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Novel use of ultrasound guidance in wide-awake local anesthesia technique for clavicle surgery

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Letter to the Editor

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Clavicle fixation is becoming more common but only a few comparative studies have been conducted to determine the optimal approach in regional anesthesia as the sole modality for such surgery. Combined interscalene and intermediate cervical plexus block seems to be the most effective technique [1]. However, this approach can be associated with undesirable effects and may be contraindicated in patients with impaired pulmonary function [2].

The wide awake local anesthesia with no tourniquet (WALANT) technique was recently reported as an alternative landmark-based technique for clavicle fractures [3]. This technique involves injecting diluted and buffered local anesthesia with epinephrine under the clavicular periosteum. We describe the use of ultrasound guidance to perform this technique in two patients undergoing clavicle surgery. This study was approved by the local Institutional Review Board committee (approval number: 2020-09). Written informed consent was obtained from the patients.

A 17-year-old patient was admitted for a displaced segmental fracture of the midshaft clavicle. The patient was placed in a semi-fowler position with the head turned away from the operative side. The anesthetic solution prepared was a mixture of 0.5% lidocaine containing 0.05% bupivacaine, epinephrine 1/200000, and 8.4% sodium bicarbonate (1 ml per 10 ml of lidocaine). We used a linear ultrasound probe (13-6 MHz, SonoSite Edge II, USA) to scan above and below the clavicle to identify relevant nearby structures particularly the pleura, brachial plexus, and subclavian vessels. After subcutaneous injection of 10 ml over the incision line, ultrasound-guided WALANT was performed by administering 40 ml of the prepared solution at four intervals along the clavicle. The probe was placed perpendicular to the long axis of the clavicle to view the bone in cross section (Fig. 1A). A conventional needle (21 gauge × 38 mm) was inserted vertically out-of-plane until the needle tip contacted the clavicle. Local anesthetic was injected, then the needle was withdrawn to the skin level and redirected cranially and caudally until bone contact to anesthetize the borders of the clavicle. Ultrasound guidance allowed visualization of adequate spread around the cortical line of the clavicle. Thickening of the hyperechoic and thin cortical line with subsequent lower echogenicity and fuzzy edges was also observed (Fig. 1B), confirming spread of the anesthetic solution under the periosteum (Supplemental Video 1). Additionally, 5 ml of anesthetic mixture was injected into the fracture site under ultrasound guidance using an in-plane technique. Surgical incision was begun after 30 min to allow maximal vasoconstriction and optimal sensory anesthesia of the clavicular area. There was no motor or sensory block of the upper limb, indicating ab-

sence of spread of local anesthetic solution to the brachial plexus. The 70 min procedure was performed successfully without sedation, and a clavicle plate was fixed using screws. Stability of the fixation was evaluated using active shoulder movements. No surgical drain was required. Intravenous acetaminophen (1 g) and ketoprofen (100 mg) were administered. No supplemental analgesics were used, and the patient was discharged after 24 h.

The second case involved a 45-year-old man, who had undergone surgery for an acromioclavicular dislocation treated with tension band wiring and a medial malleolus fracture fixed using Kirschner wires (K-wires). The patient was scheduled for hardware removal. After anesthetic skin infiltration, we performed ultrasound-guided WALANT at the lateral portion of the clavicle and the acromioclavicular junction using the previously described technique (Fig. 1C). We administered a total of 50 ml of local anesthetic solution prepared as described above, including 10 ml injected into the medial malleolus. The same ultrasonographic image was observed after subperiosteal injection, with visualization of the spread of local anesthetic around the entry points of the K-wires (Fig. 1D). The surgery lasted 25 min with no additional analgesic requirement. No adverse effects were observed. The patient reported no pain in the immediate postoperative period, required no rescue analgesia and was discharged on the same day with oral medication.

Although the benefits of ultrasound guidance in WALANT have been reported for hand surgery [4], our report is the first to examine its clinical utility for clavicle procedures. Ahmad et al. [3] expanded the use of WALANT to clavicle surgery and reported 16 patients who successfully underwent clavicle fixation. However, two patients with displaced segmental fractures experienced mild pain during fixation. Anesthesia was then completed by intraoperatively injecting a supplemental WALANT solution. No complications were observed in this first case series, suggesting that this approach may be an effective alternative. However, special precautions must be taken when injecting blindly near the lung, brachial plexus, and subclavian vessels. This encouraged us to perform this technique under ultrasound guidance. Advantages of this method include the ability to visualize the correct spread of local anesthetic around the clavicle, and to avoid inadvertent puncture of adjacent structures. Remarkably, subperiosteal diffusion results in a typical thickening and echotexture modification of the cortical line. Ultrasound guidance also allows the deposition of local anesthetic around the fixation devices and into the fracture site, thus avoiding supplementary intraoperative injections.

In addition to its technical simplicity, WALANT might reduce the risk of nerve damage and phrenic nerve palsy associated with regional techniques commonly used for awake clavicle repair [2].

