Distal radius triplane fracture

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ABSTRACT

A triplane fracture is so named because of the three planes traversed by the fracture line. These are physeal fractures that result from injury during the final phase of maturation and cessation of growth. This fracture pattern typically involves the distal tibia. We present a rare case of a triplane fracture involving the distal radius.

KEYWORDS

Distal radius – Triplane fracture – Salter–Harris classification

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A triplane fracture is so named because of the three planes traversed by the fracture line.¹ It was first described by Johnson and Fall in 1957 and a detailed description of a distal tibia fracture was given by Marmor in 1970.^{2,5} The Salter–Harris classification system can be applied to the vast majority of epiphyseal fractures. However, some fractures are too complex to be classified by a specific classification system.⁴ Triplane fractures are an example of this problem.

Triplane fractures are physeal fractures that result from injury during the final phase of maturation and cessation of growth. Magnetic resonance imaging of the distal radius has shown various grades of fusion, which result ultimately in complete fusion at the age of 17 or 18 years in boys.⁵ The triplane configuration of the fracture is the result of the characteristic asymmetric closure of the physis. Although this fracture pattern has been reported commonly in the distal tibia, there have been case reports of triplane fractures in the distal humerus,⁶ proximal phalanx of the hand⁷ and distal radius^{1,2} as well as in the distal femur.⁸ Unlike previous case reports, we present a case of a new pattern of triplane fracture involving the distal radius.

Case History

A 15-year-old boy presented with an acutely painful and swollen wrist following a fall from bicycle. The injury was closed, with no neurovascular deficit. Plain radiography showed an unusual fracture pattern at the intra-articular distal radius (Fig 1). Computed tomography (CT) confirmed a fracture in three planes suggesting Salter–Harris type III and IV patterns. The type III pattern was noted through the radial styloid, and the type IV patterns separately through the scaphoid and lunate fossa. The distal radioulnar joint and the radiocarpal joints were also involved. However, the overall displacement was less than 2mm (Fig 2).

The injury was treated in a below-elbow plaster cast for four weeks, at which point his wrist was mobilised as there was no tenderness over the distal radius. He was advised to resume his normal activities gradually and participate in contact sports at eight weeks from the date of injury. Subsequent follow-up appointments showed satisfactory clinical and radiological fracture union.

The patient's progress was assessed both clinically and radiologically up to two years following the injury. At one year, he remained completely asymptomatic with normal range of wrist motion. On clinical examination, there was no distal radioulnar instability, deformity, radioulnar length discrepancy or ulnar prominence. His DASH (Disabilities of the Arm, Shoulder and Hand) score was zero and his Mayo wrist score was 'excellent', suggesting no disability. Similar clinical findings, along with a DASH score of zero and an excellent Mayo score, were noted at his two-year follow-up visit.

The patient had plain radiography of both wrists at the one and two-year follow-up appointments. At one year, he was 16 years old and his uninjured wrist started showing early signs of normal physiological growth plate fusion. Compared with the opposite side, his injured distal radius demonstrated discrepancy in growth plate fusion as it showed premature partial fusion of the physeal plate (Fig 3). At two years, he was 17 years old and his plain radiography showed complete fusion of the physis in the injured side except a small area near the radial styloid while the physeal scar was still visible in the uninjured wrist (Fig 4).

Discussion

The distal radial physis is reported to be the most commonly separated physis following trauma in children but subsequent growth disturbance is unusual.⁹ Unlike for the distal tibia, a distal radius triplane fracture is a very rare

Figure 1 Plain radiography showing unusual distal radius fracture pattern

Figure 2 Computed tomography confirming triplane fracture, Salter-Harris types III and IV

injury. Although triplane distal radius fractures have been reported in the paediatric orthopaedic literature, this particular fracture pattern has not been reported previously. Furthermore, to our knowledge, this is the first case report explaining this injury in detail with CT.

In cases of triplane fractures of the distal tibia, the fracture patterns are combinations of Salter-Harris types II, III and IV.⁵ Previous case reports of distal radius triplane fractures showed a fracture pattern of type II and III.^{1,2} This is the first case of a distal radius triplane fracture showing types III and IV. As confirmed on CT, there was a Salter-Harris type III component through the radial styloid, a type IV component through the dorsal scaphoid fossa and another type IV fracture through the lunate fossa to the dorsal metaphysis.

Several authors have suggested open reduction and internal fixation for Salter-Harris type IV fractures.¹ Unlike the distal tibia, the distal radial and ulnar physis contribute

Figure 3 Plain radiography at two-year follow-up visit showing discrepancy in growth plate fusion between both wrists

Figure 4 Plain radiography at two-year follow-up visit showing complete fusion of physis in injured side except a small area near the radial styloid while the physal scar is still visible in the uninjured wrist

75–80% of total growth of the forearm, suggesting excellent remodelling potential for these injuries.¹⁰

Conclusions

Based on our experience, we would like to recommend that in the absence of significant displacement, triplane fractures of the distal radius should be managed conservatively, similar to normal single plane fractures.

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