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CASE REPORT

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Ultrasound-guided supracondylar radial nerve block in pain management of distal radius fractures

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Abstract
Radius fracture causes severe pain and requires extensive pain management. We aimed to present the efficacy of ultrasound (US)-guided supracondylar radial nerve block (SCRNB) in pain relief of two distal radius fracture cases. Two patients with distal radius fracture presented to emergency department. Both patients received US-guided SCRNB to provide analgesia during and after the closed reduction procedure. Reduction of displaced distal radial fractures is extremely painful and requires adequate analgesia. US-guided SCRNB is easy to administer, and comfortable with low complication risk. In previous studies, the preferred local anesthetic was lidocaine. Using bupivacaine in addition to lidocaine can provide long term analgesia. US-guided SCRNB is a safe and simple technique to perform with a minimal risk of complication and may replace commonly used sedo-analgesia in distal radius fracture at emergency department.

Keywords: Ultrasound, radial nerve, radius fractures, emergency department

Introduction

Distal radius fracture is one of the most common injuries encountered in emergency department (ED) [1]. These fractures are generally caused by falling on an outstretched arm or by direct trauma. For distal radius fractures, there are various treatment modalities. Nature of the fracture, patient's age, surgeon's preference, and physical facilities of the admitted medical centre are considered in determining the treatment [2]. Open or closed reduction can be applied. Bone corrections without surgical incision are called closed reduction. Closed reduction is the most commonly used treatment but is extremely painful. In pain management of this procedure, sedation, analgesic medications, and nerve blocks are commonly used [3]. However, ultrasound (US) guidance in peripheral nerve blocks has recently gained popularity [4-7]. US-guided, peripheral nerve blocks that can be used in distal radius fractures are interscalene, supraclavicular, infraclavicular brachial plexus, and axillary nerve blocks [8]. Along these proximal brachial plexus blocks, US-guided selective radial, ulnar, median, and musculocutaneous nerve blocks can be administered as well [9]. In this paper, we presented our findings on feasibility and efficacy of US-guided supracondylar radial nerve block (SCRNB) in closed reduction of distal radius fracture.

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Case Report

Case 1

A 21-year-old, male, ASA I was admitted to our ED. The patient complained of swelling and severe pain in his forearm that developed after falling. On plain radiographs, a Colles fracture in that the broken radius fragment tilted upward was detected (Figure 1a). Although diclofenac sodium 75 mg intra muscular was administered at the time of initial admission, the patient's visual analog scale (VAS) score was 8, which was unbearable when the arm was moved. VAS score defined by the patient was 8 and this pain was unbearable when the arm was moved. Pre-anesthetic evaluations of the patient was done, and there was no contraindications. After written consent obtained from the patient, we performed US-guided lateral SCRNB to reduce pain and provide adequate analgesia for closed reduction standard motorization (ECG, pulse oximetry, NIBP). Ten minutes after the block, we applied reduction successfully without need to sedo-analgesia. When the patient was inquired about his pain 10 minutes after the block, he declared that his pain was almost completely relieved and decreased to VAS: 0. We applied reduction without a need for sedo-analgesia, and we didn't observe any complication. First 9 hours after the block procedure, patient didn't feel pain, and

no rescue analgesic was needed. After then, tramadol 100 mg per oral was administered.

