The occasional ultrasound-guided haematoma block and reduction for distal radius fractures

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Point-of-care ultrasound (PoCUS) in emergency medicine represents a key piece of diagnostic and therapeutic equipment. Commonly used in procedures such as central venous catheterisation, arthrocentesis, regional anaesthesia and paracentesis, PoCUS has been shown to reduce complications and increase success rates of these and other procedures.[1]

Musculoskeletal injuries such as distal radius fractures are frequently treated in emergency departments (EDs). In all patient populations, distal radius fractures are the most common fractures, but in young and elderly patients, they are especially prevalent. Injuries of this kind are painful and often require interventions that prolong the patient's ED stay.[2]

Typically, distal radius fractures are confirmed with radiography [Figure 1] and managed with procedural sedation and analgesia. In resource-limited settings, bedside fluoroscopy is rarely available and closed reduction proceeds with manual palpation of the fracture and associated angulation. The adequacy of reduction is confirmed clinically, and the patient is casted before being sent for post-reduction radiography. Swelling, body habitus and pain can influence palpation, making the reduction more difficult. Moreover, this method is resource-intensive, time-consuming and has increased risks of procedural sedation. PoCUS-guided haematoma blocking and PoCUS-assisted reduction can help clinicians, reduce patient discomfort and increase ED flow without requiring personnel and time needed for procedural sedation.

Here, we present the use of PoCUS in a haematoma block to facilitate the closed reduction of distal radius fractures and describe its advantages over procedural sedation with closed reduction without PoCUS.

INDICATIONS

Closed reduction of a fracture of the metaphysis or diaphysis

CONTRAINDICATIONS

Open fracture
Infection overlying the injection site

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SONOANATOMY

The fracture site can be identified with a high-frequency linear transducer probe scanning proximal to distal [Figure 2]. The bony step-off and associated fracture haematoma can be seen [Figure 3]. This view is used during the haematoma block as well, during and after closed reduction, to assess the adequacy of reduction.

The haematoma block, which entails directly instilling local anaesthetic into the site of fracture haematoma, has been shown to be a safe and effective anaesthetic method for fracture reductions in adult and paediatric populations.[3-6] The literature suggests that haematoma blocks result in significantly shorter length of stay in the ED compared to procedural sedation and are non-inferior in terms of pain scores pre and post-reduction, without increasing rates of adverse events, including loss of adequate fracture reduction.[3,4,6-10] Compared to procedural sedation, haematoma blocks also have the advantage of requiring less monitoring for respiratory distress during the procedure, which is a critical consideration in resource-limited environments or high-risk patients.[9,10] Use of PoCUS can mitigate difficulties and facilitate an effective and less invasive method of anaesthesia compared to procedural sedation. The technique for ultrasound-guided haematoma block (described below) allows for direct visualisation of the haematoma and may improve the success of achieving an adequate haematoma block.

As mentioned previously, PoCUS facilitates the haematoma block in distal radius fracture but is also a valuable tool in guiding satisfactory fracture reduction. PoCUS provides real-time visualisation of fracture reduction at the bedside, thus allowing the physician to make adjustments, rather than having to repeat the process after post-reduction X-rays are completed. This real-time feedback improves patient care by potentially reducing anaesthesia/sedation time, patient discomfort and resource utilisation.[11] In addition to these indirect metrics, PoCUS-guided fracture reduction has also been shown to reduce rates of repeat reduction, improve post-reduction volar tilt and decrease subsequent operative rate.[11-14]

Figure 1: Pre-reduction anteroposterior (a) and lateral (b) X-ray of a distal radius fracture demonstrating significant impaction and angulation.

Figure 2: Linear transducer probe overlying the fracture site.

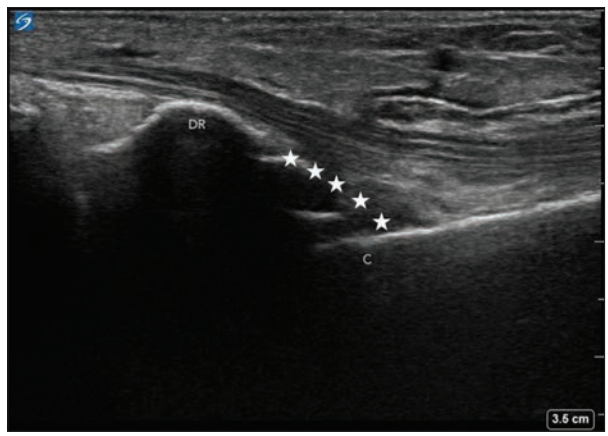

Figure 3: Sonographic anatomy of distal radius fracture (longitudinal view). DR: Distal radius, C: Proximal cortex, ★: Fracture haematoma.

EQUIPMENT

- PoCUS machine with 7.5 MHz linear transducer

- Chlorhexidine swabs
- One percent lidocaine
- 10 millilitre syringe
- 22–25-gauge needle
- Sterile ultrasound probe.

PROCEDURE

Patients often undergo radiography before manipulation. Furthermore, ensure adequate analgesia prior to the procedure.

