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Case Report

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Ultrasound-Guided Pericapsular Nerve Group (PENG) Block Combined with Lateral Femoral Cutaneous Nerve Block for Total Hip Arthroplasty

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Abstract

With the arrival of an aging society and the progress of surgical procedures, total hip arthroplasty (THA) has been carried out more and more. However, postoperative pain severely affected the patient's recovery, and there is currently no reliable analgesic method available. Evidence-based international expert consensus also recommends, compared to LIA, peripheral nerve block (PNB) as a central analgesic approach use in THA for improved outcomes [1]. In this case report, we described 4 cases of postoperative analgesia with pericapsular nerve group (PENG) block combined with lateral femoral cutaneous nerve block (LFCNB) in patients undergoing THA.

Keywords

Total Hip Arthroplasty, Pericapsular Nerve Group Block, Lateral Femoral Cutaneous Nerve Block, Case Report

Case Presentation

Four patients were diagnosed with necrosis of the femoral head or hip osteoarthritis and required THA. All of patients provided written consent for publication of this report. Patients characteristics are presented in **Table-1**. According to the patient's condition, posterior approaches of THA for all patients were considered by the surgeon. In order to alleviate the postoperative pain of the patients, we performed PENG block combined with LFCNB on the surgical side of the patients in the operating room.

Table-1: Patient Characteristics and Perioperative Data

Patient	Sex	Age	BMI	Diagnosis	Surgery	ASA
1	male	47	21.6	necrosis of the left femoral head	left THA	I
2	female	61	26	right hip osteoarthritis	right THA	II
3	male	64	23.9	necrosis of the left femoral head	left THA	I
4	female	51	23.3	left hip osteoarthritis	left THA	I

BMI: Body Mass Index; ASA: American Society of Anesthesiologists.

In operation room, routine perioperative monitors were placed and continuously monitored as recommended by the guidelines of the American Society of Anesthesiologists (ASA), and open upper limb vein access and infusion of compound sodium chloride solution. Patients received ultrasound-guided PENG block and LFCNB, respectively.

Ultrasound-Guided Pericapsular Nerve Group Block:

With the patients in the supine position, the skin surface was disinfected and covered with sterile towels, then a low-frequency curvilinear ultrasound transducer (Mindray Anesus ME7; Mindray Bio-Medical Electronics, Nanshan, Shenzhen, China) was placed parallel at the level of the anterior superior iliac spine, and the probe was rotated 45 degrees counter clockwise to visualize the iliopsoas muscle, femoral artery, and pectinius muscle. Subcutaneous infiltration was performed with 2% lidocaine (1 ml), then a 21-gauge nerve block needle (100 mm, UniPlex Nanoline) was inserted in a lateromedial direction until the tip reached the plane between the iliopsoas tendon and periosteum and between the anterior inferior iliac spine and iliopubic eminence. Ropivacaine (20 mL, 0.33%) containing 1:200,000 epinephrine was injected slowly in 5-mL increments with intermittent after negative aspiration (**Fig-1**).

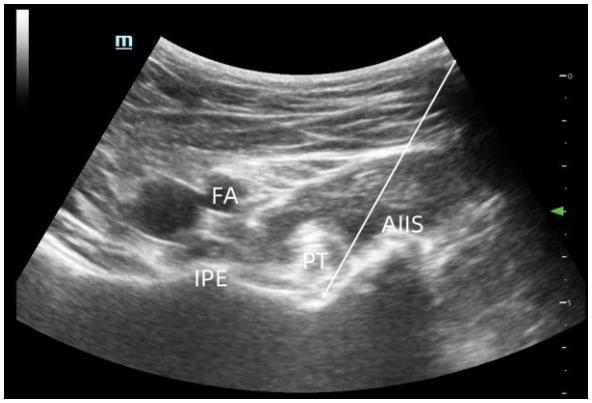

Fig-1:

Images of ultrasound-guided pericapsular nerve group (PENG) block via a lateromedial approach. The white arrow indicates the trajectory of the needle. AIIS, anterior inferior iliac spine; FA, femoral artery; IPE, iliopubic eminence; PT, psoas tendon.

Ultrasound-Guided Lateral Femoral Cutaneous Nerve Block:

LFCNB was performed *via* a high-frequency linear ultrasound transducer, 10 to 12 Hz (Mindray Anesus ME7; Mindray Bio-Medical Electronics Co., Ltd, Nanshan, Shenzhen) to identify the lateral femoral cutaneous nerve in the region of the fat-filled flat tunnel. Ropivacaine (5 mL, 0.33%) containing 1:200,000 epinephrine was administered around the lateral femoral cutaneous nerve while advancing the needle proximally with dynamic needle-tip tracking. The ultrasound image of LFCNB is shown in **Fig-2**.