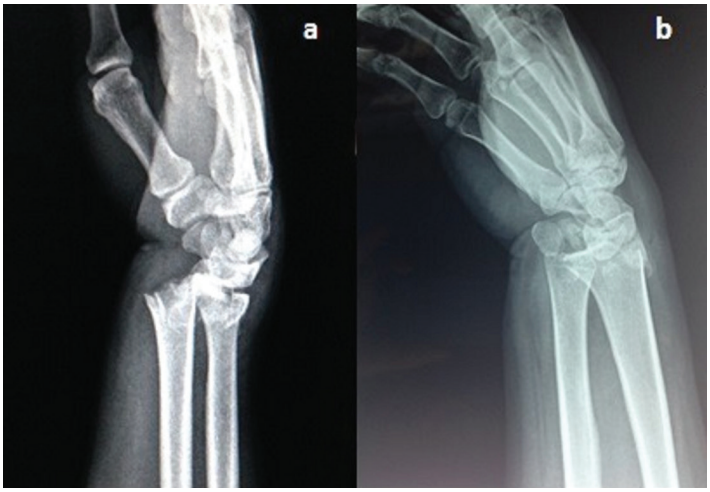

Figure 1. Case 1, Lateral forearm radiograph demonstrating distal radial fracture 1b. Case 2, Oblique radiograph of distal ulna–radius fracture

Case 2

A 35-year-old, male, ASA I presented to the ED with severe pain, malposition and edema on the right forearm after falling. We observed a distal radius fracture with associated ulnar head fracture on the patient's wrist radiographs (Figure 1b). The patient was administered 75 mg diclofenac sodium intra muscular at the time of first admission to the ED but still had intolerable pain of VAS:9. Pre-anesthetic evaluations of the patient was done, and there was no contraindications. After written consent obtained from the patient, we performed US-guided lateral SCRNB under standard motorization. Ten minutes after the US-guided SCRNB, the patient stated that the pain level decreased to VAS:1. Closed reduction could be performed without a need for analgesics and no complication was observed during the block process. The patient did not have pain during the first 11 hours after the block, tramadol 100 mg per oral was then administered as a rescue analgesic.

Technique

The procedures were performed in outpatient service of ED under local anesthesia. US scanning and blocks were performed by an anesthesiologist experienced in US-guided procedures. The patient was placed in supine position. The elbow of the fractured forearm was brought to flexion with a 90° angle and the hand was placed on the abdomen. After aseptic preparation of the skin with chlorhexidine, a high-frequency (12-5 MHz) linear transducer of an US machine (Philips HD6, Philips Ultrasound Systems, Bothell, WA, USA) was transversely positioned 3–4 cm above the lateral elbow, where the superficial and deep radial nerves are not separated yet (Figure 2A). The radial nerve was observed hyper-echoic between biceps and triceps muscles (Figure 2B). The skin was infiltrated with 2 ml of 2 % prilocaine using a 25G needle. In plane approach, a 21G, 5 cm echogenic needle (Pajunk, SonoPlex Stim, USA) was advanced to radial nerve under US guidance. Neurostimulation was applied at 2 Hz, with 1 ms pulse width. Patient described paresthesia in the distribution of radial nerve and a motor response was observed at 0.5 V. The needle-tip placement and spread of local anesthetic solution (5 ml, 2 % lidocaine and 5 ml 0.5 % bupivacaine) around radial nerve was visualized continuously. Ten minutes after the injection, pinprick test was used to confirm the block level and the pain levels of the patients were inquired as VAS score. Thereafter, closed reduction of the fracture was performed with adequate analgesia. We confirmed appropriate reduction of the fractures with radiographs and discharged patient with a forearm splint.

