Case report

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Ultrasound identification of axillary artery anomaly during axillary brachial plexus block: a case report

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Abstract

Significant inter-individual variations exist in the vascular and neural anatomy of the human axilla. Ultrasound guidance allows the detection of such variation, and facilitates the alteration of regional anesthetic technique accordingly. We describe a case of ultrasound-guided axillary brachial plexus block, in a patient with a duplex axillary arterial system. Ultrasound detection of this arterial anomaly permitted safe and successful axillary block, under real-time ultrasound guidance. Variations in the anatomy of the axillary artery and clinical implications of the use of ultrasound guidance are discussed.

Key words: double axillary artery, regional anaesthesia, ultrasonography

Rezumat

Anatomia nervoasă şi vasculară a axilei este marcată de variaţii interindividuale semnificative. Examenul ecografic permite detectarea acestor variaţii şi facilitează adaptarea tehnicilor anestezice regionale în funcţie de constatări. Prezentăm cazul unei paciente cu arteră axilară dublă la care s-a practicat blocul anestezic al plexului brahial utilizând ghidajul ecografic. Detectarea ecografică a anomaliei arteriale a permis efectuarea cu succes şi în condiţii de siguranţă a blocului axilar sub ghidaj ecografic. Sunt discutate variaţiile în anatomia arterei axilare şi implicaţiile clinice ale ghidării ecografice.

Cuvinte cheie: arteră axilară dublă, anestezie regională, ecografia

Introduction

Successful neural blockade requires deposition of local anesthetic solution adjacent to target nerve(s). Traditional axillary brachial plexus block techniques utilise a transarterial approach, nerve stimulation or paresthesia to locate nerves in the axilla. Such approaches assume anatomical uniformity with consistently reliable relations and landmarks.

Anatomical variability, of both vascular and neural structures in the axilla, is common. Variation in the position of the radial, median and ulnar nerves relative to the axillary artery has been described [1]. The arterial vasculature within the axilla similarly exhibits significant inter-individual variation [2], yet this has received little attention in the literature. As the brachial plexus lies in intimate relation to the axillary artery, alterations in the arterial anatomy will influence the location, orientation and relation of neural structures.

We describe a case that illustrates the valuable contribution of ultrasound guidance to the successful perform-

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Fig 1. MCN, Musculocutaneous Nerve; N, Nerve fibres of Median, Ulnar and Radial Nerves; A, Arterial Vessels with Colorflow Doppler; V, Axillary Vein.

ance of axillary brachial plexus anesthesia, in a patient with an axillary artery anomaly.

Case Report

A 47-year-old lady presented for removal of an external fixator device from her distal radius. Four weeks earlier, she had undergone surgical correction of a complex distal radial fracture under general anaesthesia. Prior to induction of general anaesthesia, a nerve stimulator guided axillary brachial plexus block was performed to provide post-operative analgesia. Following emergence from anaesthesia the patient complained of pain in the radial distribution of her wrist. Pain was experienced despite the presence of a radial motor block, with motor and sensory block in the distribution of median, ulnar and musculocutaneous nerves. Her pain was managed with intravenous morphine, diclofenac and paracetamol and she made a complete recovery.

On presentation for removal of the external fixator, an axillary brachial plexus block under ultrasound guidance was discussed. It was agreed to proceed with the option of regional anaesthesia and the patient was placed supine on the operating table with her arm abducted and elbow flexed to 90^0. The axilla was prepared in an aseptic fashion and the ultrasound probe was covered with a transparent adhesive cover. Ultrasound examination of the axillary anatomy with a SonoSite Titan unit (SonoSite®, Bothwell, WA, USA) revealed a duplex arterial system (fig 1). Two axillary arteries were evident, one lying deep to the other, with one large axillary vein. Neural structures were visualised lying between the arteries and the vein, in a vertical orientation.

Using a short axis approach with needle out of plane, a Stimuplex A 50 mm Needle (Stimuplex®, BBran, Melsungen, Germany) was directed under real-time guidance to lie adjacent to each of the identified neural structures. Local anaesthetic (2% lidocaine with 1:200,000 adrenaline) was injected and observed to surround all identified peri-arterial neural structures. The musculocutaneous nerve was identified in the coracobrachialis muscle and was blocked separately. A total of 20 millilitres of local anaesthetic was injected.