US-guided haematoma block[7,13]

1. Landmark the fracture site by visualising interruption and angulation of the bony cortex; this is best done by scanning proximally and longitudinally tracing the radius along the dorsal forearm with the probe until the fracture haematoma is identified as a discontinuity in the normal hyperechoic bone line along the radius [Figures 2 and 3]. Placement of a towel under the wrist can aid in patient comfort and allows for better visualisation
2. After locating the fracture site, the skin should be prepped with chlorhexidine. Clean the ultrasound probe and place a sterile cover over the transducer to maintain a clean field. Place sterile ultrasound jelly on the probe
3. Draw up 10 mL of one percent lidocaine in a syringe, then place the needle on the syringe
4. Re-locate the haematoma again and insert the needle in-plane proximally to distally at an appropriate trajectory to reach the fracture haematoma. The needle can be seen as it passes through the skin, overlying tissue and into the fracture haematoma [Figure 4]
5. Once the tip is seen entering the fracture haematoma, a small amount of blood should be aspirated to confirm placement
6. Five to ten millilitres of local anaesthetic should then be injected to the fracture haematoma. Inject slowly and warn the patient they may feel pressure and a burning sensation
7. Redirect the needle proximally and inject a further 2.5–5 mL just superficial to the periosteum
8. If a concomitant ulnar styloid fracture is present, the same procedure above can be repeated by tracing the ulna to identify an ulnar styloid fracture haematoma and injection of 2.5–5 mL of local anaesthetic
9. After the injection is complete, gently massage/compress the soft tissues overlying the injection site to assist anaesthetic dispersal
10. Wait 10–15 min before attempting any reduction to allow the local anaesthetic to take effect.

US-guided distal radius fracture reduction

1. Proceed with your method of reduction of choice. Adequate distraction of the fracture can be aided by placing the patient in a vertical finger trap and counter-traction. Some discomfort may be felt and is usually tolerable for several seconds
2. To confirm reduction, place the linear probe over the fracture as above. Often, there is an improvement in alignment and angulation with counter-traction alone
3. Repeat this step after each reduction attempt. Once the alignment is adequate [Figure 5], proceed with casting and moulding and repeat radiography [Figure 6].

Pitfalls

1. Inserting needle too proximally and unable to direct it into haematoma

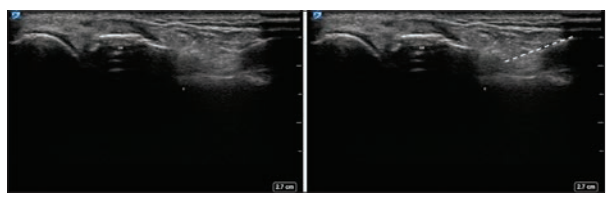

Figure 4: Point-of-care ultrasound visualisation of a needle entering the distal radius fracture haematoma (left image). Dotted line representation of needle path (right image). DR: Distal radius, C: Cortex.

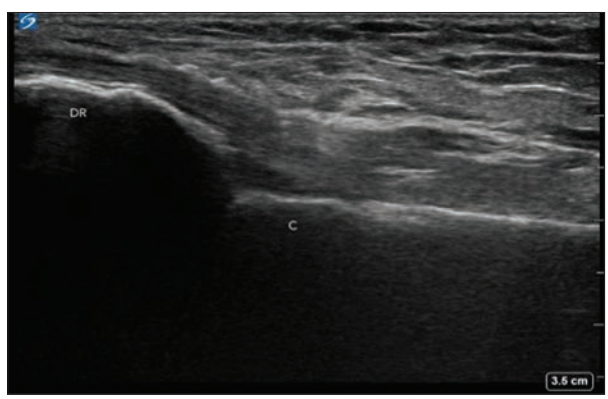

Figure 5: Point-of-care ultrasound image of distal radius fracture reduction (longitudinal view) demonstrating reduction of angulation. DR: Distal radius, C: Cortex.

Figure 6: Post-reduction anteroposterior (a) and lateral (b) X-ray of a distal radius fracture demonstrating restoration of impaction and angulation.

2. Omitting anaesthesia of the proximal periosteum
3. Not waiting long enough.

Pearls

1. Gentle compression of soft tissues post-injection will increase distribution of anaesthetic
2. Wait at least 10–15 min after injection. Go and see another patient. The anaesthetic effect continues to increase during the first 30 min
3. Some discomfort may be felt at the extremes of fracture reduction. This is usually tolerable for the few seconds it takes to achieve alignment. Also, blocking a concomitant ulnar styloid fracture may improve overall procedural success
4. Do not proceed with a reduction if anaesthesia is inadequate or the patient is highly anxious. Consider anxiolysis or light sedation to facilitate reduction.

CONCLUSIONS

Using PoCUS in the context of distal radius fractures provides good quality patient care, good fracture reduction outcomes and improves flow through ED compared to procedural sedation and reduction. The method described here is particularly useful in resource-limited settings where a single procedural sedation may overwhelm departmental resources.

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