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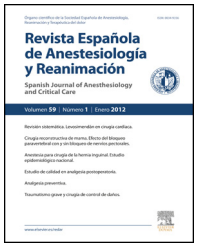

ORIGINAL

Incidence of intraneural needle insertion in ultrasound-guided femoral nerve block: A comparison between the out-of-plane versus the in-plane approaches

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KEYWORDS
Femoral nerve blockade;
Nerve puncture;
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Abstract
Background: The optimal method of ultrasound-guided femoral nerve block (in-plane vs. out-of-plane) has not been established. We tested the hypothesis that the incidence of needle-nerve contact may be higher with out-of-plane than with in-plane needle insertion.
Methods: Forty-four patients with hip fracture (American Society of Anaesthesiologists physical status I–III) were randomized to receive the femoral block with an out-of-plane approach (needle inserted at a 45–60° angle 1 cm caudal to the midpoint of the ultrasound probe just above the femoral nerve) or with an in-plane technique (needle inserted 0.2–0.4 cm from the side of the probe lateral to the femoral nerve). Data collected included depth of needle insertion, response to nerve electric stimulation, and distribution of the injected volume in relation to the nerve (anterior vs. posterior, the latter assuming needle-nerve contact). The sensory block onset was tested at 20 min and block recovery and any neurologic symptoms were evaluated at 24 h.
Results: The incidence of needle-nerve contact was significantly higher with the out-of-plane approach (14/22 patients [64%]) than with the in-plane approach (2/22 patients [9%]) ($p < 0.001$) (OR = 17.5, 95% CI: 4–79). The rate of paraesthesia on crossing the fascia iliaca was similar in the two groups. All blocks uneventfully regressed; and no patient developed neurologic symptoms.
Conclusions: Under the conditions of our study, needle-nerve contact during femoral nerve block occurs frequently with the out-of-plane approach. An in-plane approach results in an equally effective femoral block and less incidence of needle-nerve contact.

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PALABRAS CLAVE
Bloqueo del nervio femoral;
Punción nerviosa;
Guiado por ecografía

Incidencia de inserción intraneural en bloqueo femoral guiado por ecografía: comparación entre los enfoques en plano y fuera de plano

Resumen
Antecedentes: No ha quedado establecido un método adecuado para el bloqueo femoral guiado por ecografía (en plano frente a fuera de plano). Probamos la hipótesis de que la incidencia del contacto entre la aguja y un nervio puede ser mayor en la inserción fuera de plano que en el abordaje en plano.
Métodos: Cuarenta y cuatro pacientes con fractura de cadera (estadio I-III según la Sociedad Americana de Anestesiólogos) recibieron de manera aleatorizada un bloqueo femoral con un enfoque fuera de plano (inserción de la aguja en ángulo de 45-60° y 1 cm caudal a la sonda de ecografía sobre el nervio femoral) o con una técnica en plano (inserción de la aguja 0,2-0,4 cm desde el lado de la sonda lateral al nervio femoral). Entre los datos recopilados se incluían la profundidad de inserción de la aguja, la reacción a la estimulación nerviosa y la distribución del volumen inyectado en función del nervio (anterior comparado con posterior, este último con contacto entre la aguja y un nervio). Se analizó el inicio del bloqueo a los 20 min y se evaluaron la recuperación del bloqueo y los síntomas neurológicos después de 24 h.
Resultados: La incidencia del contacto entre la aguja y los nervios fue significativamente mayor con el enfoque fuera de plano (14/22 pacientes [64%]) que con el abordaje en plano (2/22 pacientes [9%]) ($p < 0,001$) (OR = 17,5 [95%]; IC: 4-79). El grado de parestesia en aponeurosis fue similar en ambos grupos. Se revirtieron todos los bloqueos sin incidentes; ningún paciente desarrolló síntomas neurológicos.
Conclusiones: En las condiciones de nuestro estudio, el contacto entre la aguja y un nervio durante el bloqueo femoral sucede a menudo con el enfoque fuera de plano. Un abordaje en plano tiene como resultado un bloqueo femoral igualmente efectivo, y una incidencia menor del contacto entre la aguja y un nervio.

Introduction

The femoral nerve block is widely used for regional anesthesia because it is simple and highly effective.[1,2] The femoral nerve is separated from the femoral artery by the fibrous aponeurotic union of the fascia iliaca and the fascia lata, an elastic structure which presents resistance to needle passage.[1,2] However, once the needle crosses the fascial layers, the loss of resistance and consequent further advancement may result in needle-nerve contact or impalement of the femoral nerve.[3,4]

We hypothesized that the incidence of needle-nerve contact is higher with the out-of-plane approach (insertion needle into the fascia at the midpoint over the femoral nerve) than with the in-plane approach (insertion needle lateral to the femoral nerve). Incidence of needle-nerve contact during femoral nerve block was compared between the two approaches in patients undergoing hip replacement surgery.

Patients and methods

American Society of Anaesthesiologists (ASA) physical status I to III patients with a diagnosis of trochanteric or cervical hip fracture and referred for hip replacement under spinal anesthesia were enrolled. Patients under the age of 65 years or over the age of 90 years were excluded. The study was approved by the ethics committee of the Hospital Clínic de Barcelona (ref: R-6345) and registered at www.clinicaltrial.gov identifier NCT01554722. All patients gave their written informed consent to participate in the study.

Prior to seating the patients for spinal puncture, an ultrasound-guided femoral nerve block (SonoSite Turbo Ultrasound machine; SonoSite, Bothell, WA, USA) was performed by means of a multifrequency probe (6–12 MHz). A short-axis view of the femoral nerve in the center of the screen just distal to the inguinal ligament was obtained. Femoral nerve depth (distance from skin to nerve) was measured. Patients were randomly assigned to either the out-of-plane ($n = 22$) or the in-plane ($n = 22$) approach by means of sealed envelopes. In the out-of-plane group, the needle was inserted 1 cm caudad to the midpoint of the ultrasound probe just over the femoral nerve, at an angle between 45° and 60°, according to nerve depth; the needle was advanced until it was seen and felt to cross the iliac fascia iliaca. In the in-plane group, the needle was inserted 0.2–0.4 cm from the external side of the probe and advanced through the tissues to a position lateral to the femoral nerve, then advanced through the fascia iliaca.

After the needle crossed the fascia iliaca, a nerve stimulator (Stimuplex NHS, B. Braun, Melgunsen, Germany) was set to a frequency of 2 Hz to deliver a stimulus of 0.1 ms. The intensity was gradually increased until 1 mA or until a motor response (sartorius or quadriceps muscle contraction with evident movement of the vastus medialis, vastus lateralis or rectus femoris) was observed. One milliliter of