Sensory and motor testing of the blocked limb approximately five minutes later revealed complete motor and sensory blockade in the territories of the radial, median, ulnar and musculocutaneous nerves. Surgery proceeded uneventfully without supplemental sedation or analgesia.

Discussion

Variation in the axillary vasculature has been described in the anatomy literature. Anomalies such as double axillary artery [3], dominant superficial brachial artery [4] , absent brachial artery [5] and a thoracodorsosubscapular trunk [6] have been reported. The prevalence of axillary artery variations in the general population is not known, but is estimated to be between 5% and 18% [2,5]. It is thought that axillary artery variability results from abnormal embryonic development of the limb bud vascular plexuses. This produces arterial systems that are derived from the persistence of more than one cervical intersegmental artery [5].

Successful axillary block necessitates the deposition of local anesthetic solution around median, ulnar, radial and musculocutaneous nerves. Ultrasound guidance permits the visualisation of these structures and their relations permitting the anesthesiologist to place block needles precisely adjacent to the target nerves. Vascular relations may be avoided. Importantly, anatomical variation may be appreciated and adjustments made to technique and needle approach to provide individualised anesthesia.

Bigeleisen [7] describes a case of bifid axillary artery in a patient presenting for arteriovenous fistula formation under axillary block. In this case a diffuse pulse palpated in the axilla prompted the author to request an ultrasound evaluation by his surgical colleague. Subsequent identification of a bifid axillary artery resulted in an interscalene approach being chosen. In the case we describe, the initial axillary block was performed using a multi-injection nerve stimulator technique. Despite adequate stimulation of radial, median, ulnar and musculocutaneous nerves as manifest by appropriate mo-

tor response at 0.5mA current, sensory blockade in the distribution of the radial nerve was not achieved. Success rates vary between single, double and multi-injection techniques. Multiple injection techniques have the highest quoted success rates [8]. A recent study suggests equivalence between ultrasound and nerve stimulation in the hands of experienced practitioners [9]. This study was, however, underpowered to conclusively demonstrate a difference in success rates between ultrasound and nerve stimulation.

In our case, identification of the arterial anomaly allowed identification of the relevant neural structures and permitted the performance of a successful axillary brachial plexus block. Direct visualisation of neural structures with ultrasound may allow the detection of anatomical abnormality and prevent the phenomenon of block failure. We believe this to be the first report of successful ultrasound-guided axillary brachial plexus block, in the presence of a duplex arterial system in the axilla.

In conclusion variations in both vascular and neural anatomy are common with respect to the brachial plexus in the axilla. Ultrasound facilitates the identification of anatomical variation, allowing the clinician to adjust technique during axillary brachial plexus block, to provide safe, effective, individualised anesthesia.

References

1. Retzl G, Kapral S, Greher M, Mauritz W. Ultrasonographic findings of the axillary part of the brachial plexus. Reg Anesth Pain Med 2001;92:1271-1275.
2. Begman RA, Thompson SA, Afifi AK, Saadeh FA. Compendium of Human Anatomic Variation. Baltimore: Urban & Schwarzenberg, 1988:72-74.
3. Jurjus AR, Correa-de-Aruauju, Bohn RC. Bilateral double axillary artery: Embryological basis and clinical implications. Clinical Anatomy 1999;12:135-140.
4. Cadver A, Zeybek A, Bayramicli M. Rare variation of the axillary artery. Clinical Anatomy 2000;13:66-68.
5. Ciervo A, Kahn M, Pangilinan AJ, Dardik H. Absence of the brachial artery: Report of a rare human variation and review of upper extremity arterial anomalies. J Vasc Surg 2001;33:191-194.
6. Lengele B, Dhem A. Unusual variations of the vasculonervous elements of the human axilla. Report of three cases. Arch Anat Histol Embryol. 1989;72:57-67.
7. Bigeleisen PE. The bifid axillary artery. J Clin Anesth 2004;16:224-225.
8. Handoll HH, Koscielniak-Nielsen ZJ. Single, double or multiple injection techniques for axillary brachial plexus block for hand wrist or forearm surgery. Cochrane Database Syst Rev. 2006;(1):CD003842.
9. Casati A, Danelli G, Baciarello M et al. A prospective randomised comparison between ultrasound and nerve stimulation guidance for multiple injection axillary brachial plexus block. Anesthesiology 2007;106:992-996.