

## Case Report: Radioulnar Dissociation in a Child

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### Introduction

Distal radioulnar joint (DRUJ) dislocation is a rare and commonly missed injury in the paediatric population due to the absence of obvious clinical deformity. Failure to diagnose and treat complex DRUJ dissociation can result in persistent subluxation, dislocation and osteoarthritis [1, 2]. DRUJ dislocation is most commonly associated with specific fracture patterns- namely Galeazzi, Essex-Lopresti, ulnar styloid and distal radius fractures [3]. We present the case of an 8-year-old female that had DRUJ dislocation with a concomitant irreducible monteggia fracture. To our knowledge, this is the first case of DRUJ dislocation with anterior dislocation of the radial head reported in the paediatric population and demonstrates the need for prompt and careful evaluation of the ipsilateral distal radio-ulnar joint for associated instability.

### Case Report

An 8-year-old right hand dominant schoolgirl presented to the emergency department following a fall from bed. She had an unwitnessed fall landing on her right elbow in flexion. She presented with her mother complaining of right elbow pain and inability to rotate her forearm. The patient's co-morbidities include hypothyroidism and increased BMI, and had no previous injuries to the wrist, forearm or hand and up to date with immunisations.

On examination she had generalised forearm and elbow swelling with no obvious bony deformity. There were no sensory or motor deficits and distal pulses were intact, and the skin was intact.

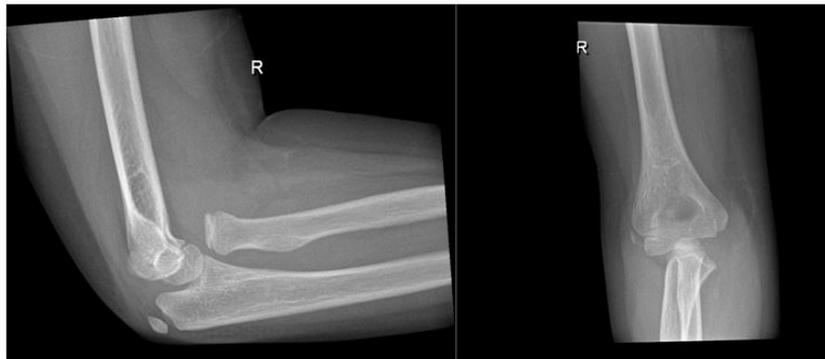
Initial radiographs demonstrated a dislocation at the elbow joint with anterior displacement of the radial head associated with a small elbow joint effusion. Furthermore, a cortical buckle to the dorsal aspect of the distal humerus was seen suggesting a minimally displaced supracondylar fracture. A subtle lucency to the radial head metaphysis suggestive of a Salter-Harris 2 fracture of the radial head was also reported. Anteroposterior and lateral radiographs of the right forearm demonstrated dorsal displacement of the distal ulna at the carpus indicative of DRUJ dislocation.

The patient was initially placed in an above elbow plaster in the emergency department. A closed reduction of the DRUJ and radial head dislocation under general anaesthetic was attempted but failed. The DRUJ was persistently unstable, most stable in supination and the radial head was irreducible. The patient was placed in an above-elbow plaster and transferred to a tertiary paediatric trauma centre. The patient was taken to theatre again with reduction of radial head and repair of annular ligament. Unfortunately,

post-operative imaging demonstrated dislocation of the radiocapitellar joint necessitating further return to theatre. Intraoperatively, the radial head had displaced through the previous anterior capsular rent, although the annular ligament repair was intact.

After further assessment, it was also noted that the patient had a grossly unstable ulnohumeral joint and radiocapitellar joint, together with an unstable distal radioulnar joint.

This is a most unusual injury, given instability of the ulnohumeral joint, with separate instability of the proximal radioulnar joint/radiocapitellar joint, and instability of the distal radioulnar joint. These joints were reduced and temporarily fixed with K-wires to enable satisfactory stability.

