

Ultrasound-guided supracondylar radial nerve block for closed reduction of a distal radius fracture in the emergency department: Case report

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ABSTRACT

Background: Closed reduction and a closed cast are common treatments for patients with acute distal radius fractures in the emergency room. Many of the common analgesic techniques such as hematoma block may not be effective, which can hinder the stabilization and reduction of fractures.

Case report: An 81-year-old woman who had a Colle's fracture (metaphyseal fracture with dorsal angulation) of the left distal radius arrived at the emergency room. Due to intense pain and need for proper pain management, an ultrasound-guided block of the radial nerve prior to its bifurcation into deep and superficial branches was carried out as an alternative to infiltration of the fracture site. The fracture could be reduced and immobilized with a closed cast as a result of the peripheral nerve block, which caused the patient the least amount of discomfort.

Conclusions: The reduction of a distal radius fracture in the emergency room can be accomplished with safe and efficient analgesia using an ultrasound-guided supracondylar radial nerve block close to the beginning of the deep and superficial branches. This is, as far as we are aware, the first report of an ultrasound-guided supracondylar nerve block utilized to treat a distal radius fracture in our nation.

Introduction

Distal radius fractures represent the most frequent fractures in adults, accounting for 1/6th of all fractures seen in emergency departments [1]. In elderly patients, this type of fracture most commonly derives from low-energy trauma, it may not require surgical management, and, particularly in this age group, an appropriate reduction can represent the final treatment [2]. There are several methods to achieve reduction, however, adequate reduction in these cases requires sufficient muscle relaxation and anesthesia, which represent a constant challenge in emergency department settings. The most commonly used methods for pain control include hematoma block, Bier's block, sedation, and general anesthesia (though this one remains complicated especially in the elderly), all of which have limitations and none of which have been shown to be superior in systematic reviews [3].

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Supracondylar radial nerve blocks are an effective alternative for anesthesia for this type of patient. This type of technique has been shown to be effective for pain management, has a relatively short learning curve, a low complication rate, and relatively low costs, making it suitable for more widespread use. Therefore, we propose the use of this technique for the closed reduction of a distal radius fracture in an elderly patient.

Case report

We present the case of an 81-year-old woman, with past medical history of hypertension and type 2 diabetes mellitus controlled with medication, who presented to the emergency department after falling from her own height onto her left hemibody and outstretched hand. She denied cranioencephalic trauma or loss of consciousness. At admission, she complained of intense pain in her left hand and reduction in the wrist's range of movement due to pain. At physical examination, she had a "fork back deformity", swelling, and was tender to touch; the patient complained of a pain level of 9 out of 10 according to the VAS score with fracture manipulation. Plain radiographs showed a minimally displaced, dorsally angulated, extra-articular, shortened distal radius fracture with loss of radial tilt (Fig. 1).

The patient referred severe pain with passive motion and near the fracture site, she was reluctant to allow for a block near the site and to receive surgery. Due to the intense pain referred by the patient, and the possibility of management with closed reduction, we opted for a supracondylar radial nerve block to ensure proper pain management. Therapeutic options were discussed with the patient and her daughter, and as a result of a shared decision-making process, she opted for closed reduction with supracondylar radial nerve block. After obtaining the patient's informed consent, the procedure was performed. With the patient supine and the arm flexed over the abdomen, the physician positioned themselves facing the lateral aspect of the affected arm. The ultrasound machine was placed front-facing the physician, allowing an unobstructed view of the screen. A high-frequency 6–13 MHz (MHz) Mindray linear transducer was used to locate the radial nerve on the lateral aspect of the humerus, approximately 2 cm above the lateral epicondyle. At this location, the nerve is followed distally, visualizing its bifurcation into deep and superficial branches. Subsequently, the probe was displaced proximally to ensure the correct anatomic location. The nerve (hyperechoic) travels through the intermuscular septum between the surrounding (more hypoechoic) brachial and brachioradial muscles (Fig. 2).

