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Pericapsular Nerve Group block (PENG) and total hip arthroplasty

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Abstract

A new method of regional anaesthetic called Pericapsular Nerve Group block (PENG) blocks these nerves in order to target the hip's anterior capsule. PENG Block applications include medial thigh lesions, hip fractures, and vascular operations. Only ultrasonic guidance is used when performing the PENG Block, and two methods—out-of-plane method and in-plane method—are used with the low-frequency probe. When employed in a multimodal manner, ultrasound guided peripheral nerve blocks were shown to be more effective and to have less adverse effects. Infection, bleeding, nerve injury, and local anaesthetic toxicity are some of the consequences. PENG is useful in complete hip replacement.

Keywords: Anaesthetic, Pericapsular, vascular operations

Introduction

One orthopaedic procedure that is consistently effective and cost-effective is total hip arthroplasty (THA) [1]. A new method of regional anaesthetic called PENG blocks these nerves in order to target the hip's anterior capsule [2].

PENG block was initially presented by L. Girón-Arango *et al.* [3] is an unique localized analgesic method that can be used to treat pain from THA while maintaining motor function. In this method, local anaesthetic is injected into fascial plane between psoas muscle and ilio-pubic eminence.

Anatomy of hip joint

It is possible to move while carrying weight upright thanks to the hip joint, which joins the head of femur to the pelvis. The proximal end of femur consists of the femoral head, neck, and greater and lesser trochanters, and these components are what make up the hip joint, which includes a ball and socket [4].

Anatomy of PENG

The PENG block seems to be supra-inguinal analogue of articular femoral nerve branches, with extra benefit of blocking both accessory and primary obturator nerves [5].

The femoral nerve, which originates from ventral rami of L2-L4 spinal nerves, is the longest branch of the lumbar plexus. It exits from lateral border of psoas muscle and descends between iliacus and psoas muscles separated into two divisions: anterior and posterior and give motor and sensory branches. A motor branch is born from the femoral nerve, which is then sent to iliac prior to passing through inguinal ligament [6]. (Figure 1)

The hip joint serves as the higher point along the nerve's course where the articular branches originate. This explains why the fascia iliaca or femoral compartment blocks are still ineffective for hip analgesia [6].

The anterior and posterior branches of obturator nerve split in obturator canal, which is generated by anterior divisions of the L2, L3, and L4 of lumbar plexus. Following common iliac arteries, the nerve descends into the psoas major fibers before proceeding laterally along the pelvic wall. The medial thigh's middle region's skin is supplied by the obturator nerve's cutaneous branch, which emerges from the anterior branch's penetration of the fascia lata [6]. The auxiliary obturator nerve, which develops from the third and fourth lumbar nerves and frequently innervates hip joint and adductor longus, is existed in 10% to 30% of people.

It developed from L2 to L4 ventral rami. The medial capsule, which contains sensory fibres, was discovered to be

innervated by auxiliary obturator nerve [8].

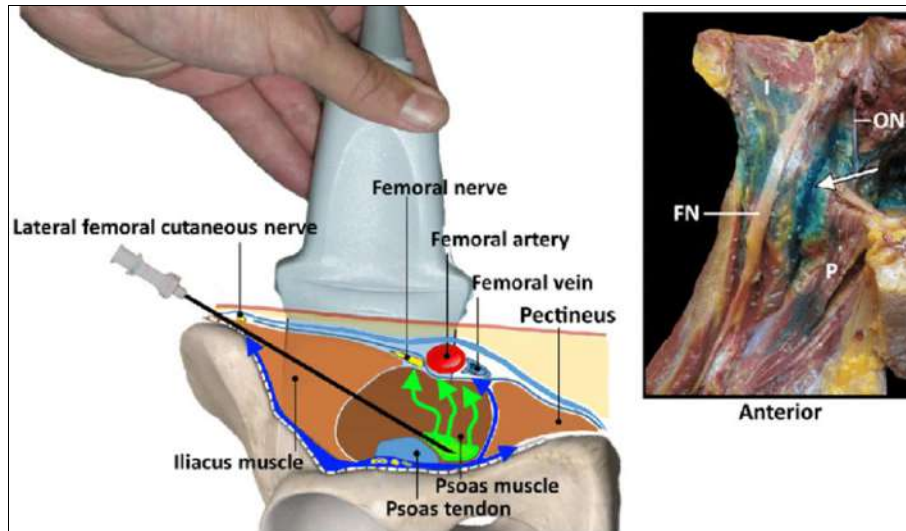


Fig 1: Anatomy of PENG block [7]

The distribution of anesthesia

Short *et al* anatomic's study showed that high branches of femoral and obturator nerves, and accessory obturator nerve, innervate anterior hip capsule because it is this capsule that receives majority of sensory innervation, while posterior and inferior capsules are devoid of sensory fibers. The hip capsule contains two parts: the anterior and the posterior, with the anterior part mostly containing nociceptive fibers and the posterior part containing mechanoreceptors [9]. Potential locations for localized analgesia may be indicated by the three nerves' physical course via psoas major, relationship of their articular branches to inferomedial acetabulum, and the area between anterior inferior iliac spine (AIIS) and ilio-pubic eminence. The three nerves between the psoas muscle and upper pubic branch may be helped to numb by the injection of local anaesthetics, providing analgesic coverage during hip surgery [10].