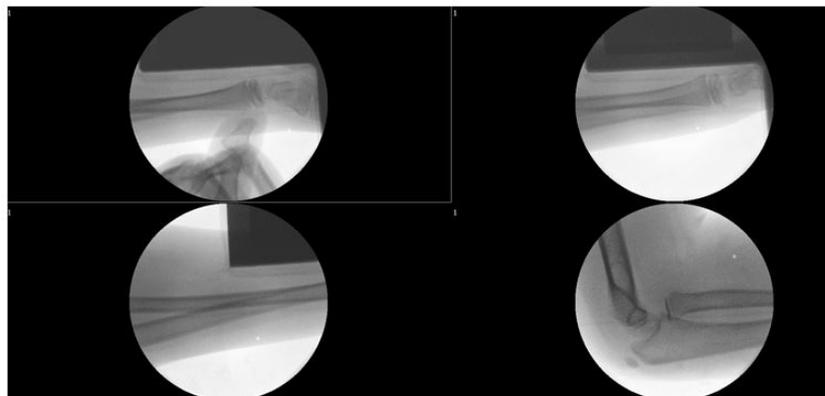


(a) Elbow AP/Lateral

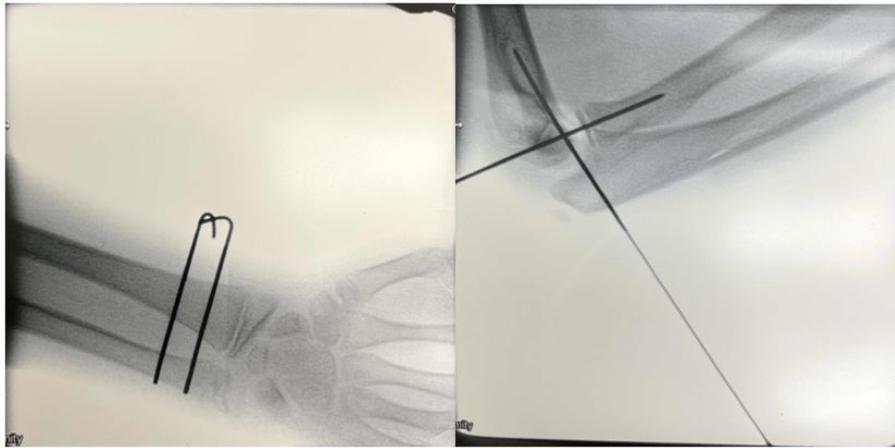


(b) Wrist AP/Lateral

**Figure 1:** Initial radiographs



**Figure 2:** Intraoperative Imaging – Failed closed reduction



**Figure 3:** Intraoperative imaging – Open reduction and k-wire fixation at wrist and elbow

## Discussion

The distal radioulnar joint (DRUJ) plays a critical role in forearm rotation, hand positioning in space, and it is an inherently unstable structure [4]. The DRUJ allows for supination and pronation which are essential for upper limb function [3]. Given the radius and ulna are shaped differently; movement at the DRUJ can result in translocation of these bones. For example, during supination and pronation, the ulnar head translocates in a volar and dorsal [3].

The DRUJ is supported by multiple structures including the triangular fibrocartilaginous complex (TFCC), extensor retinaculum, pronator quadratus, ulnar carpal ligaments and interosseous membrane [3]. Kinematic studies demonstrate that removal of these structures result in significant instability of the DRUJ [3]. Of these structures, the TFCC is considered the most critical [3]. However, DRUJ dissociation is a commonly missed injury, with up to half missed on initial evaluation, particularly if the injury is not associated with a fracture [3].

