



# How Can Ultrasound Reduce Negligence Claims?

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The distal forearm fracture is one of most common fracture in the paediatric emergency department. The golden standard of imaging is still the x-ray. However, it's sensitivity is low (Jørgsholm 2013i, Balai 2015ii). Several studies focusing on making the diagnosis based on Ultrasound examination could show the high sensitivity and specificity for the diagnosis of distal forearm fracture. We are presenting cases where the diagnosis of the fracture could have been missed on X-ray.

## **Material and methods:**

Paediatric patients presenting with acute distal forearm trauma and suspicion of a fracture were enrolled into the study. The young patients underwent a physical examination and an Ultrasound by the same orthopaedic surgeon before anteroposterior and lateral x-rays were obtained. The surgeon evaluated the findings

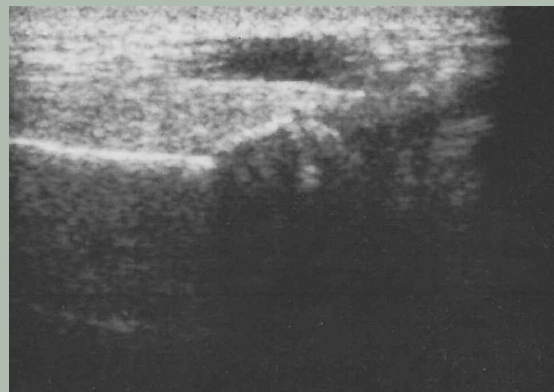
## **Results:**

In total, 101 patients between 4 and 16 years of age were recruited with an average age of 11 years at the time of the trauma. There were 51 fractures that involved the distal radius in 86 cases, 9 injuries of the distal ulna, and 6 combined injuries (radius and ulna). 32 greenstick fractures were detected. Specificity and sensitivity of ultrasound diagnosis were 99.5%.

## **The cases:**

### **Case 1:**

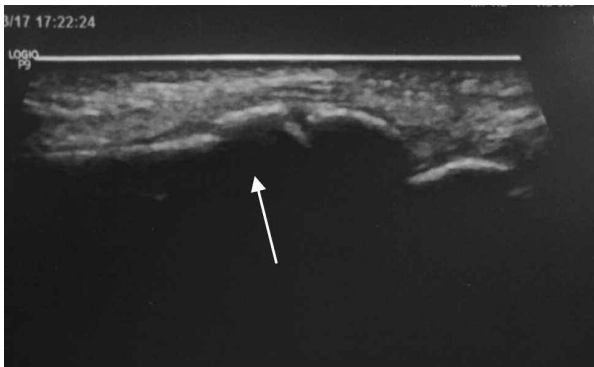
A 14-year old boy fell on his outstretched right wrist whilst playing football. He could finish the match but complained of a gradual onset of pain and painfully restricted movements. On examination, he presented mildly swollen soft tissues over the distal forearm but no gross deformity. Pain on palpation of the distal radius and a function laesa suggested a bony injury. The Ultrasound examination could show a mild angulation over the posterior metaphysis with a fracture in the cortex, highly suggestive of a bony lesion. His X-ray confirmed the diagnosis.



*The Ultrasound shows cortical fragmentation and angulation in the metaphysis.*

### Case 2:

A seven-year old boy fell off a carousel onto his forearm. He presented without significant soft tissue swelling but with pain on mobilisation. On examination, he was able to move the wrist, but showed painful restrictions at the extremes. There was pain on palpation of the distal radius. X-rays were unable to show the lesion. In retrospect, a cortical irregularity can be queried in the ap plane (arrow). Ultrasound, in contrast, found a cortical fragmentation in the metaphysis.



*The Ultrasound shows a cortical fragment extending from the metaphysis like a Salter Harris II lesion.*

### Case 3

An 11-year old girl fell whilst skating onto her wrist a day ago. Swelling started within hours after the accident but was not significant. Her mother wanted to wait and see what would happen. On examination, there was only little soft tissue swelling. There was an



intracutaneous hematoma though, but not very prominent. The wrist was painful on palpation of the distal radius without deformity or step.

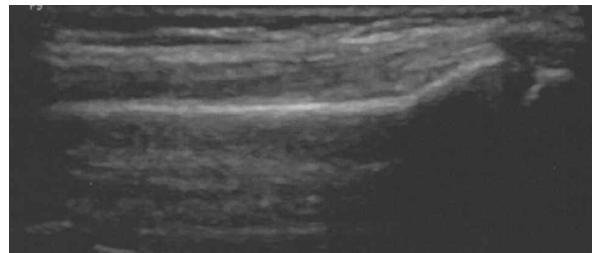
X-rays raise suspicion with a positive fat pad sign and a possible cortical angulation over the dorsal aspect of the metaphysis.

### Discussion:

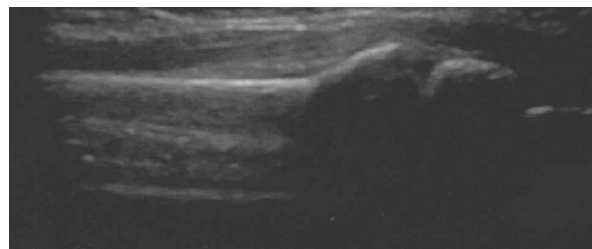
Studies evaluating the diagnostic accuracy of sonography in forearm fractures have been carried out in the paediatric population. Techniques are known as FAST POCUS, which stands for a “focused assessment with sonography for trauma” and was initially used for Ultrasound examination of the abdomen and heart. POCUS stands for „point of care ultrasound“ and examines areas of interest, e.g. the painful forearm. It was found that the sensitivity of US examination for distal radius fractures was 100%. But still, the gold standard diagnostic tests are x-rays in those studies.

False negative results for x-ray imaging have not been reported. It appears that they are more sensitive for detecting ulna fractures (Eckert 2012iii, Herren 2015iv, Williamson 2000v, Ackermann 2009vi, Chen 2007vii, Javadzadeh 20014viii, Kocarci 2015ix). With a sensitivity of almost 100%, Herren (2015)x suggested that a negative result in ultrasound may reduce the need for further radiographs in children with distal forearm lesions. But in any doubtful situation the need for conventional radiographs should remain.

The beauty of Ultrasound examination is the number of angles that can be applied whereas X-rays usually provide only two planes. Thus, pathologies in the interim junction can be visualised that would be possibly missed on films (Case 2). Even subtle changes, e.g. minor angulations become more obvious during the examination (Case 3).



*The Ultrasound shows a slight cortical angulation but no frank fragment.*



*However, a different angle makes the angulation more noticeable.*

However, false positive results for radius fractures have been reported by Sivrikay (2016)<sup>xi</sup>. The authors discussed that the Lister tubercle may be seen like a cortical disruption that mimics a displaced fracture of radius on the longitudinal axis. Therefore, emergency physicians should be aware of potential false positive results with sonographic examination.

### Conclusion

US examination has excellent sensitivity for diagnosis of distal radius fracture and appears superior in detecting cortical irregularities. Emergency physicians should consider both Ultrasound and X-rays as diagnostic tools for young patients with distal forearm trauma. Ultrasound can close the gap between high clinical suspicion and a questionable or even unremarkable X-ray and prevent negligence claims as a result of missed fractures.

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