 1 g, continued every 8 hours for 36 hours. Pain scores remained ≤ 3 on the NRS throughout the first 36 postoperative hours, and no episodes of nausea or vomiting were observed. Twelve hours after surgery, the patient was mobilized without pain to initiate physiotherapy. Postoperative recovery was uneventful, and no major complications occurred.

Discussion

With the progressive aging of the population, anesthesiologists increasingly manage frail elderly patients presenting with multiple comorbidities and elevated perioperative risk.³ Although general

and neuraxial anesthesia remain established and effective techniques, they may not always represent the safest option in selected high-risk individuals, particularly in the presence of anticoagulant therapy, cardiovascular instability, or neurological conditions.

For total hip endoprosthesis surgery, PNBs such as L-ESP block and FICB are commonly combined with general or neuraxial anesthesia to optimize perioperative analgesia.^{4,9} However, their use as the sole anesthetic strategy remains relatively uncommon, despite emerging evidence supporting their feasibility in selected cases.^{5,6}

PNBs improve perioperative analgesia, reduce opioid requirements, and may facilitate early mobilization and physiotherapy,^{3,4} potentially contributing to shorter hospital stays and improved functional recovery.¹ Compared with neuraxial techniques, PNBs are associated with less sympathetic blockade, thereby preserving cardiovascular stability – an important consideration in elderly patients with significant cardiac disease. Previous reports have demonstrated the safety of combined lumbar plexus and sciatic nerve blocks in patients with severe cardiac pathology undergoing hip fracture surgery.^{11,12}

Alternative regional techniques have also been described. The pericapsular nerve group (PENG) block targets the articular branches of the femoral, obturator, and accessory obturator nerves.¹³ Although associated with reduced quadriceps weakness, it may not consistently anesthetize the lateral femoral cutaneous nerve; combining PENG with a lateral femoral cutaneous nerve block may enhance sensory coverage.¹⁴ Furthermore, recent reports have described the combination of PENG with sacral ESP blocks as a potential anesthetic strategy for hip fracture surgery,¹⁵ highlighting the growing interest in multimodal peripheral block approaches.

The L-ESP block is increasingly recognized as a valuable component of multimodal analgesia in hip procedures.^{6,9,10} When combined with the FICB, it may provide extensive sensory coverage of the hip joint while avoiding the hemodynamic consequences of neuraxial anesthesia and the systemic effects of general anesthesia. In the present cases, this combination allowed total hip endoprosthesis surgery to be performed under light sedation without conversion to general or neuraxial techniques, with stable intraoperative parameters and satisfactory postoperative analgesia.

Nevertheless, the combined use of multiple regional techniques may increase the theoretical risk of local anesthetic systemic toxicity (LAST), particularly in elderly patients with altered pharmacokinetics. Careful dose calculation, ultrasound guidance, and vigilant monitoring remain essential. Given the limited sample size and observational nature of this report, these findings should be interpreted cautiously.

Further prospective studies and randomized controlled trials are warranted to better define the role of combined PNBs as an alternative anesthetic strategy for total hip endoprosthesis surgery in high-risk elderly patients.

Conclusions

These two cases suggest that the combination of L-ESP block and FICB may represent a feasible anesthetic alternative for total hip endoprosthesis surgery in frail elderly patients with significant neurological or cardiovascular risk.

This approach may preserve hemodynamic stability, provide adequate surgical anesthesia and postoperative analgesia, reduce

opioid requirements, and facilitate early mobilization. However, combining regional techniques increases the theoretical risk of LAST, particularly in elderly patients.

Further prospective studies and randomized controlled trials are warranted to define optimal dosing strategies and to confirm the safety and efficacy of this approach.

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Consent for publication: written informed consent for publication of this report and any accompanying images was obtained from both patients.

Availability of data and materials: all data underlying the findings are fully available.

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