

# Pericapsular nerve group block: a 3D CT scan imaging study to determine the spread of injectate

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## ABSTRACT

**Background** Current understanding of the mechanism of action of the pericapsular nerve group (PENG) block is primarily based on cadaver studies. We performed an imaging study in patients undergoing hip surgery to enhance the understanding of the analgesic mechanisms following a PENG block.

**Materials and methods** 10 patients scheduled for hip surgery received an ultrasound-guided PENG block with 18 mL of 0.5% ropivacaine mixed with 2 mL of a contrast agent. After completion of the block, a high-resolution CT scan was performed to obtain a three-dimensional reconstruction of the injectate's dispersion.

**Results** The CT imaging revealed that injectate was mainly confined to the epimysium of the iliopsoas muscle, with a minor spread to the hip capsule. Contrast dye was detected within the iliacus and/or the psoas muscle in all patients. No observed spread to either the subpectineal plane or the obturator foramen was detected.

**Conclusion** Our study suggests that the analgesic effect of the PENG block may be related to the block of the branches of the femoral nerve traveling within the iliopsoas muscle without a spread pattern commensurate with the block of the obturator nerve.

**Trial registration number** ClinicalTrials.gov Registry (NCT06062134).

during a PENG block were performed on cadavers, we performed this study to evaluate the dispersion of the local anesthetic in patients and complement the current understanding of the analgesic mechanisms following a PENG block.

## MATERIALS AND METHODS

The study was registered at ClinicalTrials.gov (NCT06062134 on October 2, 2023). Patient enrollment started on October 18, 2023.

## Inclusion and exclusion criteria

10 patients scheduled for hip surgery were recruited. Inclusion criteria comprised an indication for interventional analgesia for postoperative pain management for hip surgery, American Society of Anesthesiologists physical status I, II, or III, >18 years old, and being able to understand the purpose and risks of the study. Exclusion criteria were pregnancy, body mass index above 35 kg/m<sup>2</sup>, hepatic or renal insufficiency, and history of allergic or adverse reactions to local anesthetics or contrast agents.

## Study protocol

Preoperatively, patients received an ultrasound-guided PENG block using an Aplio 700 machine (Canon Medical System Europe) equipped with a curvilinear low-frequency ultrasound transducer (2–5 MHz), and a 21-gauge 80 mm stimulating needle (SonoPlex Stim, Pajunk, Germany). The correct needle tip position was confirmed by injecting 2 mL of 0.9% sodium chloride. Next, a total volume of 20 mL of the study mixture was injected comprising 18 mL of 0.5% ropivacaine mixed with 2 mL of radiopaque contrast; Iomeron 300: 61.24% w/v of iomeprol equivalent to 30% iodine or 300 mg iodine/mL (Bracco UK Limited). 30 min post-injection, patients underwent a high-resolution CT scan (Siemens), followed by a three-dimensional (3D) reconstruction of the images with injectate spread. Subsequently, the patients were transferred to the operating room for hip replacement surgery under spinal anesthesia.

## PENG block technique

An experienced anesthesiologist performed the ultrasound scanning, identified the correct fascial planes, and administered the local anesthetic following the original technique description for the PENG block.<sup>1</sup> With the patient in a supine position,

## INTRODUCTION

The pericapsular nerve group (PENG) block has been adopted in many centers as a motor-sparing interventional analgesia technique in patients having hip surgery.<sup>1,2</sup> This technique is primarily based on anatomical dissection studies conducted in cadavers. These studies suggested that the PENG injection can reach articular branches of the femoral nerve and accessory obturator nerves between the anterior inferior iliac spine and the iliopubic eminence prior to their entry into the anteromedial aspect of the hip capsule. Consecutive cadaveric studies supported this mechanism, as evidenced by methylene blue injections reaching the articular branches of the femoral, accessory obturator, and obturator nerves.<sup>3,4</sup>

While the cadaveric studies indicate that the PENG block comprises a pericapsular block, clinical reports of quadriceps muscle weakness<sup>5–7</sup> suggest that the distribution of the local anesthetic could be more extensive than expected.<sup>8</sup> Since previous studies on the distribution of injectate



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