The Battle of Ultrasound vs X-ray: Diagnosis of a Finger Fracture

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INTRODUCTION

Phalangeal fractures of the hand are a common injury that presents to the Emergency Department (Kee and Massey, 2023). X-ray is typically the modality of choice when trauma to the finger occurs as it is readily available. Although there may be no evidence of a fracture, trauma to the finger can result in a tendon or muscle abnormality.

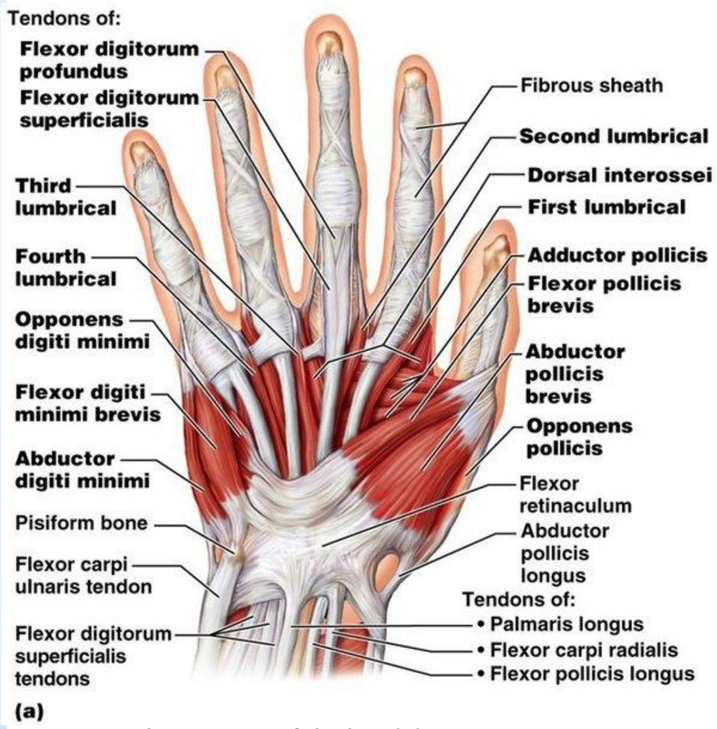

Figure 1 : Palmar aspect of the hand demonstrating musculoskeletal anatomy (Jacobson, 2018).

The distal phalanx of a finger is anatomically distal to the insertion of the flexor digitorum superficilais, flexor digitorum profundus and extensor digitorum tendons. When trauma occurs to the distal phalanx, it is these tendons that are subject to injury. Therefore, if symptoms persist and a fracture is not evident, MRI or Ultrasound becomes the preferred modality of choice.

Injury to the finger may also be caused by the presence of a foreign body. Foreign bodies that are radiopaque are evident on X-ray and therefore, removal can occur promptly. However, radiolucent foreign bodies are not evident on X-ray and may never be discovered unless the patient's symptoms persist (Rooks, Shiels and Murakami, 2020) . Therefore, Ultrasound is beneficial in the investigation and exclusion of radiolucent foreign bodies due to its high sensitivity and specificity characteristics (Rooks, Shiels and Murakami, 2020).

PATIENT BACKGROUND

A 29 year old male presented to the Emergency Department complaining of pain and tenderness in their left index finger after injuring it at work . On examination, the left index finger appeared swollen and tender on palpation. The patient was referred for X-ray, however no bony injury was detected. The patient was therefore discharged with medication to control the pain and ease the swelling.

The patient presented to the Emergency Department one month after the injury had occurred as the distal phalanx of the left index finger appeared infected and the swelling was still present. An ultrasound examination was subsequently requested by the team to out rule a foreign body as a possibility, however the clincial history did not suggest a penetrating foreign body injury.

ULTRASOUND EXAMINATION

The Ultrasound examination was justified by the sonographer in advance, in accordance with the British Medical Ultrasound Society Professional Guidelines (2022).

