



Severe joint cartilage degeneration after minimally displaced fracture of proximal radius in children: a report of 2 cases



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It is estimated that 6%-7% of upper-extremity fractures in children occur around the elbow.³ Among them, proximal radius fractures are less prevalent, with extra-articular fractures of the radial neck being the most frequent.^{3–5} Intra-articular fractures of the proximal radius are rare but associated with a poor functional prognosis in patients with immature skeletons. Reports in the literature regarding intra-articular fractures in skeletally immature patients are scarce.^{1,2,4,8} Van Zeeland et al⁸ presented a series of 7 cases with an average age at the time of injury of 10 years 6 months and reported progressive radiocapitellar subluxation and osteoarthritis in all cases. In a cohort of 311 patients, Ackerson et al¹ identified 12 patients with intra-articular fractures of the proximal radius with an average age of 11.4 years and compared the complications with a group with extra-articular fractures, with rates of 50% for the intra-articular fractures and 1.34% for the extra-articular fractures. Moreover, Leung and Peterson⁴ found poor functional results in 5 of 6 patients.

We present 2 cases of patients with immature skeletons and intra-articular fractures of the proximal radius, one of whom also had a minimally displaced fracture of the lateral epicondyle, who were treated conservatively in the acute phase and presented later with severe and diffuse chondral degeneration. Surgical treatment of their sequelae and outcomes at 3 years' clinical follow-up are reported.



Figure 1 Anteroposterior plain radiograph of left elbow in case 1 showing marginal lateral epicondylar fracture and minimal intra-articular proximal radius fracture.

The ethics committee of our institution approved this study, and each subject gave written informed consent.

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Figure 2 Lateral plain radiograph of left elbow in case 1 showing marginal intra-articular proximal radius fracture.

Case presentation

Case 1

A 13-year-old boy presented to the emergency department after a fall on the outstretched left arm. On plain radiographs, we observed a Salter-Harris (SH) type IV or Peterson type 5 fracture of the radial head, with a possible marginal bone fracture of the lateral epicondyle (Figs. 1 and 2). The patient was immobilized with a long-arm cast for 3 weeks, after which a non-painful joint was

maintained with full range of motion (ROM). However, 6 months later, the patient returned, complaining of pain, stiffness, and locking of the elbow, with active ROM of 30°–130° of flexion-extension (FE) and normal pronation-supination (PS). New radiographs and a computed tomography scan showed decreased joint space and irregularities at the ulnohumeral and radiocapitellar joints, with marginal osteophytes and epiphyseal sclerosis of the radial head, significant joint effusion, and synovitis (Figs. 3 and 4). An elbow arthroscopy was performed for synovectomy, débridement, and excision of loose bodies and chondral flaps. At 3 years' follow-up, the patient had mild pain, had returned to sport (sailing), and had active ROM of 20°–140° of FE and normal PS with a Mayo Elbow Performance Score of 85 points.

Case 2

An 11-year-old boy presented after a fall on the outstretched arm from a 2-m height. Plain radiographs and a computed tomography scan showed an SH type IV or Peterson type 5 proximal radial head fracture (Figs. 5 and 6). The patient was immobilized with a long-arm cast for 3 weeks, with a good clinical outcome initially. Eight months later, he reported pain and frequent elbow locking with limited ROM of 25°–130° of FE, normal pronation, and 50° of supination. On magnetic resonance imaging (MRI), we observed joint effusion, extensive elbow synovitis, a hypertrophic radial head with posterior subluxation and radiocapitellar joint incongruity, bone edema, and epiphyseal necrosis of the radial head (Fig. 7). On elbow arthroscopy, we observed a significant chondral injury (grade IV) at the capitellar surface and ulnar greater sigmoid notch. We proceeded to perform partial synovectomy, microfracture, and anterior capsule release. Owing to radiocapitellar joint incongruity and posterior radial head subluxation, we decided to perform open radial head excision (Fig. 8). At 3 years' follow-up, the patient reported mild pain with heavy sporting activities and had



Figure 3 Anteroposterior and lateral plain radiographs of left elbow in case 1 showing irregularities at articular ulnohumeral and radiocapitellar joint, with marginal osteophytes and epiphyseal sclerosis of radial head.



Figure 4 Coronal and sagittal computed tomography scans of left elbow in case 1 showing degenerative changes in ulnohumeral and radiocapitellar elbow compartments.

active ROM of 0°-140° of FE, normal PS, and a Mayo Elbow Performance Score of 85 points.

Discussion

Most proximal radius fractures in children occur in the radial neck and are extra-articular.^{3,5} Intra-articular fractures of the proximal radius are rare in patients with immature skeletons.^{1,4} Published series coincide on the high rate of complications when this combination occurs.^{1,2,4,8} We have presented 2 cases of children with proximal intra-articular radius fractures with minimal displacement observed on simple radiographs, both managed conservatively and presenting after 6-8 months with pain, restricted ROM, and articular cartilage degenerative changes, requiring surgical treatment. It is important to note the severe and relatively rapid joint destruction of both the radiocapitellar and ulnohumeral compartments. In case 1, in addition to the proximal radius fracture, a possible marginal lateral epicondylar fracture also occurred. Given his clinical evolution, it is very possible that there was a more severe chondral lesion that included the articular cartilage of the capitellum and that was not suspected based on the simple radiographs.

