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CLINICAL REPORT

Ultrasound guided obturator nerve block: a single interfascial injection technique

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Abstract We describe a new technique of single interfascial injection for 25 patients scheduled for transurethral bladder tumor resection. An ultrasound probe was placed at the midline of inguinal crease and moved medially and caudally to visualize the fascial space between the adductor longus (or pectineus) and adductor brevis muscles. We injected 20 mL 1% lidocaine containing epinephrine into the interfascial space using a transverse plane approach to make an interfascial injection, not an intramuscular swelling pattern. And just distally, firm pressure was applied for 3 min. Afterwards, surgery was performed under spinal anesthesia. The time required for identification and location of the nerve was 20 ± 15 and 30 ± 15 s, respectively. Adductor muscle strength, which was measured with a sphygmomanometer, decreased in all patients, from 122 ± 26 mmHg before blockade to 63 ± 11 mmHg 5 min after blockade. No movement or palpable muscle twitching occurred in 23 cases, slight movement of the thigh not interfering with the surgical procedure was observed in 1 case, thus the obturator reflex was successfully inhibited in 96% of cases. Ultrasound-guided single interfascial injection is an easy and successful technique for obturator nerve block.

Keywords Obturator nerve block · Obturator reflex · Ultrasound technique

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Introduction

The obturator reflex is an inadvertent contraction of medial thigh muscles provoked by direct electrical stimulation of the obturator nerve during transurethral resection of a tumor on the posterolateral bladder. To prevent this reflex, the common obturator nerve or separately all of its divisions should be blocked.

Recently, ultrasound-guided obturator nerve block has been identified [1–4]. Theoretically, the common obturator nerve should be visualized and blocked in close proximity to the exit of the obturator canal to increase the chance of success. However, the deep location of the structures surrounded by thick fascia make visualization of the nerve difficult [3]. Furthermore, the common obturator nerve may bifurcate into divisions in the obturator canal or even more proximal regions where the ultrasound beam cannot penetrate [3]. Otherwise, at some distance from the obturator canal, each division of the obturator nerve must be blocked separately. The posterior one is, however, sometimes invisible [5]. In addition, the anterior and posterior divisions have multiple branching patterns which are widely distributed among the adductor muscles [3], thus leading to unsuccessful blockade despite a complicated procedure. These challenges in ultrasound-guided obturator nerve block led us to develop an easy technique with high success. We hypothesized that the local anesthetic solution injected in the interfascial space containing the anterior division of the obturator nerve might spread up and anesthetize the posterior one also, to blunt the obturator reflex during transurethral bladder tumor resection.

Case report

After having obtained approval from the institutional review board of Chonnam National University Hospital

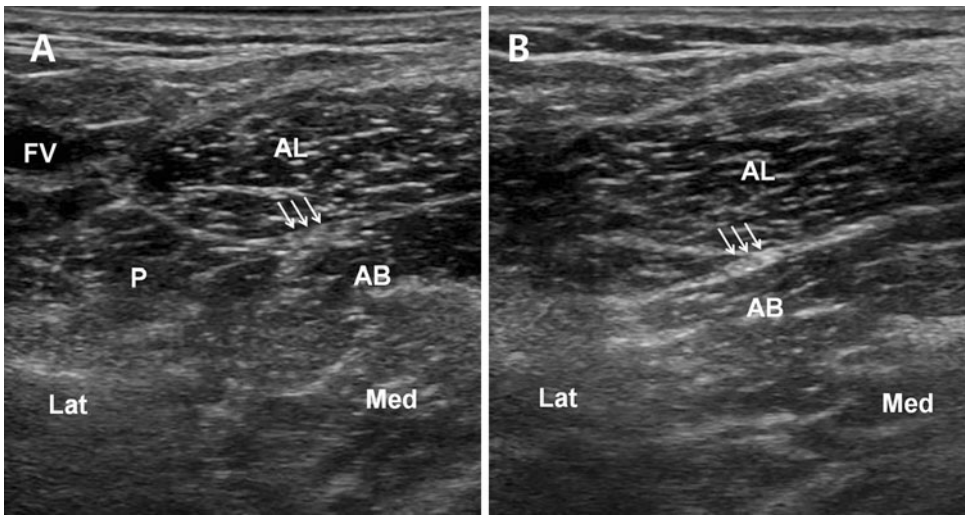

Fig. 1 Ultrasonographic visualization of the fascial planes of adductor muscles and the anterior division of obturator nerve in a patient's right thigh (**a**). If a clear image of the structures was not obtained, the transducer was moved caudally to visualize the nerve in the fascial space between the adductor longus and brevis muscles (**b**). *FV* femoral vein, *P* pectineus muscle, *AL* adductor longus muscle, *AB* adductor brevis muscle, *arrows* anterior division of obturator nerve, *Med* medial side, *Lat* lateral side