A high frequency linear hockey stick transducer was used to examine the distal phalanx of the left index finger both medially and laterally. Using a high frequency linear hockey stick probe allowed for static and dynamic imaging including flexion and extension imaging.

Figure 2: Image demonstrating patient positioning for the Ultrasound examination (Jacobson, 2018).

ULTRASOUND EXAMINATION

The patient was positioned on a chair opposite the sonographer with their hand placed with the volar aspect facing the sonographer on the ultrasound bed to allow for full visualisation of the anatomy (Figure 2).

The ultrasound examination included sonographic evaluation of the flexor and extension tendons, the distal, medial and proximal interphalangeal joints, the volar plate and the distal, medial and proximal phalanges of the left index finger. It also included dynamic assessment of the flexor tendons.

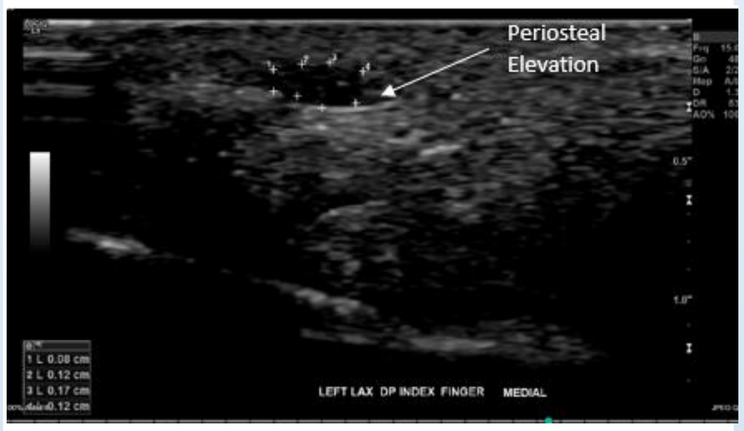

Figure 3: Longitudinal image of the distal phalanx of the left index finger demonstrating periosteal elevation.

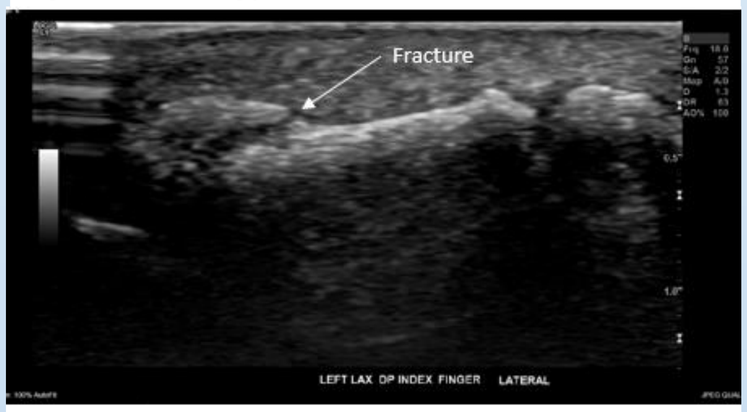

Figure 4: Longitudinal image of the distal phalanx of the left index finger demonstrating a hypoechoic defect of the bony cortex of the distal phalanx indicative of a fracture.

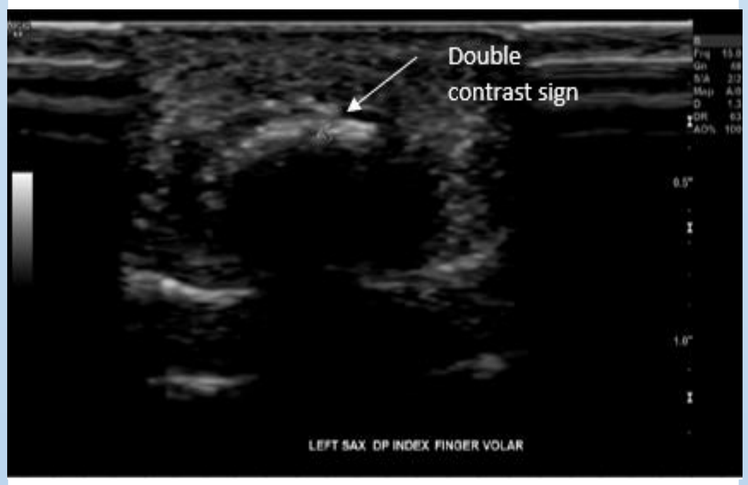

Figure 5: Transverse image of the distal phalanx of the left index finger demonstrating the double contrast sign which indicates disruption to the bony cortex.

