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Ultrasound guided supraclavicular perivascular block. Anatomical, technical medial approach description and changes in regional perfusion☆

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ABSTRACT

Introduction: Supraclavicular block is usually performed using a lateral to medial approach, although a medial to lateral approach is also feasible. Block onset may be evaluated through the sympathetic effect associated with the sensitive and motor blockade.
Objective: To describe the ultrasound-guided supraclavicular block using a medial approach, evaluating the sensitive, motor, and sympathetic block onset.
Materials and methods: An ultrasound-guided supraclavicular block was performed in a fresh cadaver with 20 ml volume (2 ml of iodine and 1 ml of methylene blue). A CT scan was performed and sagittal sections were obtained. The clinical phase included 10 patients undergoing a medial approach block; the onset of the block was evaluated based on a motor, sensory and sympathetic assessment (measuring flow changes in the humeral artery, the palmar temperature, and the perfusion index).
Results: Adequate distribution of the contrast medium was observed in the cadaver, with complete spread through the brachial plexus, both in terms of the CT-reconstruction as in the anatomical cross sections. A significant change in all the sympathetic block parameters was observed 5 min after the bock: temperature (32.5 ± 1.8 °C to 33.4 ± 1.7 °C; $p = 0.047$), humeral arterial flow (105 ± 70 ml/min to 192 ± 97 ml/min; $p = 0.007$), and thumb perfusion index (5 ± 3 to 10 ± 3%; $p = 0.002$). The block was effective and uneventful in all patients.
Conclusions: This supraclavicular approach achieves a homogeneous distribution throughout the brachial plexus, with high anesthetic efficacy. Regional changes secondary to the sympathetic block occur early after the block.

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Bloqueo supraclavicular ecoguiado por abordaje perivascular medial. Descripción anatómica, técnica de bloqueo y cambios de perfusión regionales

Palabras clave:
Bloqueo nervioso
Temperatura corporal
Bloqueo nervioso simpático
Plexo braquial
Ultrasonido

RESUMEN

Introducción: El bloqueo supraclavicular habitualmente se realiza mediante abordaje lateral a medial, si bien puede realizarse de medial a lateral y su instauración puede evaluarse por el efecto simpático asociado al bloqueo sensitivo y motor.

Objetivo: Describir el bloqueo supraclavicular ecoguiado por abordaje medial evaluando la instauración del bloqueo sensitivo, motor y simpático.

Materiales y métodos: Se realizó el bloqueo supraclavicular ecoguiado en cadáver fresco con 20 ml de volumen (con 2 ml de yodo y 1 ml de azul de metileno). Se realizó una tomografía computarizada y posteriormente cortes anatómicos sagitales. En la fase clínica se incluyeron diez pacientes a quienes se les realizó el bloqueo y posteriormente se evaluó la instauración del bloqueo con valoración sensitiva, motora y simpática (cambios en flujo arterial humeral, temperatura palmar y el índice de perfusión).

Resultados: En el cadáver se evidenció una adecuada distribución del medio de contraste bañando la totalidad del plexo braquial, tanto en la reconstrucción tomográfica como en los cortes seccionales anatómicos. A los 5 minutos del bloqueo se observó un cambio significativo de todos los parámetros de bloqueo simpático: temperatura ($32,5 \pm 1,8\,^{\circ}C$ a $33,4 \pm 1,7\,^{\circ}C$; $p = 0,047$), flujo arterial humeral (105 ± 70 ml/min a 192 ± 97 ml/min; $p = 0,007$) e índice de perfusión del pulgar (5 ± 3 a $10 \pm 3\%$; $p = 0,002$). El bloqueo fue efectivo en todos los pacientes y sin complicaciones.

Conclusiones: El abordaje supraclavicular propuesto logra una correcta distribución en el plexo braquial con elevada eficacia anestésica. Los cambios regionales secundarios al bloqueo simpático son precoces tras el bloqueo.

Introduction

The supraclavicular access of the brachial plexus (BP) is an option for upper extremity surgical procedures.[1–5] Initially, supraclavicular block (SCB) was widely popularized by Kulenkampff[5] as a result of its high effectiveness since all the trunks of the plexus are closely bundled above the first rib and behind the pulse of the subclavian artery. Multiple supraclavicular (SC) approaches to the brachial plexus (BP) were described during the era of neurostimulation, based on the cutaneous point of entry and the direction of the needle.[5–8] The perivascular technique described by Winnie relied on the idea of the neurovascular sheath to account for the clinical behavior and the efficacy of the block through a single point injection of the anesthetic agent, allowing for a distribution among the trunks and the divisions of the plexus.[6] However, the high incidence of complications and side effects (arterial puncture, dysphonia secondary to recurrent laryngeal nerve block, hemi diaphragmatic paralysis due to ipsilateral phrenic nerve block, Horner's syndrome, pneumothorax as a result of accidental pleural puncture, and peripheral nerve injury neuropathy) led to the discontinuation of the technique.[9]

The SC approaches were reintroduced after the advent of ultrasound because of a significantly improved safety from visualizing the potentially vulnerable anatomical structures.[9–15] The visualization through the short axis of the supraclavicular plexus is achieved using a lineal probe and using an in-plane approach the needle may be directed from lateral to medial (external to internal) until it reaches the lower trunk "corner pocket". However, a medial to lateral (internal to external) approach is also feasible. Whilst this latter approach has been reported, the references about the description of the technique and final needle position are limited.[9,12,14]

Traditionally, the onset of regional blocks is determined through clinical parameters that evaluate the patient in response to a sensitive stimulus (cold or piercing) and the muscle contraction capacity (motor).[4,9–11] When blocking the sympathetic nerve fibers, vasodilatation and increased blood flow of the blocked extremity follows. These regional hemodynamic alterations can be measured non-invasively via the skin temperature (T°), the perfusion index (PI), and the humeral arterial flow (HAF).[16–19] These changes have not yet been reported with respect to the SCB.

The purpose of this trial was to present an anatomical description of the ultrasound-guided supraclavicular block using a medial approach (MSCB) in a cadaver, evaluating its clinical evolution through a sensitive, motor, and sympathetic regional evaluation in an initial group of patients.

Methodology

Phase one: anatomical

Upon approval by the appropriate Ethics and Scientific Committee (ESC), ultrasound-guided MSCB was performed on a