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CASE REPORT

# Association of PENG block, lateral femoral cutaneous, iliohypogastric, subcostal, and superior cluneal nerve blocks for postoperative analgesia in osteosynthesis of trochanteric fracture: a case report

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## ABSTRACT

The pericapsular nerve group block (PENG block) has been successfully used in postoperative analgesia for hip surgeries. However, this technique does not address the innervation of incision areas. As the absence of this coverage can cause postoperative pain, the PENG block is associated with the lateral femoral cutaneous nerve block. Nevertheless, the typical incision areas of hip surgeries can also be innervated by the iliohypogastric, subcostal, and superior cluneal nerves. This report evaluated the effective postoperative analgesia generated by the association of these blocks in the osteosynthesis of a transtrochanteric fracture, reflected by low pain scores and no opioid requirements.

## KEYWORDS

Regional anesthesia; hip fractures; nerve block

## INTRODUCTION

The pericapsular nerve group block (PENG block) has been successfully used in postoperative (PO) analgesia for hip surgeries[1,2]. However, since the technique does not address the innervation of the incision areas of these surgical procedures, it has been associated with the lateral femoral cutaneous nerve (LFCN) block[3]. Nevertheless, the incision areas of some hip surgeries are innervated not only by the LFCN but also by the iliohypogastric (IHN), subcostal (SN), and superior cluneal nerves (SCNs)[3,4]. This report evaluated the PO analgesia generated by the association of these cutaneous nerve blocks with the PENG block in a case of transtrochanteric fracture osteosynthesis (TFO), which, to our knowledge, has not yet been described in the literature.

This article adheres to the applicable Enhancing the Quality and Transparency of Health Research (EQUATOR) checklist Case Report Guidelines (CARE) and was approved by the appropriate Research Ethics Committee. Written informed consent was obtained from the patient for the publication of this case report.

## CASE REPORT

The patient was a 62-year-old male weighing 75 kg and 1.70 m tall; hypertensive, using losartan 50 mg/day. Due to a transtrochanteric fracture of the right

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femur, he underwent osteosynthesis of the fracture with a short intramedullary rod (IMR) within the first 48 hours of trauma. After noninvasive monitoring and positioning the patient on an orthopedic traction table, 1 g of tranexamic acid, 2 g of cefazolin, and 4 mg of ondansetron were administered. Sedation was initiated with a bolus of dexmedetomidine 1 mcg · $kg^{-1}$ in 10 minutes and ketamine 0.5 mg/kg, and maintained with dexmedetomidine 0.5 mcg · $kg^{-1}$ · $hr^{-1}$. Then, the PENG block was performed with 20 ml of 0.25% ropivacaine, associated with the LFCN block with 10 ml of 0.25% ropivacaine, as described by Girón-Arango et al. and Nielsen et al., respectively[2,3]. Next, the iliohypogastric and subcostal nerves were accessed through the transversalis fascia plane block, as described by Nielsen et al.[4] With a low-frequency transducer positioned transversely between the iliac crest and the subcostal border, the transversus abdominis and quadratus lumborum muscles, as well as the pararenal fat, were visualized; a 100-mm nerve stimulator needle was introduced in-plane in an anteroposterior direction, with the tip positioned in the pararenal fat, between the quadratus lumborum and the transversus abdominis aponeurosis; 20 ml of 0.25% ropivacaine was injected in this plane[3,4]. Finally, the block of the superior cluneal nerves was performed. With the patient in prone position, a high-frequency transducer was positioned dorsally, transversely between the posterior costal margin and the iliac crest, identifying the erector spinae muscles and the thoracolumbar fascia; a 100-mm needle was introduced in-plane, from lateral to medial, between the thoracolumbar fascia (near the fusion of its posterior and anterior layers) and the iliocostal muscle (one of the three bellies forming the erector spinae muscles); 20 ml of 0.25% ropivacaine was injected at this point[3]. The total mass of local anesthetic was 175 mg of ropivacaine. The blocks were performed with the aid of an ultrasound machine (GE LOGIQ V2®; General Electric Company, Wauwatosa, WI). Subsequently, spinal anesthesia was performed with 8 mg of hyperbaric bupivacaine. The surgery lasted 52 minutes, and the patient remained hemodynamically stable with a satisfactory spontaneous breathing pattern throughout the anesthetic procedure. In the PO, 1 g of dipyrone was administered every 6 hours and 30 mg of ketorolac every 12 hours, on a fixed schedule; tramadol, morphine, and ondansetron were prescribed as needed. We used symptoms of moderate to severe pain as a trigger for prescribing opioids, and nausea as a trigger for prescribing ondansetron. PO pain was assessed using the verbal numerical rating scale (VNRs) from 0 to 10. At 6, 12, 24, 36, and 48 hours PO, the VNRs was 0 for pain at rest. For dynamic pain, assessed by leg elevation to 15º, the VNRs scores were 0, 1, 2, 2, 1, respectively. There was no opioid or ondansetron consumption in the 48 hours evaluated. Quadriceps muscle strength testing was performed using a dynamometer (Med Force hand-held push dynamometer, Med Dor LTDA, Governador Valadares, MG, Brazil), with the patient in the supine position, hip flexed at 45º, and the knee flexed at 90º. The device was placed on the distal portion of the leg, on its anterior surface (intermalleolar line) and stabilized by an adjustable inelastic strap. The patient was then asked to perform maximum knee extension, and the force in newtons was recorded on the device screen. The preoperative force measured in the non-fractured limb was 47 newtons. The quadriceps strength measured in the operated limb at 6, 12, 24, 36, and 48 hours PO was 39, 42, 42, 45, and 45 newtons, respectively. There were no episodes of nausea or vomiting, pruritus, urinary retention, respiratory depression, or complications from the peripheral blocks identified during the PO. Weight-bearing ambulation and hospital discharge occurred at 24 and 48 hours PO, respectively.