Indications

A cutting-edge method of localized analgesia called the PENG Block can be applied in:

Hip surgeries & fractures

When the hip or thigh is injured or surgically repaired, it is generally used to give analgesia [11]. It should be emphasized that posteromedial hip capsule is surrounded by branches of sacral plexus and sciatic nerve, therefore PENG block cannot serve as the only anaesthetic for hip surgery [12].

Medial thigh lesions

An efficient PENG block for surgical anaesthesia was used by the author to treat a medial thigh lesion in a recent publication [13].

Vascular operations

Because ligation and stripping area existed in both FN and ON dermatomes, authors of other research mention using the block in vascular surgeries like stripping [14].

Ultrasound anatomy & technique (Figure 2)

Only the low-frequency probe and ultrasonic guidance are used to execute the PENG Block, there are two techniques:

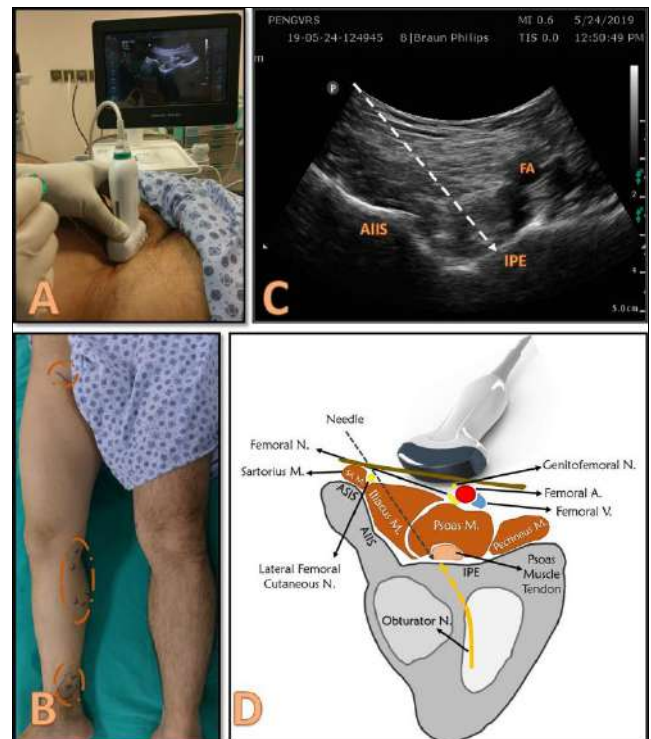


Fig 2: (A) Ultrasound, probe, needle, and setup of the patient for Pericapsular Nerve Group block. (B) Surgical areas of patient. (C) Sonographic anatomy. (D) Basic illustration of a Pericapsular Nerve Group block. AIIS, anterior inferior iliac spine; FA, femoral artery; IPE, iliopubic eminence

Out-of-plane technique

After adequate premedication, patient is positioned supine with their hips extended. Under ultrasound guidance, 3 ml of 2 percent lidocaine are injected at the location of placement utilizing a hyperechoic needle adequate for

regional anaesthesia and a low-frequency probe designed for this type of block ^[15].

The anterior superior iliac spine (ASIS) is where probe is positioned parallel to the inguinal fold, and scanning is done by gently moving the probe head. Once the lower AIIS has been located, probe is turned slightly midline until upper pubic ramus's continuous hyperechoic shadow is seen. Using this technique, we can recognize psoas muscle, which has a noticeable tendon immediately above pubic ramus ^[15]. In the plane between these two buildings, the target is located. To be focused only inside AIIS, pubic ramus must be in the exact center of the image. The ultrasound-guided out-of-plane approach is used to give 20 mL of a local anaesthetic through a 100 mm nerve block needle ^[15].

In-plane technique

To see the pubic ramus, the low-frequency curvilinear transducer is shifted inferiorly while being positioned in transverse plane above AIIS. A 100 mm nerve block needle is placed through skin wheel at a 30- to 45-degree angle toward ultrasound beam once femoral artery and iliopubic eminence have been identified. 20 mL of local anaesthetic is then deposited between pubic ramus posteriorly and psoas tendon anteriorly ^[16].

Complications

Techniques for regional anaesthesia necessitate in-depth familiarity with any potential risks connected to a specific surgery. The risks of peripheral nerve blocks include infection, haemorrhage, nerve injury, and toxicity from local anaesthetics. Local anaesthetic systemic toxicity is associated with intravascular injection or a high dose that exceeds toxic dose limits. In this situation, intravenous intralipid and hemodynamic supportive measures must be administered right away ^[17].

Because PENG block is exclusively performed via an ultrasound-guided method, there is now very little chance of femoral nerve or vascular damage. Per 10,000 peripheral nerve blocks of all sorts, there are 2 to 4 incidences of long-term peripheral nerve injury ^[18].

Role of PENG in THA

In terms of the PENG block's analgesic effectiveness, it decreased pain scores and opioid use contrasted to no block group in Pascarella *et al* study ^[19] and Alrefaey K *et al* ^[20] and contrasted to femoral nerve block in Lin *et al* ^[21]. In addition, Mysore *et al* ^[22] discovered that in patients receiving local infiltration analgesia after THA and receiving PENG block, the 24-hour hydromorphone consumption was decreased by 2.4 mg.

Conflict of Interest

Not available

Financial Support

Not available

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