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Research article

Anatomical investigation of a new vertical obturator nerve block technique

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ABSTRACT

Background: We evaluated a vertical obturator nerve block (VOB) using a single morphological landmark and no additional distance measurement or obligatory changes of the needle's direction.
Materials and method: A total of 88 cadavers (176 lower limbs), prepared using Thiel's embalming method, were examined. The index finger was placed lateral to the palpable pubic tubercle and the needle inserted laterally to the distal part of the fingernail at the tubercle's level and advanced strictly perpendicular to the table's surface. If bone contact was made, the needle was slightly turned to pass the bone distally. Colored latex (5 ml) was then injected. The injection depth was documented, then followed by dissection and nerve exposition. The real skin–nerve distance and the degree of difficulty in orientation and of palpation were measured. Additionally, the dissemination around the nerve or its branches and the intrapelvic spread were documented.
Results: The nerve was colored completely in 93.75%, partially in 1.71%, and not colored in 4.54% of cases. The mean injection depth was 3.9 cm (±0.7 SD) and real nerve depth was 3.8 cm (±0.69 SD). Bone contact necessitating the needle's redirection was found in 20 (11.4%) cases. Easy orientation and palpation of the tubercle was always found. In 40 cases, the latex spread via the obturator canal into the lesser pelvis.
Conclusion: In this anatomical study, the VOB technique exhibits easy orientation without stimulation or ultrasound guidance. The nerve was located at a constant depth. The injection offered a high percentage of colored nerves.

1. Introduction

Many different nerve blocks exist, for all nerves of the lower limb. Extensive interest and research has been put especially into the development and modification of the techniques for the sciatic and femoral nerve, however, little interest has been paid to the obturator nerve. However, there are some indications for an obturator nerve block such as in the therapeutic and diagnostic procedures on the knee (Büttner, 2007), diagnostic and therapeutic purpose of pain syndromes of the hip (Hong et al., 1996), spasticity of adductor muscles (Vloka and Hadzic, 1999), and transurethral resection of parts of the bladder wall (Augspurger and Donohue, 1980). At the knee, the variable innervation of the medial skin area, the periosteum of the distal femur, and of the joint capsule can make an obturator nerve block necessary (Lang and Wachsmuth, 2004). Existing techniques include either two landmarks or, in case of a single landmark, a binding needle turn with a success rate of only approximately 82% (Choquet et al., 2005). However, as some landmarks, arterial pulses, or needle turns with recommended angles represent variables, the needle might be displaced with a consecutively inefficient block. With the upcoming use of ultrasound, Soong et al. (2007) suggested ultrasound as useful in blocking the obturator nerve, soon to be confirmed by Fujiwara et al. (2007) or Sinha et al. (2009). Sinha et al. (2009) mentioned a success rate of approximately 93%. Nevertheless, the use of electrostimulation-guided approaches remains the most commonly used. Therefore, we would like to present the morphological assessment of a vertical obturator nerve block (VOB) which orients on a single anatomical landmark without any additional measurements or obligatory needle turns and is as successful as ultrasound guided block techniques.

2. Materials and method

A total of 88 cadavers (76.3 years; ±12.2; 37 females and 51 males), representing 176 lower limbs, were investigated during two consecutive dissection courses for advanced medical students (first course in January 2009: 50 cadavers; second course in January 2010: 38 cadavers). All cadavers were preserved using Thiel's method (Thiel, 2002), according to the donation program of the

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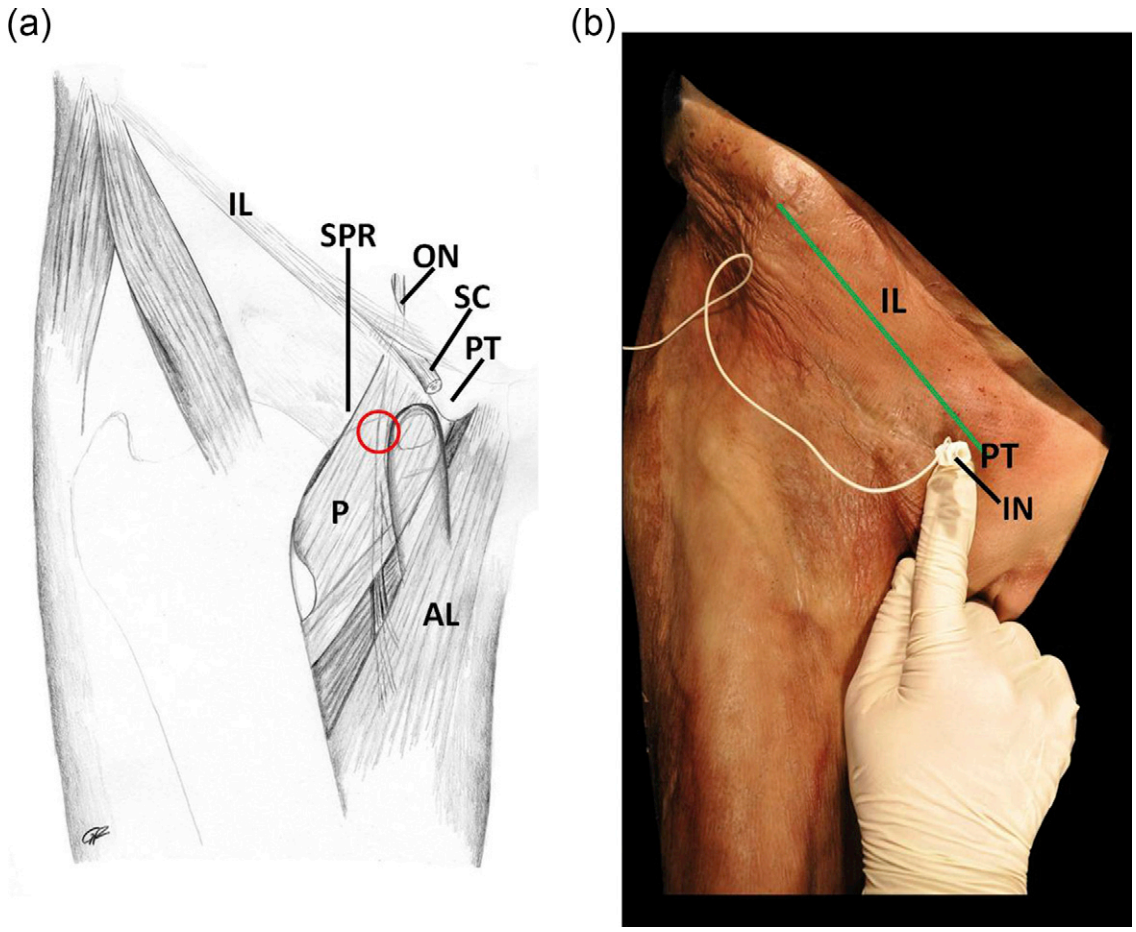