and informed consent from each patient, 25 ASA physical status 1–2 patients scheduled for elective transurethral resection of a bladder tumor, cases in which blockade of the obturator nerve was needed to inhibit the obturator reflex, were enrolled. Before the obturator nerve block, patients were asked to compress a blood pressure cuff already inflated to 40 mmHg, between the extended knee, without rotation of the hip joint. The maximum sustained pressure with the contralateral thigh restrained was regarded as their adductor muscle strength [6]. Then the ipsilateral thigh was slightly abducted and externally rotated and was prepared aseptically. The ultrasound probe of 6–13 MHz (Vivid i; GE Healthcare, Milwaukee, WI, USA), which was enclosed in a sterilized sheath, was placed perpendicular to the skin and to the long axis of the thigh at the midline of the inguinal crease. After visualization of femoral vessels, the probe was moved medially and caudally, and the pectineus and adductor muscles were identified. The probe was then moved downward to achieve clear visualization of the anterior division of the obturator nerve in the fascial plane between the pectineus, adductor longus and adductor brevis muscles (Fig. 1a) or more caudally between the adductor longus and adductor brevis muscles (Fig. 1b). At this level, the obturator nerve usually appeared as hypoechoic circles in a hyperechoic thick layer of the muscles. One milliliter of 2% lidocaine was subcutaneously infiltrated to anesthetize the skin of needle entry point 2 cm distal to the center of the ultrasound probe. A short beveled, 50 mm, insulated 22 gauge stimulating needle was inserted at a 30°–45° angle to the skin (Fig. 2) and advanced toward above-mentioned structures, under ultrasound guidance. Confirmation of the nerve was attained by electrical stimulation (B. Braun, Melsungen, Germany), observing the motor responses of the medial upper thigh muscles with a current lower than 0.5 mA. Afterwards, 20 mL 1% lidocaine containing 100 μg

Fig. 2 Probe position, the site and angle of needle puncture. Note that the skin was punctured 2 cm distally to the probe and the needle was angled 30°–45° using a transverse plane approach to facilitate the cranial spread of the injectate

epinephrine was injected through the needle, while monitoring the spreading pattern of the anesthetic solution. The location of the needle tip was slightly adjusted to distribute the anesthetic solution in the interfascial space, to avoid an intramuscular swelling pattern. When approximately 5 mL of the solution was injected, the homogenous hypoechoic distension pattern and separation of the muscles was visualized on the ultrasound monitor (Fig. 3). The needle was then more angled and slightly advanced cranially in the dilated interfascial space to facilitate the cranial spread of the local anesthetic solution. After that, the remaining solution was injected and the needle was removed. Firm pressure was applied just distal to the puncture site for 3 min, also to encourage the cephalad distribution of the anesthetic solution. After measuring the adductor muscle

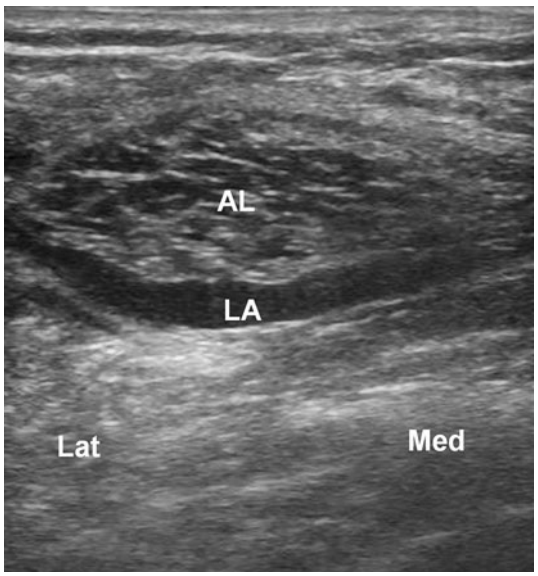

Fig. 3 Ultrasound imaging of the interfascial injection scanning slightly proximal to the needle tip. The location of the needle tip was slightly adjusted to distribute the anesthetic solution in the interfascial space, identified as a homogenous hypoechoic distension pattern and separation of the muscles, not to make an intramuscular swelling pattern. *AL* adductor longus muscle, *LA* injected local anesthetics, *Med* medial side, *Lat* lateral side

