Radiology Corner

Gymnast Wrist

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Note: This is the full text version of the radiology corner question published in the February 2009 issue, with the abbreviated answer in the March 2009 issue.

We present a case of bilateral wrist pain in an adolescent female who is active in competitive sports. Multiple imaging modalities demonstrate a case of gymnast wrist. A discussion of gymnast wrist and differential diagnosis are presented.

Introduction

A young adolescent female presents with complaint of bilateral wrist pain for almost one year. She is otherwise healthy with no other complaints. She has been competitive in sports such as gymnastics and high board diving for several years. Conservative treatment to include short term rest, Non Steroidal Anti-Inflammatories (NSAIDS) and physical therapy have not resolved her symptoms.

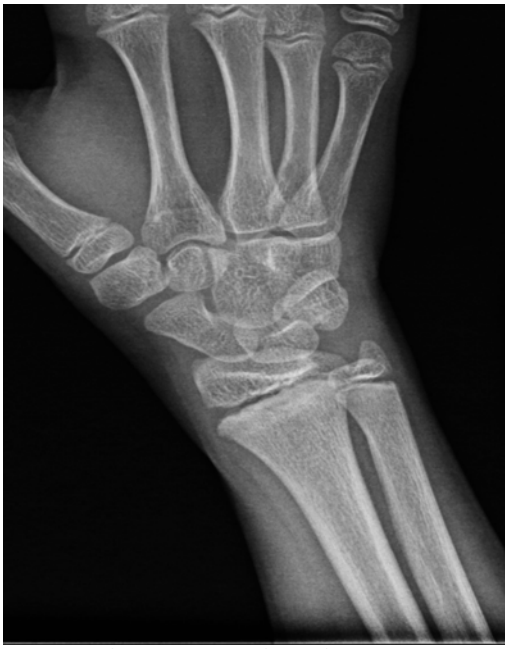

Fig 1: Oblique plain film radiograph of the left wrist demonstrates irregular contour and widening at the radial physis.

Summary of Imaging Findings

Initial presentation oblique plain film radiograph of the left wrist (Fig 1) demonstrates contour irregularities and widening at the radial physis. Not shown is the right wrist with similar findings.

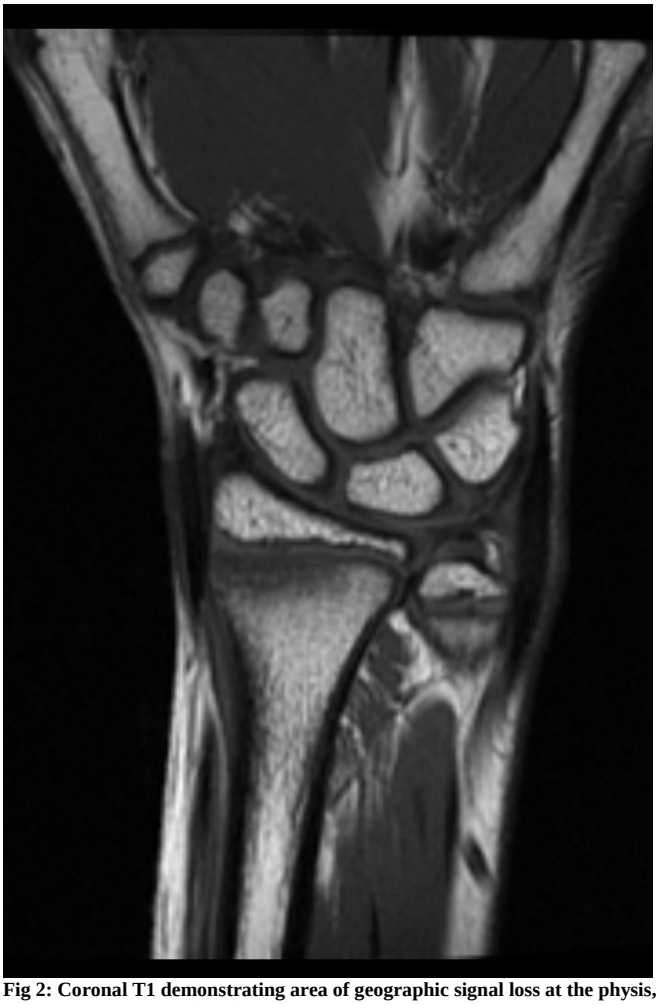

Fig 2: Coronal T1 demonstrating area of geographic signal loss at the physis, correlating with plain film findings.

Upon presentation, coronal T1 and T2 with fat saturation images (Fig 2,3) of the left wrist demonstrates an area of geographic signal abnormality at the physis, correlating with the plain film findings.