The site was prepared with an aseptic technique and sterilized with a chlorhexidine solution. Sterile surgical lubricant was spread on the intended injection site. Later, a mixture of 10 ml of 1:1 0.25 % bupivacaine and 1 % lidocaine with epinephrine was injected with a 50-mm, 22-gauge Stimuplex® insulated echogenic needle around the radial nerve (proximal to its branch) under direct ultrasound guidance using an in-plane technique, identifying the needle in its full length. To prevent nerve injury due to high pressure at the injection site, low resistance during the procedure was assured. The patient manifested minimal discomfort during the injection process. Fifteen minutes after the injection, the patient reported no pain at rest, and the fracture was reduced. Axial traction maneuvers and ligamentotaxis, hyperextension, flexion, and ulnar deviation were performed with subsequent immobilization with a forearm sugar tong splint without complications. Shortly thereafter, the dorsally angulated distal fragment was reduced with minimal discomfort. After confirmatory radiographs showed adequate reduction, she was discharged with orthopedic follow-up (Fig. 3). At the



Fig. 1. Fracture radiograph on emergency admission: AO/OTA 2R3A2.2.

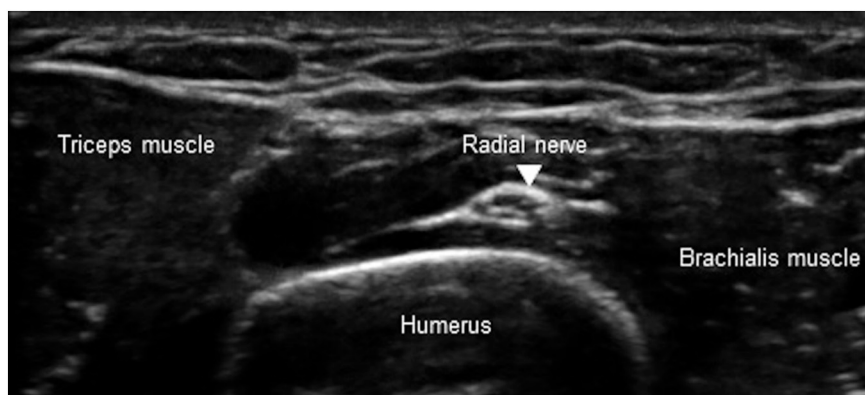


Fig. 2. Ultrasound scan over the lateral aspect of the arm in an axial plane, the radial nerve is located inside the brachialis muscle before its division into two branches: superficial and deep.

two-week follow-up, the sugar tong splint was replaced by a brachiopalmar closed cast, and at the monthly follow-up, the appropriate fracture reduction was again verified through radiographs. After that, the patient was lost to follow-up due to administrative concerns derived from her insurer, where we believe she was transferred elsewhere to continue her care.

Discussion

Other authors have demonstrated the usefulness of ultrasound in the emergency department for regional anesthesia for analgesic purposes and fracture reduction [4,5], nevertheless, to our knowledge, this is the first description of an ultrasound-guided supra-condylar nerve block used for the treatment of a distal radius fracture in our country.

There are currently several methods of anesthesia for upper extremity fractures, among the most commonly used is the hematoma block, which is easy to practice, relatively safe, and does not require much equipment; it has even been used in pediatric patients [6]. However, studies have shown that this method is not always effective for pain control. For example, a randomized clinical trial comparing ultrasound-guided nerve blocks versus hematoma block demonstrated higher satisfaction for patients and physicians in the nerve block approach [7]. Hematoma block has also been compared to other methods such as Bier Block (regional anesthesia technique that involves injecting a local anesthetic into a vein of the affected limb while a tourniquet is applied to prevent the anesthetic from entering the systemic circulation, allowing for a localized numbing effect [8]), however, this is not a procedure that is routinely used and can have several adverse effects, including pain associated with tourniquet use and more serious ones such as systemic toxicity associated with local anesthetics, seizures and acute myocardial infarction [9]. Sedation during fracture reduction, although commonly used in the emergency department, especially in the pediatric population, is more resource consuming and may have relative contraindications in patients with a history of allergic reactions or respiratory compromise, among others, therefore it is not



Fig. 3. Post-reduction radiograph in the emergency room.

widely used in the adult population [10].

