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CLINICAL REPORT

Failure of supraclavicular block under ultrasound guidance: clinical relevance of anatomical variation of cervical vessels

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Abstract We describe a case with partial analgesia after ultrasound-guided supraclavicular block for elbow surgery. The failure of the block was caused by the limited spread of local anesthetic because of blockage by a vessel (either transverse cervical artery or dorsal scapular artery) running through the brachial plexus. Anesthesiologists should be aware that cervical anatomy is complex and has anatomical variations. Thus, careful ultrasound screening of anatomical structure, especially using color Doppler, is important in performing brachial plexus block.

Keywords Peripheral nerve block · Supraclavicular brachial plexus block · Ultrasound guided

Introduction

Supraclavicular brachial plexus block is an excellent anesthetic technique for upper extremity surgery. Because of recent improvements in ultrasound technology, ultrasound-guided placement of nerve blocks has gained popularity. Multiple papers have reported that ultrasound-guided supraclavicular blocks have a high success rate (78–97%) for surgical anesthesia/analgesia [1–4].

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We discuss a case with atypical sonographic nerve and vascular structures seen while performing an ultrasound-guided supraclavicular block. The local anesthetic spread was limited by a vessel passing through the brachial plexus, which resulted in incomplete analgesia for elbow surgery. The vessel was understood to be the transverse cervical artery or the dorsal scapular artery.

Case report

The patient was a 48-year-old man scheduled for right elbow arthroscopy and epicondylectomy with tendon repair. In the preoperative area, an ultrasound transducer (12L-RS probe of a GE Logiq E; GE Healthcare, Wauwatosa, WI, USA) was placed in the posterior triangle of the neck just above the clavicle with a coronal oblique orientation. The brachial plexus was identified immediately lateral to the subclavian artery and above the first rib. We noticed that a vessel arising from the subclavian artery was running through the brachial plexus divisions (Fig. 1). Arterial flow was confirmed using color Doppler (Fig. 2). The vessel measured 0.17 cm in diameter. The brachial plexus was accessed using an in-plane approach. A 22-gauge 50-mm echogenic needle (Pajunk, Geisingen, Germany) was directed in a lateral to medial direction with the needle tip visualized throughout the procedure. After negative aspiration, 25 ml 0.5% ropivacaine was injected incrementally. Ultrasound imaging showed the limited spread of local anesthetic to the area surrounding the upper division. We were not able to inject local anesthetic to the lower division of the plexus from concern about piercing the artery to reach the lower division. On subsequent neurological examination, the patient developed motor block of his deltoid, and sensory block of the arm in the

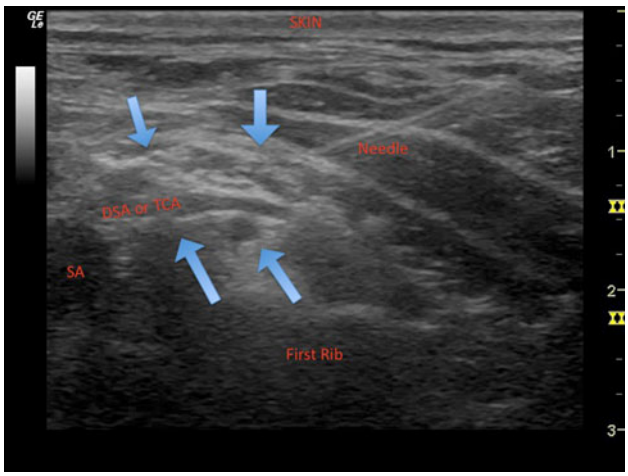

Fig. 1 Ultrasound image of right supraclavicular region and trajectory of block needle. A vessel arising from subclavian artery runs through brachial plexus. *Arrows* indicate brachial plexus. *DSA* dorsal scapular artery, *SA* subclavian artery, *TCA* transverse cervical artery