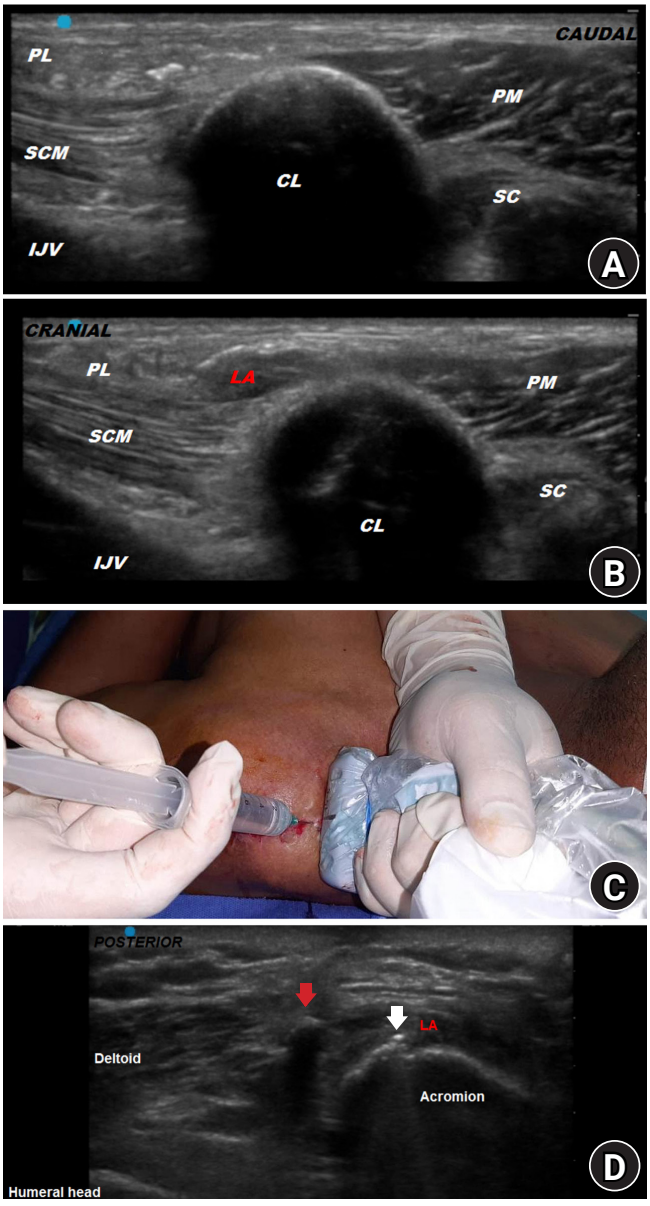

Fig. 1. Ultrasound-guided WALANT. A needle was inserted to contact the clavicle. After confirming proper position of the needle, local anesthetic was injected under real-time ultrasound guidance. (A) Sagittal cross section sonogram of the clavicle and (B) the modifications after subperiosteal injection showing a thickened and less echoic cortical line with fuzzy edges. (C) Patient position and needle insertion for the out-of-plane technique performed at the lateral portion of the clavicle. All needle redirections are performed through the same insertion site. (D) Image showing the Kirschner-wire at its entry point as a hyperechoic structure with a comet-tail artifact (white arrow) and the hyperechoic tension band wire with an acoustic shadowing behind (red arrow). Note the typical thickening and echotexture change of the acromial cortical line after subperiosteal injection. CL: clavicle, IJV: internal jugular vein, LA: local anesthetic, PL: platysma muscle, PM: pectoralis major muscle, SCM: sternocleidomastoid muscle, SC: subclavius muscle.

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Although WALANT is performed anatomically distant from the phrenic nerve, theoretically precluding its involvement, we did not assess diaphragmatic function by ultrasound to validate this. Moreover, WALANT avoids motor blockade of the upper limb, allowing the patient to dress independently right after surgery, and making it suitable for outpatient surgery. Active patient movements also assist the surgeon in assessing fixation stability. However, there are some concerns including delayed onset of blockade and patient discomfort due to prolonged surgery [3].

We have presented two cases describing the advantages of ultrasound guidance in WALANT for clavicle surgery, with a novel ultrasonographic image of subperiosteal injection. Effective postoperative analgesia and the absence of upper limb motor blockade facilitate early recovery. This alternative could constitute a diaphragm sparing option in patients with respiratory impairment, but also in more common cases. Further investigation is required to establish the efficiency and safety of this novel technique.

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Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

Author Contributions

Khalid Azizi (Conceptualization; Resources; Writing – original draft; Writing – review & editing)
Sabah Benhamza (Supervision; Validation; Visualization; Writing – review & editing)
Youssef Motiaa (Supervision; Validation; Visualization; Writing – review & editing)

Supplementary Material

Supplemental Video 1. Ultrasonographic video of the subperiosteal spread of local anesthetic after out-of-plane WALANT injection. Note the thickening and echotexture modifications of the clavicular cortical line.

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