To our knowledge, this is the first case of DRUJ dislocation with anterior dislocation of the radial head in a paediatric patient. Dislocation of the distal radioulnar joint (DRUJ) is most often associated with fracture of the radius or ulna, and isolated DRUJ dislocation without fracture is uncommon. Acute isolated paediatric DRUJ dislocation injuries are even more rare with Trousdale et al (1992) and Dello Russo et al (2009) series being the most comprehensive reviews of such an injury [5,6]. Similar to our report, the most common mechanism of injury was due to fall, however in adults it can also result due to a direct blow to the ulnar aspect of the wrist [7]. None of the reported injuries involved dislocation of the radial head [5,6]. Our case demonstrated dorsal displacement of the distal ulna, which is more common following hyperextension and hyperpronation as the ulna moves dorsally relative to the radius as a result of avulsion of the TFCC from its insertion [8]. Additionally with the hyperextension, our patient sustained a concomitant anterior radial head dislocation [9]. In paediatric populations, radial head dislocations are usually complicated by complete elbow dislocations or fractures, such as Monteggia fracture complexes [10]. This occurs because force is transmitted down the shaft of radius and the annular ligament is disrupted anteriorly resulting in isolated radial head dislocation [9].

The majority of case reports relating to DRUJ dislocation in paediatric patients demonstrated a delay in diagnosis as the injury can be easily hidden from clinical and radiographic examinations [11]. In the case of dorsal dislocation, the wrist is locked in pronation with the patient unable to supinate. The diagnosis can be suspected on the basis of the clinical history and of physical examination, and confirmed by radiographic examination [12]. Both postero-anterior and true lateral x-rays are essential to make the diagnosis of DRUJ dissociation [13]. In the postero-anterior view, the distal ulna groove for the extensor carpi ulnaris tendon must be seen radial to the ulnar styloid. Rotation of the forearm during the radiologic examination will alter the position of the ulna making the diagnosis of DRUJ dislocation difficult [3]. To achieve a true lateral view, the volar surface of the pisiform should be positioned equidistant between the volar margins of the distal pole of scaphoid and capitate. Should it be difficult to illicit DRUJ instability

or dislocation, a clenched fist PA view in forearm pronation to assess DRUJ gap and a weight lateral stress view in pronation can be helpful [14,15]. If the diagnosis is uncertain, it can be confirmed by further imaging like computed tomography (CT) scan or Magnetic resonance imaging (MRI), which demonstrates any joint incongruence.

Management of acute DRUJ dislocation without fracture can be attempted with closed reduction. This is usually performed under local anaesthetic with or without sedation. In our case, dorsal dislocation of the ulna was attempted with gentle traction, dorsal pressure over the ulnar head, followed by supination. Should reduction be achieved, the DRUJ should be assessed for stability and typically is most stable in supination [16]. Typically, the injury can be immobilised with a forearm above-elbow plaster in its most stable position for 6 weeks. Given that the TFCC has been shown to have good vascularity and healing potential, closed reduction does result in restored construct [17]. In our case however, we demonstrated that there was marked instability after attempted reduction, this can be attributed to the inability to reduce the concomitant radial head dislocation. In DRUJ dislocations, the tendon of the extensor carpi ulnaris (ECU) can be displaced either to the ulnar or radial border of the distal part of the ulna. Potential factors that can prevent reduction and stability in DRUJ dislocation include displacement of the ulnar styloid which can cause ECU tendon dislocation, entrapment of the extensor digitorum communis to the ring and little finger, the extensor digiti minimi, the flexor pollicis longus, fragments of a torn TFCC or the median nerve [2]. In such cases, radioulnar pinning is performed with the DRUJ reduced to allow for healing of soft tissues using one or two Kirschner wires proximal to the DRUJ and its respective physes [16,18]. If the dislocation proves to be irreducible following closed reduction, open reduction in combination with repair of the TFCC is recommended [19].

## Conclusion

This case study demonstrates an unusual pattern of injury in a paediatric patient and highlights the need for prompt and careful evaluation of ipsilateral DRUJ for instability in association with any lateral sided injury of the elbow.

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