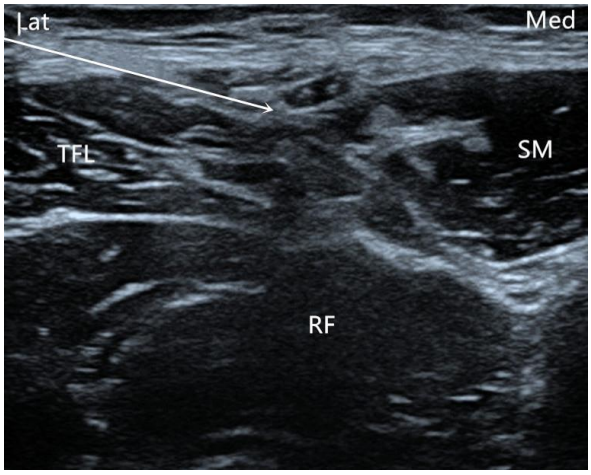

Fig-2:

Ultrasound image of LFCNB. TFL: tensor fasciae latae muscle; SM: sartorius muscle; RF: rectus femoris muscle; Lat: lateral; Med: medial. The red arrow points to the injection location.

After nerve blocking, routine general anesthesia was administered. All patients were given pure oxygen, followed by standardized endotracheal general anesthesia using a series of general anesthetics (Midazolam, 2 mg; Propofol, 2 mg/kg; Sufentanil, 0.3 mg/kg; Cis-atracurium, 0.2 mg/kg). Patients were then intubated, given an inhaled anesthetic (Sevoflurane, 1-1.5 MAC) and remifentanil (0.25 ~ 4 μg/(kg·min)) for maintenance of anesthesia. Then sufentanil and cis-atracurium were given intermittently according to the needs of the operation. The non-steroidal anti-inflammatory drug flurbiprofen (50 mg) was administered 20 min before the end of the surgery to prevent postoperative pain, along with tropisetron (5 mg) to prevent postoperative nausea and vomiting. Once patients had regained consciousness and were extubated, they were transferred to the post-anesthesia care unit (PACU).

All patients received a multimodal analgesic regimen, including perioperative oral analgesics (Celecoxib, 200mg, twice daily), postoperative intravenous analgesics (Parecoxib, 40mg, twice daily) and ice pack treatment. Postoperative numeric rating scale (NRS) scores of patients at different time intervals in **Table-2**. If the NRS score was higher than 4 or patients requested analgesia, the morphine hydrochloride (10 mg) was injected subcutaneously.

In the results, the NRS of these patients were lower than 4 at rest or during motion within 24 hours postoperatively, no rescue analgesics were needed, no patients with quadriceps strength weakness, and no patients with postoperative adverse effects, including dizziness, nausea, vomiting, local anesthetic intoxication, venous thrombotic events, urinary retention, postoperative infection, and falls after surgery. The patients recovered well after surgery and was discharged on the 3rd day after surgery.

Table-2: Postoperative Numeric Rating Scale (NRS) Scores of Patients at Different Time Intervals

Case	NRS Scores at Rest				NRS Scores during Movement			
	0	6 h	12 h	24 h	0	6 h	12 h	24 h
case 1	1	1	1	2	1	1	2	3
case 2	1	1	1	2	1	1	3	3
case 3	1	2	2	2	2	2	2	3
case 4	1	1	1	1	1	2	2	2

Discussion

More than half of patients undergoing total hip arthroplasty (THA) suffered moderate to severe pain after surgery, and impacted on early recovery of patients [2]. Regional analgesia techniques such as PNBs are critical components of an optimal multimodal analgesia technique, as they have been shown to improve pain relief, decrease opioid requirements, time to first mobilization, and hospital length of stay. Promising postoperative analgesia results of ultrasound-guided pericapsular nerve group (PENG) block have been demonstrated in THA on previous studies. However, according to the observation our clinical work, THA patients after PENG block usually complained pain at the distal surgical incision location. The previous cadaveric study showed that the anterior capsule of the hip joint is most richly innervated by the obturator, accessory obturator and femoral nerves [3]. The distal incision sensation of THA is mainly innervated by the lateral femoral cutaneous nerve [4]. Therefore, we performed PENG block combined with LFCNB for patients undergoing THA.

In our results, the four cases of effective pain relief after THA using the PENG block combined with LFCNB confirmed our hypothesis. Impressively, all parents are very satisfied with the surgery and postoperative analgesia, and NRS score was lower than 4 at different time intervals and either rest or motion station. In addition, no patients with quadriceps strength weakness was found in patients who ambulated 6 hours after surgery. These remarkable findings suggested that the combination PENG block with LFCNB could provide satisfactory analgesia while maintaining adequate motor capacity.

No patients with quadriceps strength weakness in our present cases, suggesting that the combination blocks are feasible. Similar motor-sparing results were reported in trials using the same dose of 20 mL of 0.5% ropivacaine [5] as we did, or using 20 mL of 0.375% ropivacaine [6], and lower concentration of ropivacaine used in our study, indicating that our results convincing. We suggest that optimizing the use of PENG block for postoperative analgesia of THA patients requires using the maximal effective volume of local anesthetic in 90% (MEV_{90}) of subjects that still avoids motor block.

In summary, we reported four cases of excellent analgesia after PENG block combined with LFCNB for patients undergoing THA. We believe that PENG block combined with LFCNB could improve postoperative pain relief, reduce opioid use and enhance recovery in patients undergoing THA, without weakening the

quadriceps strength. Further studies were needed to verify the efficacy and safety of the combination techniques.

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Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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