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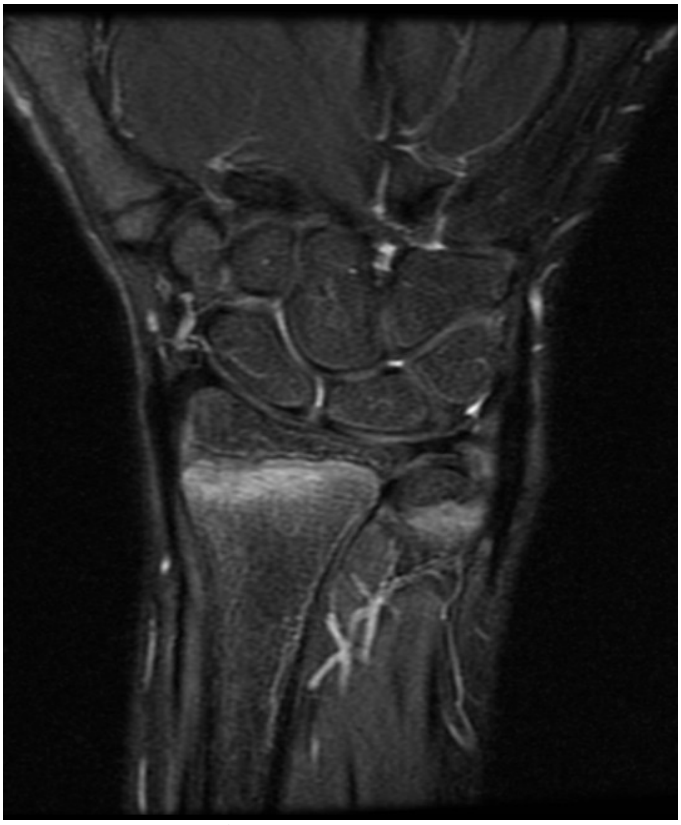


Fig 2, 3: Coronal T2 with fat saturation demonstrate low and high signal band on the metaphyseal aspect of the radial physis respectively.

Follow up plain film image of both wrists (Fig 4) after nearly one year of complete cessation of offending activities; demonstrates partial resolution of contour irregularities with sclerosis indicating healing.

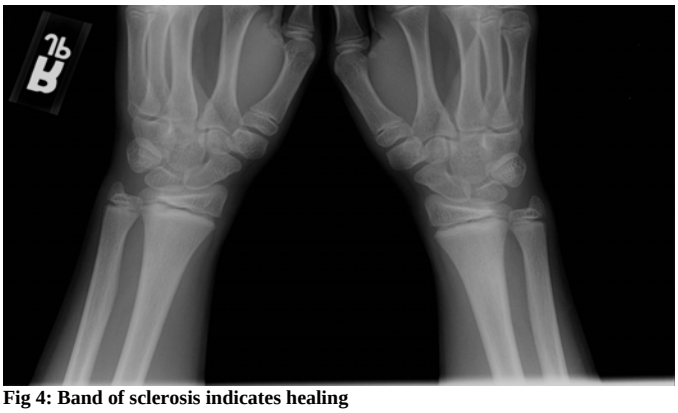


Fig 4: Band of sclerosis indicates healing

Coronal T1 and T2 with fat saturation images (Fig 5,6) obtained within three days of the plain films illustrate near resolution of the findings seen on presentation. Signal abnormalities are consistent with edema indicating healing.

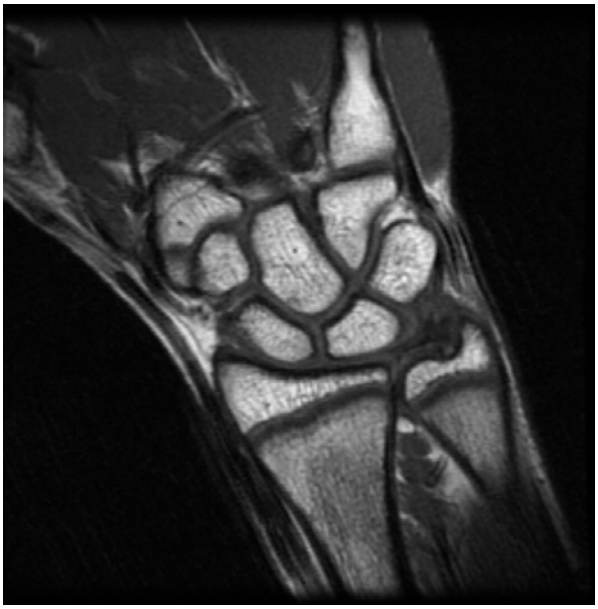
Discussion

Gymnastics is a sport of the youth, and has gained in popularity over recent years. Many athletes enter the sport by age 7, reach peak involvement during pre-teen and teenage years, with almost all ending competition before age 20.[1,2] Greatest participation and maximum training often coincides with the athletes' period of maximum growth.[1] Depending on the level of competition, some of these skeletally immature athletes devote upwards of 60 hours per week to intense training.[1] During training and competition, gymnasts subject their wrists to high levels of stress including repetitive axial loading, torsion, and extremes of position, effectively making the wrist a weight bearing joint. The repetitive stresses on skeletally immature wrists result in a high rate of injury and disability.[3] In fact, wrist pain is so common among gymnasts that many consider it a normal part of the sport.[4]