## DISCUSSION

The PENG block targets the terminal branches of the femoral, obturator and accessory obturator nerves, responsible for innervating the anterior capsule of the hip, and thus is an option for PO analgesia for surgeries in this area[1,2]. However, the PENG block does not access the cutaneous innervation of the lateral thigh. Since the incisions of these procedures also contribute to PO pain, the PENG block is commonly associated with the LFCN block to provide better analgesia[1,3]. However, the area where most incisions occur is innervated not only by the LFCN but also by the iliohypogastric, subcostal, and superior cluneal nerves (Figure 1)[3,4]. In TFO with a short IMR, three incisions are made: one for the IMR entry, proximal to the greater trochanter and covered by the iliohypogastric, subcostal, and superior cluneal nerves; and two others, distal to the greater trochanter, for the proximal and distal locking screws, primarily covered by the LFCN[3,4]. Since the LFCN is not responsible for innervating the IMR entry region, this case report proposed, for the first time, the performance of iliohypogastric, subcostal, and superior cluneal nerve blocks associated with the LFCN and PENG blocks to achieve complete analgesia of the three incision regions of TFO[3,4].

Liang et al. compared the association of the PENG block and LFCN to the suprainguinal iliac fascia block for hip arthroplasties, where the incision area can be innervated by the four aforementioned nerves, and found no analgesic differences between the techniques. The static and dynamic PO pain scores (VNRs) found by these authors in the group combining the PENG block and LFCN were, respectively: 6 hours: 2 and 2; 24 hours: 1 and 2; and 48 hours: 0 and 1. There was also opioid