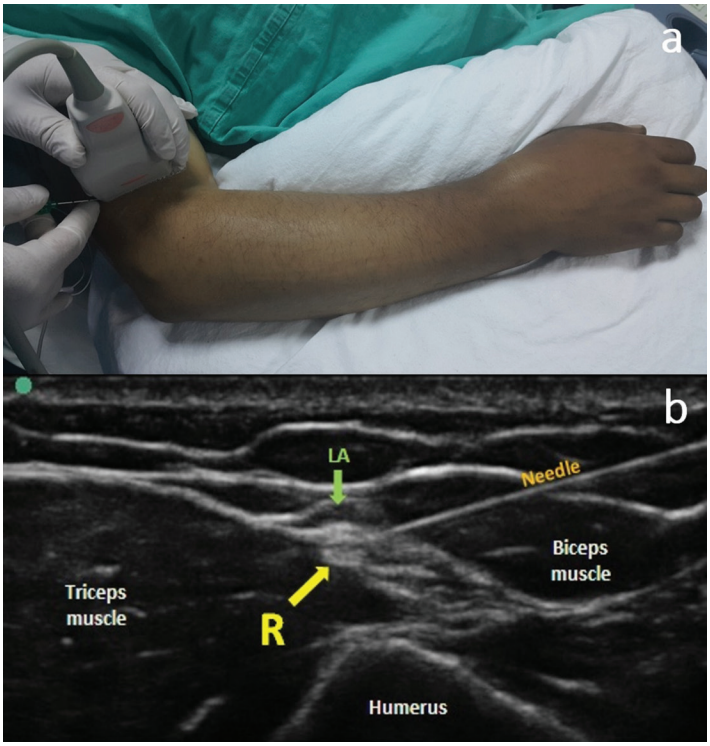

Figure 2a. Placement of the ultrasound probe in the supracondylar radial nerve block. The elbow was placed at a 90° flexion and the linear probe was transversely placed 3–4 cm above the lateral elbow, 2b. The transverse image shows the ultrasonographic anatomy of the target area for the supracondylar radial nerve block and the distribution of the local anesthetic drug (R: Radial nerve, LA: Local anesthetic drug).

Discussion

Our report presented that the selective US-guided SCRNB with a volume of 10 ml bupivacaine and lidocaine solution provided rapid pain relief during closed reduction of two distal radius fracture cases. US-guided SCRNB preserves the motor function at the elbow while the brachial plexus and axillary blocks do not. Recently, interest in ambulatory surgery has increased due to long-term hospital stay complications and economic factors [9]. In our cases, US-guided SCRNB provided immediate and satisfactory pain relief with prompt recovery due to improved retention of motor function at the elbow.

Equipments required for US-guided SCRNB block treatment are only an ultrasound machine, echogenic nerve block needle, and local anesthetic. On the other hand, an operation room environment is required for reduction under general anesthesia or sedo-analgesia. Also, after the procedure, patients need close follow-up in the recovery period. However, patients who undergo ultrasound-guided nerve block do not require intensive follow-up, thus reducing cost for both equipment and staff [10].

Eventhough, SCRNB is an easy to administer block under US guidance because of superficial localization of the nerve, there is very limited studies in the literature. In these studies, the preferred

local anesthetic during the block was lidocaine, and the studies focused only on pain relief during the closed reduction procedure [11,12]. In our study, we provided long-term analgesia with bupivacaine rather than giving only lidocaine. Since, bupivacaine has longer duration of action considerably longer than lidocaine, in our study, we provided long-term analgesia with bupivacaine rather than administering only lidocaine. Addition of lidocaine to bupivacaine provided more rapid onset of block as well.

Brachial plexus block can be performed at different anatomical sites such as interscalene, supraclavicular, infraclavicular, and axillary region [13]. However, at these levels, brachial plexus is adjacent to important anatomical structures and has risk of catastrophic complications related to needle puncture such as pneumothorax, nerve palsy, and hematoma [14,15]. SCRNB, has very low risk profile when compared to these brachial plexus blocks. At supracondylar level, radial nerve can be recognized quite easily. US guidance makes the technique, SCRNB safer by preventing misplacement of the needle tip and undesirable spread of local anesthetic. Hereby, we applied the US-guided SCRNB rapidly, comfortably, safely, and confidently under US guidance. Thus, US-guided SCRNB can be administered easily as a bedside procedure, with low risk of adverse events and complications in closed reduction of radius fractures.

Conclusions

Distal radius fractures are orthopedic urgent cases those can be encountered in ED frequently. Since, analgesia for closed reduction and postoperative pain management of these cases are challenging, US-guided SCNRB is a promising approach. According to our experience, US-guided SCRNB is an easy–to–perform and fast–acting peripheral nerve block technique that can be effectively used in ED. In order to generalize the effects of SCRNB on distal radius fractures, there is a need for larger patients series.

Competing interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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