Fig. 1. (a) Drawing of the anterior femoral region with an anatomical overview: the inguinal ligament (IL) inserts at the pubic tubercle (PT). The finger is placed with its tip directly lateral to the PT. The needle is inserted in the circle's area. Advancing the needle strictly vertical to the table surface, it will pass the pectineus muscle (P) to reach the trunk of the obturator nerve (ON). AL adductor longus, SC spermatic cord, and SPR superior pubic ramus. (b) Overview of the surface anatomy showing the marked inguinal ligament (IL), the pubic tubercle (PT) and the position of the finger tip adjacent and lateral to the PT. The injection needle shows the recommended direction.

Institute of Anatomy and under approval of the Medical University of Graz. Thiel's method provides flexible cadavers and the tissue behavior is almost the same as that in the living, especially for the purposes of regional anesthesia (Feigl et al., 2006, 2007a) or investigating the spread of contrast (Umfahrer et al., 2002; Feigl et al., 2007b). The landmark determined was the pubic tubercle (Fig. 1a and b) which was palpated with the cadaver lying in a supine position and straight legs. Approaching distally, the index finger tip was placed laterally to the palpable tubercle, in male cadavers pushing the spermatic cord medially to the fingertip. The width of the investigator's index (1.5 cm) was measured before performance of the block. An Uniplex needle UP 3/80 with facet-tip (Pajunk, Geisingen, Germany) was inserted and advanced directly laterally and adjacent to the distal part of the fingernail strictly perpendicular to the table surface (Fig. 1a and b) which corresponds to the transverse plane. The depth of the needle tip position was estimated to be between 2.5 and 6 cm depending on the cadaver's size and according to measurements described by Locher et al. (2008). The needle was inserted 2.5–3.5 cm on cadavers up to 60 kg, from 60 to 80 kg we inserted the needle between 3.5 and 4.5 cm and on patients over 80 kg the needle was advanced to a maximal depth of 6 cm. In the case of bone contact, the needle depth was documented. The needle was pulled back a short distance, the peak of the needle tilted slightly distally and re-advanced till the superior pubic ramus was passed (Fig. 2). The needle tip was inserted 1 cm deeper than the distance to where the bone was encountered. The individual needle tip position, or the skin needle tip distance, was documented and 5 ml of colored latex was injected. Therefore this distance was documented as the "injection depth" (ID) distance. Injection was performed two days prior to the determined day of dissection. This was to ensure that the injected latex will be hardened and there would be no falsifying spread of latex during the investigation. Dissection was performed with a skin incision at the needle insertion point. Lateral to this incision all tissue layers such as skin, subcutaneous fat pad, fascias and muscles were carefully removed. Medial to the incision the layers remained intact to measure the real "skin–nerve-distance" (S–N-D) with a calliper. Each limb's individual measured "injection depth" was compared to the documented "skin–nerve-distance". Additionally, the latex spread around the obturator's trunk or its branches was documented as well as an additional intrapelvic distribution through the obturator canal. An entire distribution around the nerve trunk with a thickness of at least 1 cm was determined as a supposedly successful block.

3. Statistical analysis

SPSS 14 (SPSS Inc., Chicago, IL, USA) was used for descriptive statistical analysis and correlation of Pearson concerning correlation of BMI to the nerve depth. A $p < 0.05$ was considered significant.

4. Results

The injection of colored latex showed a distribution completely surrounding the trunk of the obturator nerve in 165 cases (93.75%; Fig. 3; Table 1). Partial coloration, spread around the anterior branch