"Gymnast wrist" refers to the result of chronic repetitive loading of the skeletally immature distal radial physis.[1] The etiology is thought to be Salter Harris type I stress microfractures of the epiphysis due to chronic repetitive shear stress applied to the hyperextended wrist joint.[5,6,7] The chronic stress on the immature distal radius can disrupt the metaphyseal vascular network, which lies in the weakest layer with the least amount of collagen matrix and ossification.[4,5] Chondrogenesis continues in the germinal zone, but does not fully transform to normal bone because a sufficient vascular network is required for ossification of primary spongiosa. The decreased ossification results in a widened irregular growth plate.[1,4]

Changes in the distal radial physis of young gymnasts have a characteristic radiographic appearance. Typical radiographic findings of distal radial physis stress reaction include widening of the distal radial physis, mainly on the radial volar aspect, cystic changes in the periphyseal metaphysis, and palmar and radial beaked appearance of the distal epiphysis.[1,2,4] The physis may also appear hazy due to irregularity of the border between the cartilage and the metaphyseal zone of ossification.[2,4] Narrowing of the distal ulnar epiphysis has also been documented.[2]

Patients who present with gymnast wrist typically complain of chronic dorsal wrist pain and swelling exacerbated by activity, especially axial loading and dorsiflexion.[2,8] Treatment consists mainly of early recognition and cessation of aggravating activities while allowing the wrist to heal.[2,4] For athletes with symptoms but no radiographic changes, 4 weeks of rest without weight-bearing activity usually results in resolution of symptoms. However, the recovery period is significantly longer if there are radiographic changes. In these cases, splints or casts may be used and it may take 3 to 4 months of non-weight bearing on the affected wrist before symptoms resolve. Patients should be asymptomatic with full range of motion and non-tender during forced dorsiflexion and axial loading before resuming training. A gradual re-introduction to training is recommended, and wrists should be taped or braced to inhibit extreme positioning.[2]



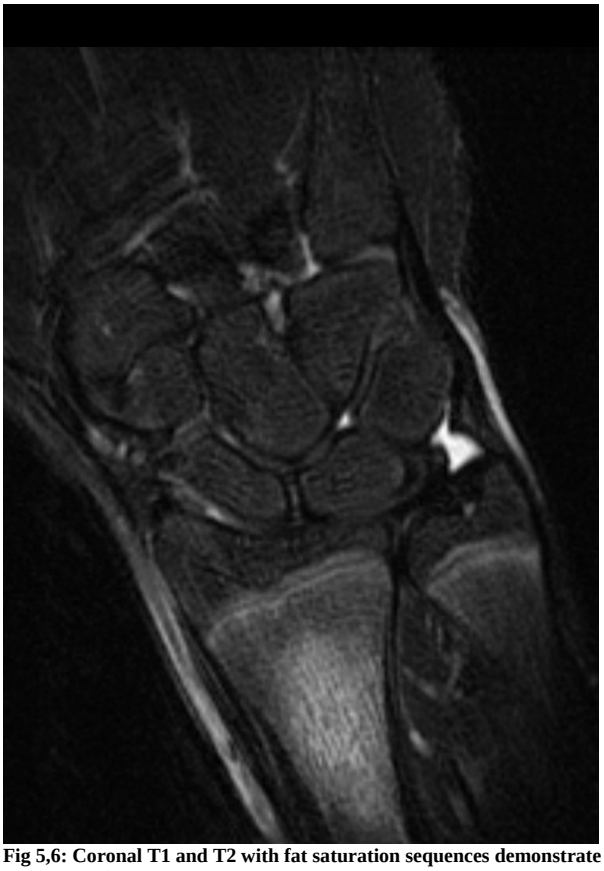


Fig 5,6: Coronal T1 and T2 with fat saturation sequences demonstrate resolution of signal abnormality adjacent to the physis and mild signal abnormalities more proximally in the metaphysis consistent with edema secondary to healing.

Prognosis is good if the joint is rested and circulation is re-established to the cartilage, thereby allowing ossification to continue. Transformation to normal bone usually occurs rapidly and the injury heals much as any stress fracture would.[4] Long-term sequelae are uncommon if the condition is recognized and treated early. However, permanent changes have been documented. These changes include premature closure of the radial physis, which leads to a positive ulnar variance and increased radial-ulnar slope, where the length of the distal ulna exceeds the length of the distal radius.[2,3,4,8] An acquired Madelung deformity has also been recognized.[2,3,4,9] Madelung deformity of the wrist is characterized by a growth disturbance in the volar-ulnar distal radial physis that results in volar and ulnar tilting of the distal radial articular surface and volar translation of the hand and wrist with a dorsally prominent distal ulna.

The authors presented a typical case of gymnast wrist with plain radiographic and MR findings.

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