Table 1 Demographic data of study patients

Characteristics	Mean ± SD ($n = 25$)
Age (years)	68.5 ± 12.2
Gender ratio (male/female)	24/1
Height (cm)	164.5 ± 7.0
Weight (kg)	66.3 ± 8.6
Duration of surgery (min)	98.5 ± 30.3

strength 5 min post-blockade, surgery was performed under spinal anesthesia. The obturator reflex grade was assessed by the same surgeon in all cases (Gr I no movement or palpable muscle twitching, Gr II palpable muscle twitching without movement, Gr III slight movement of the thigh not interfering with the surgical procedure, Gr IV vigorous movement interfering with the surgical procedure).

The demographic data of the patients are shown in Table 1. The time required for identification of the nerve and from injection of cutaneous local anesthetics to confirmation of the nerve location were 20 ± 15 and 30 ± 15 s, respectively. The number of skin punctures to perform the blockade was 1 in all patients except one who required 2 skin punctures. Adductor muscle strength decreased in all patients, from 122 ± 26 mmHg before blockade to 63 ± 11 mmHg 5 min after blockade. Obturator reflex was successfully inhibited in 24 of 25 patients (96%); the reflex grade was I in all but one case of grade III. In one case, the obturator reflex grade was IV and general anesthesia was performed to conduct the surgery without adverse events. There was no paresthesia, no signs of vascular puncture, nor systemic toxicity.

Discussion

The key finding in this observational study of the obturator nerve block is that we utilized a single-injection interfascial technique facilitating cranial spread of the anesthetic solution, after identifying only the anterior division of the nerve at a distance from the pelvic bone, using a high frequency ultrasound probe.

The obturator nerve reaches the adductor muscles by piercing the medial border of the psoas and passing straight along the sidewall of the pelvis to the obturator foramen [7]. During this course it divides into anterior and posterior divisions, and further caudad, these are multiply branched to innervate the medial thigh muscles. The anterior division is initially located between the pectineus and adductor brevis muscle and courses more caudally through the fascial plane between the adductor longus and adductor brevis muscle. The posterior one is located more deeply between the adductor brevis and adductor magnus muscle [3, 4]. In this study, we did not try to locate the transducer and needle cranially toward the pubic bone or to block the divisions separately. Instead, we encouraged the cranial spread of the injectate toward the interfascial space where the common obturator nerve or its main branches are located, after identification of only the anterior division of the obturator nerve and then assessing the fascial plane containing the nerve. The cranial spread was facilitated by adjustment of the needle position to make an interfascial injection guided by sonographic visualization of the homogenous hypoechoic distension pattern and separation of the muscles, rather than an intramuscular swelling pattern. Spread was further encouraged by application of firm pressure just distal to the puncture site. In the one case of block failure in this study, we failed to achieve an interfascial distension pattern on ultrasound monitoring, and we assumed that the injectate could not spread up to anesthetize the posterior division.

This technique has some advantages over the other cranial or separated two-injection methods. First, only the anterior division, with a reported visibility rate of 100% [5], needs to be identified and a single injection was enough to achieve successful blockade in 96% of cases, possibly reducing performance time and patient discomfort. Second, because of its superficial location [8], the high-frequency probe rather than the low frequency one could be utilized to improve the resolution of the image at the expense of lower penetration [9]. Finally, because the

obturator artery and medial femoral circumflex artery and veins may be in close proximity to this level of blockade [4] and vascular punctures are frequent despite the sonographic visualization [10], puncturing at a distance from the pelvis may minimize the risk of complications and enable compression in the event of a hematoma, as previously described by Choquet et al. [11].

We evaluated the clinical applicability of a new technique. The limitation of this study was the lack of a control group of other techniques. Therefore, this technique warrants further study with a larger number of subjects and with a control group. In addition, the volume of local anesthetic of this technique was chosen arbitrarily. Thus, the minimum amount of local anesthetic required for successful blockade should be determined in the future study.

In conclusion, this observational study suggests that a single injection through the interfascial space containing the anterior division of the obturator nerve is an easy and successful technique for ultrasound guided obturator nerve block.

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