In case 2, enlargement of the radial head and radiocapitellar joint incongruity led us to consider resection of the radial head, despite the patient's young age. Arthroscopic evaluation in both cases showed significant synovial inflammatory changes, loose bodies, and grade IV chondral lesions. These findings are in agreement with those of published case reports regarding complications described when intra-articular fractures of the proximal radius occur in patients with open growth plates. Although these injuries are infrequent, they are associated with poor functional results in the literature.^{1,2,4,8}



Figure 5 Anteroposterior plain radiograph of right elbow in case 2 showing Salter-Harris type IV proximal radius fracture.

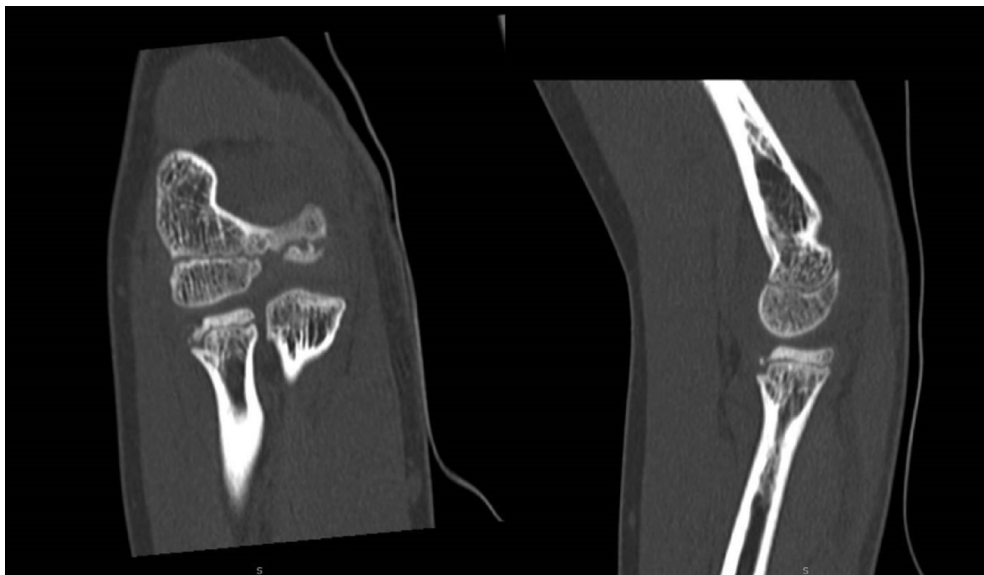


Figure 6 Coronal and sagittal computed tomography scans of right elbow in case 2 showing Salter-Harris type IV proximal radius fracture.

In a retrospective study, Leung and Peterson⁴ reported on 116 children with proximal radius fractures. Of these patients, 33 had closed physes, of whom 17 (52%) had intra-articular fractures (SH type III or IV). In contrast, of the 83 patients with open physes, only 6 (7%) had intra-articular fractures. In all cases with intra-articular fractures and open growth plates, premature physal arrest and circumferential enlargement of the radial head occurred. In 3 cases, resection of the radial head was performed. In this series, the only patient who had a good outcome was the one who was treated surgically initially. Van Zeeland et al⁸ reported on 7 cases with the same combination of injuries referred for management after

undergoing conservative treatment at the time of acute trauma. On average, the referral occurred 12 months after the trauma, with lateral elbow pain and restricted ROM in FE and PS being the reasons for consultation. In all cases, the initial diagnosis was an SH type III or IV fracture and simple radiographic studies showed posterior subluxation of the radial head, radiocapitellar osteoarthritis, and premature physal closure. Unlike in our cases, no involvement of the ulnohumeral joint was reported. Of the 7 cases, 6 were treated surgically, and resection of the radial head was necessary in 3 of them. In 4 cases, annular ligament injury was reported, so the authors speculated that proximal radius instability