In the elderly, the upside of nerve blocks for fracture reduction is not limited to pain management. The reduction of complications related to more invasive procedures or general anesthesia techniques imply less rates of delirium and respiratory issues, as well as decreased use of opioids, hospital length of stay, and overall healthcare costs [11].

Concerning nerve blocks, brachial plexus blocks (BPs) are commonly used for anesthesia and analgesia in patients undergoing distal radial fracture reduction. It has been mostly used for surgical reduction, even demonstrating better pain control than general anesthesia postoperatively in a randomized controlled trial [12]. Yet, it has been also proposed for initial management in the emergency department [13]. However, it is necessary to consider that serious complications related to its anatomical location can occur. The proximity of the brachial plexus to the apex of the lung, subclavian, and axillary vessels can increase the risk of pneumothorax, accidental puncture of vessels, hematoma formation, nerve compression, or inadvertent injection of local anesthetic into the bloodstream during the block procedure [14]. We hypothesize that radial nerve block can offer similar results, reducing the potential adverse effects of a more proximal block; however, it is important to acknowledge that there is inherent risk of complications associated with it.

Among the potentially preventable complications to be considered in supracondylar blocks are motor block, postoperative neurologic symptoms (PONS), local anesthetic-associated systemic toxicity (LAST), infection, and rebound pain [15]. Therefore, an adequate technique that takes into account the use of a short bevel needle, the use of ultrasound guidance, the adoption of a slow injection technique, and consideration of adequate local anesthetic concentration and volume can mitigate the occurrence of these complications [15]. Furthermore, a proper aseptic and antiseptic technique can effectively prevent infection, and the continuation of multimodal post-blockade analgesia can help to avoid rebound pain [16].

As mentioned before, thanks to improved imaging, ultrasound-guided regional anesthesia is now safer and simpler and can be performed with a high degree of reliability [17]. Although this type of block has not been widely studied in the literature, it has been shown that it can be performed by a physician trained in ultrasound in an emergency department, with success rates of 95% [18]. Likewise, studies have demonstrated that supracondylar blocks are more effective than hematoma blocks in reducing pain scores before, during, and after the reduction of distal radial fractures [17,19]. The implementation of ultrasound has also resulted in a significant reduction in complication rates. Postoperative neurologic symptoms have an incidence of 2–4 cases per 10,000 [20], and systemic toxicity of local anesthetics is approximately 1.5 per 10,000 blocks [21]. In addition, studies have shown that the learning curve for ultrasound-guided BPB can be acquired in approximately 15 sessions [22]. Finally, from an economic point of view, costs can be relatively lower compared to other anesthesia modalities, considering that closed reduction under conscious sedation can come up to €276 and closed reduction in the operating room under general anesthesia with percutaneous pinning ascends up to €2550 [23], while in pediatric patients the cost of a radial nerve block and close reduction has been estimated at \$88 [24].

Although the information in this report is similar that previously reported in the literature, supracondylar radial nerve blockade is still not widely used, which is reflected in the limited literature. This report is part of a larger project to apply effective therapeutic measures that are sustainable and, more importantly, lead to better clinical outcomes for patients. Given that distal radius fracture is one of the most common fractures, adequate, painless, and resource-saving treatments can have an impact on health care systems, which generally do not cover the entire population and are often oversaturated.

Conclusion

Ultrasound-guided supracondylar radial nerve block may potentially provide less painful anesthesia compared to other methods for the treatment of distal radial fractures. Likewise, this type of technique has a relatively short learning curve, a low complication rate and relatively low costs, which makes it a suitable technique for more widespread use not only in anesthesiologists but also in emergency physicians or orthopedists.

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CRediT authorship contribution statement

Juan José Martínez-Arboleda: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Milena Moreno:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Conceptualization. **Juan Pablo Díaz-Solórzano:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Conceptualization. **Alejandro Mejía-Grueso:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors (Dr. Alejandro Mejía-Grueso, Dr. Juan José Martínez Arboleda, Dr. Milena Moreno, and Dr. Juan P. Díaz-Solórzano) of the manuscript titled “Ultrasound-guided supracondylar radial nerve block for closed reduction of a distal radius fracture in the emergency department: Case report” hereby declare no conflicts of interest that could in any way, shape or form compromise or determine the realization or outcomes of this work.

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