A review of radiological imaging in the hand and wrist

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Abstract

Wrist injuries are common and ongoing wrist pain is a cause of functional loss in the general population especially affecting the younger population. It is a complex joint comprised of the distal radio-ulnar joint (DRUJ), the radio-carpal joint (RCJ), the intercarpal joints and the carpo-metacarpal joint (CMCJ). The primary radiological investigation of the wrist is plain film radiography. Advanced imaging techniques play an important role in evaluating the complex anatomy of bone and soft tissues of the wrist. This is a result of the bony arrangement, multiple ligamentous structures and triangular fibrocartilage complex (TFCC), which provide much needed support to the wrist. As such, second line investigations including ultrasound (USS), computerized tomography (CT) and magnetic resonance imaging (MR) are increasingly used to diagnose wrist pathologies. These modalities allow a more focused assessment of the bony and soft tissue structures in this region. This in turn can enable faster diagnosis of a patient's condition, leading to a more efficient management plan and a quicker return to functional activity. We hereby, present an educational review from an imaging perspective that demonstrates a range of pathologies that would otherwise be missed or unapparent if advanced imaging is not utilised.

Keywords radiological imaging; wrist pain

Learning objectives

- the wrist is a complex joint
- wrist pain is a common cause of functional loss in the general population especially young patients
- clinical assessment combined with imaging is important in helping to diagnose wrist problems
- multiple imaging modalities have different roles in assessing wrist pathology with various indications and application

Introduction

After the history and clinical examination, radiological evaluation is helpful in determining the treatment pathway and prognosis of patients. Plain films, consisting of posteroanterior, lateral, oblique, and scaphoid views, are traditionally the first line of investigation and this remains the case. Spot views of the carpal bones are less commonly used nowadays. Video fluoroscopy (see TFCC degeneration peripheral tear negative fluoroscopy), arthrography, bone scan and others are also less regularly used as part of the investigation pathway. USS, CT, MRI and MR arthrography of the wrist are the most readily available techniques and therefore have established themselves as the second line investigations after the plain film.

Ultrasound wrist protocol

Ultrasound (USS) is a valuable imaging modality for evaluation of patients presenting with wrist pain. We provide a comprehensive ultrasound service for one-stop orthopaedic, rheumatology and fracture clinics in our institution in order to diagnose common wrist pathologies without delay. USS scan is performed after the patient has been reviewed by the hand surgeons/clinicians and a further management plan is formulated during the same hospital visit. Ultrasound guided steroid injections are also performed in the same sitting if required. An important advantage of USS over other modalities is the ability to clinically correlate the symptoms at the time of image acquisition. The ability to dynamically assess the wrist and directly compare it with the contralateral side makes it a very effective diagnostic tool in day-to-day musculoskeletal (MSK) radiology. We use high-resolution linear array transducers with a broad bandwidth in order to produce better visualisation of superficial structures

Figure 1 TFCC Degeneration Peripheral Tear: The high vertical linear signal within the low signal TFCC on a PD Fat Sat coronal sequence on an MR arthrogram.

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Figure 2 Normal arthrogram: TFCC tear negative. There has been no leak of contrast to the midcarpal joint suggestive of intact scapholunate and lunatotriquetral ligaments.

and less beam divergence. The examination of volar structures may require the wrist to be flat or in slight dorsiflexion with either ulnar or radial deviation, whereas the examination of dorsal structures requires mild volar flexion with the palm down. There is a slight drawback to ultrasound that it does not clearly visualise the bony structures efficiently and it is extremely operator dependent.[1] However, USS is good at looking at early erosions for inflammatory arthropathy.

CT wrist protocol

For CT scans of the wrist and hand, a small field of view is applied, using bone and standard algorithms. Wrist CTs are reformatted in three orthogonal planes (coronal, sagittal and axial). A fourth plane, the oblique sagittal, is acquired if a

Figure 4 No fracture is seen within the scaphoid however there are degenerative changes seen in the scaphoid-trapezium-trapezoid (STT) joint, on plain radiograph ten days after initial trauma.

scaphoid fracture is suspected. The patient is positioned prone with the affected arm straightened in a 'superman position'. This particular position reduces dose delivery to other unrelated body parts, for example, the cornea, as well as reducing beam hardening artefacts due to overlying body parts. The coverage starts proximal to the DRUJ and finishes distal to CMCJs. Streak artefacts generated by orthopaedic fixation devices such as plates and screws may degrade CT images due to the extreme density of a metal piece. When the metal is large and unavoidable by any change in the orientation of the CT slices, the CT images may be

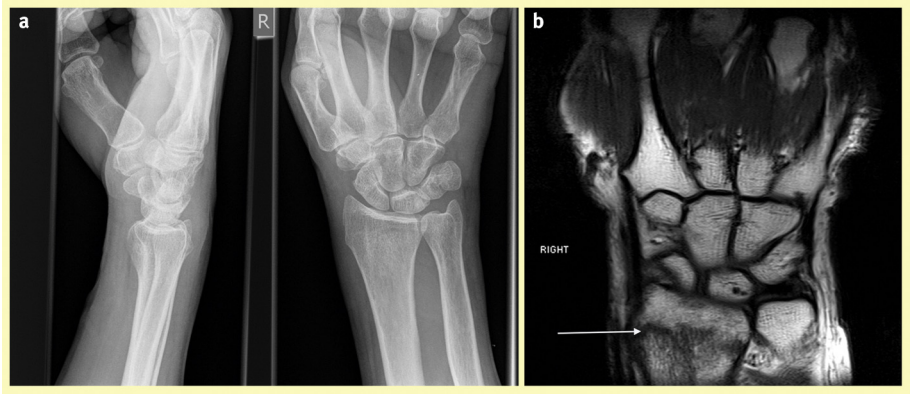

Figure 3 (**a**) Occult distal radius fracture not clearly visible on plain film but proven later on MRI. (**b**) T1 low signal intensity line distal radius on T1 coronal image in keeping with undisplaced fracture.