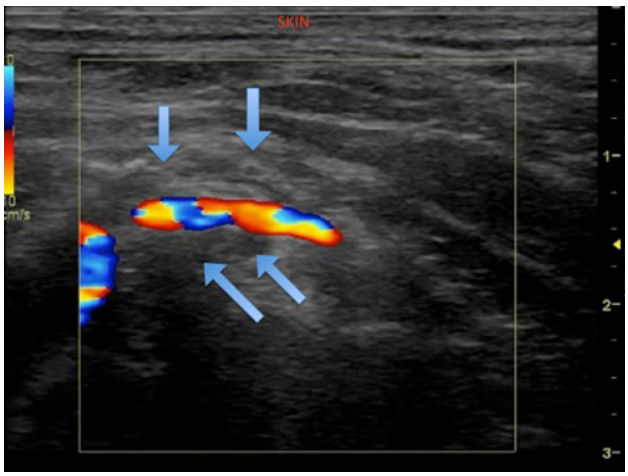

Fig. 2 Ultrasound image of right supraclavicular region with color Doppler. *Arrows* indicate brachial plexus

radial and median nerve distribution, but not in the ulnar distribution. The patient reported tingling and numbness of the thumb; he was able to move his fingers. Subsequently, the patient underwent surgery under general anesthesia with a laryngeal mask airway without incident. In the recovery room, the patient reported moderate incisional pain. The option of repeating a brachial plexus block via an axillary approach, as an alternative to a supraclavicular block, was discussed with the patient. The patient chose conservative pain management over a nerve block. After pain was controlled with intravenous opioids (125 μg fentanyl and 0.6 mg hydromorphone) and an intravenous nonsteroidal antiinflammatory drug (30 mg ketorolac), the patient was discharged to his home.

Discussion

To date, only a few cases have been reported similar to our case. Abrahams et al. [5] reported an "anomalous vessel" arising from the subclavian artery that limited the spread of local anesthetic during an ultrasound-guided interscalene block. However, Abrahams et al. [5] simply stated the responsible vessel as "anomalous" and did not specify the name. Sites et al. [6] described a case with unintentional puncture of the vessel during ultrasound-guided supraclavicular block, which resulted in a hematoma in the neck, requiring compression. The vessel in our case report was understood to be the transverse cervical artery (TCA) or dorsal scapular artery (DSA). The authors think that differentiation between the TCA and DSA is difficult without direct exploration. Chen et al. [7] reported that the TCA arose from the thyrocervical trunk (54.2% of cases) or the subclavian artery (45.8% of cases); the TCA ranged in diameter from 0.15 to 0.24 cm. The TCA crosses in front of the phrenic nerve and scalene muscles, and in front of or between the divisions of the brachial plexus. Aggarwal et al. [8] reported an anatomical variant in a cadaver study in which the brachial plexus had only two trunks and two cords. In this patient, the TCA was found to arise from the subclavian artery and then course between the two trunks. This variant is in contrast to the usual course of the TCA, where after arising from the subclavian artery, the TCA passes lateral and superficial to the brachial plexus. Aggarwal et al. [8] stated that such anatomical variation may lead to failure of a regional block.

The DSA, which supplies the rhomboid muscle, arises from the subclavian artery or TCA. Cadaveric examination by Reiner and Kasser [9] showed that 75% of DSAs arose from the subclavian artery and 25% from the TCA. Subclavian origins were approximately equally divided between the second part (35.7%) and third part (38.9%). DSAs arising from the second part of the subclavian artery passed either between the superior and middle trunk (47%) of the brachial plexus or between the middle and the lower trunk (53%) of the brachial plexus. In contrast, DSAs arising from the third part of the subclavian artery were nearly always found to pass between the superior and middle trunks of the brachial plexus (89%). According to their report, males and females showed no clear differences in this respect.

These anatomical variations may be associated with technical difficulty, potential vascular puncture, or a failure of local anesthetic to spread throughout the brachial plexus. Because atypical anatomical structures can compromise the success and safety of supraclavicular techniques, we believe that careful preprocedural scanning, especially using color Doppler, is important to differentiate between

vascular structures, soft tissues, and nerves. Identification of such anatomical variation will likely improve the safety and quality of the block. It may be better to choose other locations (such as axillary or selected peripheral nerve block) if the anatomy indicates a potentially problematic block.

Conflict of interest None.

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