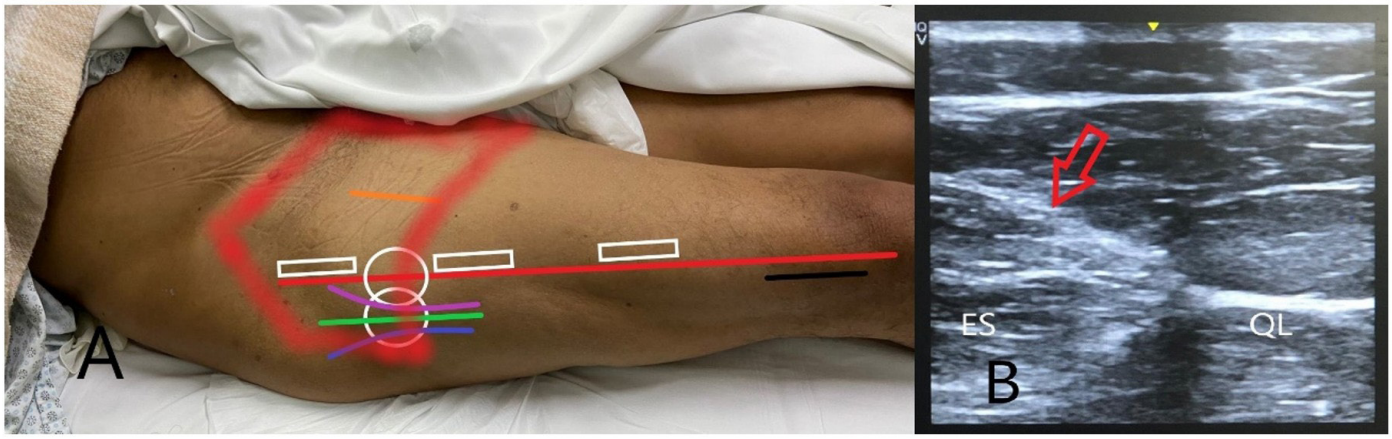


**Figure 1. A –** Anterior white circle: Projection of the greater trochanter with the patient in the supine position; Posterior white circle: Projection of the greater trochanter with the patient in the lateral position; Horizontal red line: Femur trajectory to the patella; Green line: Lateral incision; Magenta line: Anterolateral incision; Blue line: Posterolateral incision; Orange line: Anterior incision; Proximal white rectangle: Incision for the entry of the intramedullary nail (IMN); Intermediate white rectangle: Incision for the proximal fixation of the IMN; Distal white rectangle: Incision for the distal fixation of the short IMN. Black line: Incision for the distal fixation of the long IMN. Shaded red line: Region to be anesthetized by the transversalis fascia block[3]. **B –** Ultrasonographic anatomy of the superior cluneal nerve block; Red arrow: Posterior sheath of the thoracolumbar fascia. ES: Erector spinae muscle; QL: Quadratus lumborum muscle[3].

consumption by a percentage of the patients in the PO of this study[1].

Jadon et al. compared the PENG block to the suprainguinal iliac fascia block in hip fractures. The median VNRs found in the PENG block group for static and dynamic PO pain were, respectively: 6 hours: 1 and 1; 12 hours: 2 and 4; 24 hours: 2 and 3. There was also opioid consumption in the PO of this study[5].

In this report, we found that the association of the PENG block with all the nerve blocks responsible for the incision areas showed lower pain scores than those reported by Liang et al.[1] and Jadon et al.[5] Unlike their findings, the proposed association avoided the need for opioids in the PO. There is the possibility of partial reduction in quadriceps strength in the operated limb but the motor function of the quadriceps in thigh extension is preserved. The values measured by the dynamometer normalized within 48 hours, allowing for early ambulation. Therefore, it is hypothesized that the superiority presented by the results in pain score and opioid consumption of this report, in a simple comparison with the cited literature, is justified by the complete analgesic coverage of the cutaneous incision regions.

The association of the PENG block with the LFCN block provides satisfactory analgesia for hip surgeries[1]. However, there is a perspective for improving this analgesia, with reduced opioid requirements, if the approach to the cutaneous incision areas is optimized[3,4]. Since performing blocks for complete incision area coverage may not be practical, wound infiltration (WI) has the potential to be more feasible. Postoperative analgesia from WI showed statistically similar results compared to the LFCN block in the clinical trial by Pascarella et al.[6], reinforcing the hypothesis that WI may be a plausible and effective option to complement incision areas not covered by the LFCN block[6].

In conclusion, PO analgesia achieved with the presented combination of blocks was effective, with the trade-off of partial reduction in quadriceps strength, though it did not avert early ambulation. The alternative proposal of WI as an alternative for the combination of blocks used in this case report may be a plausible hypothesis. There is potential for improving postoperative analgesia for hip surgeries beyond what is currently practiced in clinical settings.

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