Figure 6: Longitudinal image of the distal phalanx of the left index finger which demonstrates an absence of hyperameia, therefore there was no sonographic evidence of inflammation.

DIAGNOSTICS & TREATMENT

Ultrasound was beneficial in imaging the distal phalanx as it allowed real time dynamic scanning to occur in order to outrule a pathology. It also allowed for full visualisation of both the bony cortex and soft tissue together to outrule the presence of a foreign body. However, Ultrasound is not readily available and it relies on the availability of a musculoskeletal sonographer to perform the examination.
Upon sonographic evaluation there was evidence of a hypoechoic defect of the bony cortex of the distal phalanx of the left index finger and a double contrast sign (Figure 5) which is indicative of an occult fracture (Rutten *et al.*, 2007).

There was also evidence of periosteal elevation on Ultrasound which can be associated with several bone disorders including a fracture (Figure 3).

DIAGNOSTICS & TREATMENT

Ultrasound has the ability to detect a periosteal reaction much quicker than X-ray due to its high levels of sensitivity and specificity (Moraux, Gitto and Bianchi, 2019).

There was no evidence of a foreign body which was originally suspected by the clinicians. Therefore, the sonographer concluded that upon sonographic evaluation, there was evidence of an undisplaced healing fracture of the distal phalanx of the left index finger.

Figure 7 and 8: Plain film X-rays which were undertaken prior to the Ultrasound examination being performed. The fracture was not identified by the Radiologist, however, it was retrospectively identified once the Ultrasound report had been generated.

The patient was subsequently referred to Orthopaedics for treatment.
The primary aim of treating a phalanx fracture is to heal the fracture appropriately whilst avoiding complications including deformity and stiffness which would affect the normal function of the phalanx (Kee and Massey, 2023). The type of treatment is dependent on the type of fracture and if it is intraarticular or extraarticular.

Intraarticular fractures typically require non surgical treatment in the form of buddy strapping and/or splinting for stabilisation and immobilisation (Kee and Massey, 2023)
Extraarticular fractures with associated deformity typically require surgical intervention. The are typically stabilised with Kirshner wires or open reduction internal fixations (Kee and Massey, 2023).

In this case, the fracture was diagnosed on ultrasound 4 weeks after the patients injury which is typically the stage that callus formation occurs post injury (Kee and Massey, 2023). Once the fracture was identified on ultrasound, it was retrospectively seen on the X-ray, despite the initial report stating no bony injury was present.
As the fracture was undisplaced, a splint was applied to the patient's index finger. An orthopaedic review was scheduled for 4 weeks later to ensure the fracture remained undisplaced and had healed. After 4 weeks the fracture had healed and the patient had maintained full range of movement. Therefore, the patient was fully discharged from orthopaedics.

CONCLUSION

Fractures are not typically seen on Ultrasound as X-ray is the modality of choice when a fracture is suspected. However, from this case it is evident that Ultrasound is useful in detecting occult fractures which may not be visualised on X-ray.

In this case, the patients diagnosis was unknown prior to ultrasound. Timely diagnosis of a fracture is paramount in order to achieve the best possible outcome for the patient as it prevents deformity occurring. Ultrasound can therefore compliment X-ray in the investigation of a fracture and the presence of a foreign body.

However, it is important to note that the ultrasound examination should be performed by a sonographer with appropriate musculoskeletal knowledge. This in turn could effect the timely diagnosis required to ensure the best possible outcome for the patient.

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