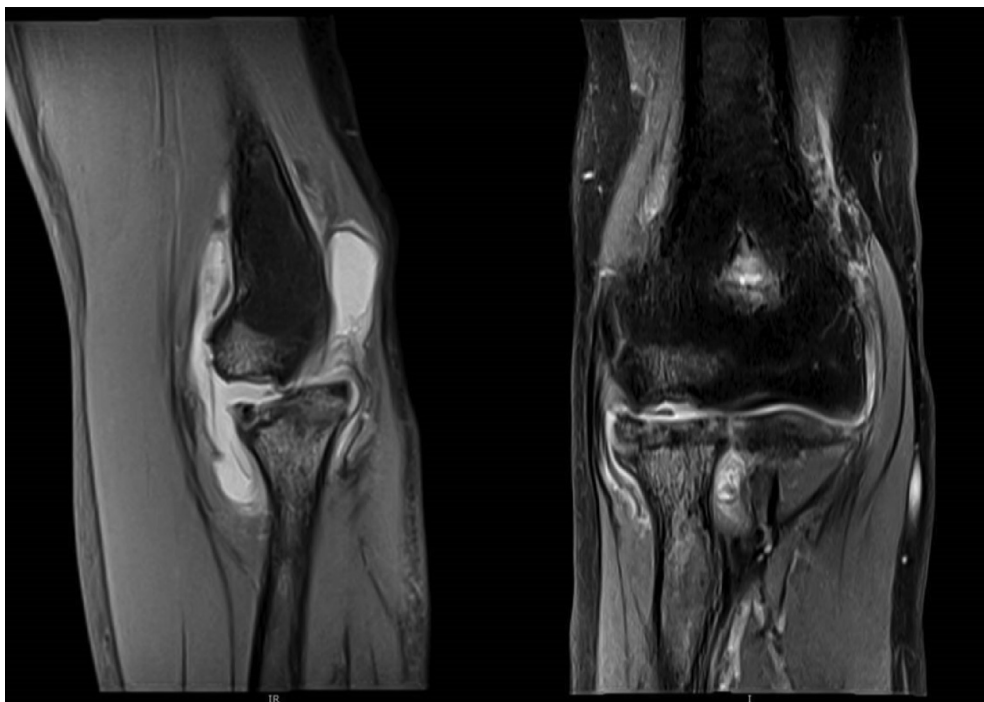


Figure 7 Sagittal and coronal fat-saturation magnetic resonance imaging sequences of right elbow in case 2 showing joint effusion, hypertrophic radial head with posterior subluxation, bone edema, and epiphyseal necrosis of radial head.

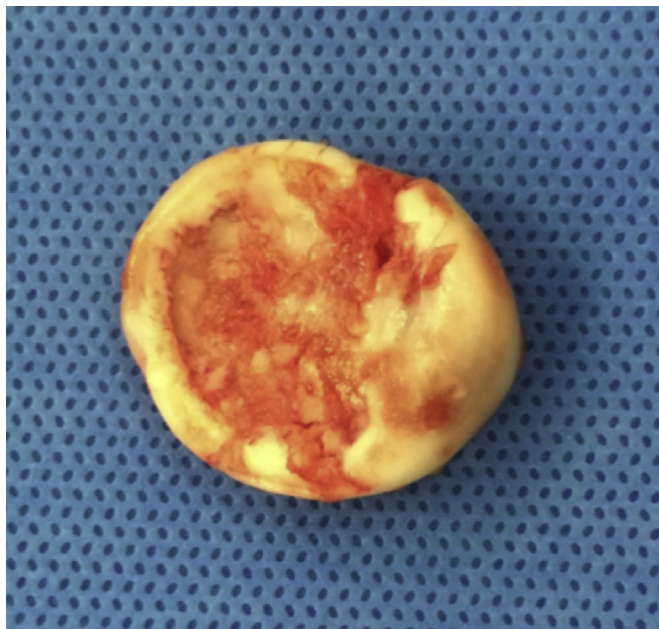


Figure 8 Excised radial head in case 2 showing severe and diffuse chondral injury.

was an associated factor in the etiopathogenesis of joint damage. In a retrospective series, Ackerson et al¹ published 311 cases with proximal radius fractures and immature skeletons, reporting extra-articular fractures in 299 patients (96.1%) and intra-articular fractures in 12 (3.9%). The rate of complications was significantly higher in the intra-articular fracture group than in the extra-articular fracture group: 50% vs. 1.34%. Pain, restricted ROM, and chondral injuries were the complications described in the group with intra-articular fractures.

Most studies of proximal radius fractures in children report good results in general, which can be explained because they mainly include extra-articular fractures, without making specific reference to intra-articular fractures.^{6,7,9} We do not exactly know the reason for the poor prognosis of these injuries. Probably at the moment of trauma, chondral lesions occur in the radial head or in the capitellum that are not diagnosed by simple radiologic studies. For this reason, we strongly recommend performing more advanced imaging studies at an early stage, such as MRI or ultrasonography, when facing intra-articular fractures in patients with open physes.¹¹ In a recently published study, Dragoni et al² reported 6 cases, with 3 managed conservatively and 3 treated surgically. The clinical results were significantly better in patients who underwent reduction and internal fixation as primary treatment. In accordance with the assertion of Dragoni et al, these lesions should be suspected when there is clinical discrepancy between pain and

significant functional limitations and apparently insignificant findings on simple radiographs. Waters et al¹⁰ described these fractures as TRASH (“the radiographic appearance seemed harmless”) lesions. If displaced chondral or osteochondral lesions are found, we think it is advisable to treat them initially with open reduction and internal fixation.

Conclusion

This report underlines the association between intra-articular proximal radius fractures in skeletally immature patients and poor clinical outcomes. This case study also suggests the need for a high index of suspicion regarding chondral lesions in minimally displaced or nondisplaced intra-articular proximal radius fractures in patients with open physes, and more advanced imaging studies (MRI) are advocated in these cases.

Disclaimer

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