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Wrist pain in a 13-year-old gymnast

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Question

A 13-year-old female gymnast, presented with 6 weeks of left wrist pain. She denied fever or trauma to the wrist. She started competitive training in artistic gymnastics at 7 years of age and joined the national gymnastics team a year ago. Her training duration was 5 hours daily and her training routine involved floor gymnastics and parallel bars whereby she had to constantly apply pressure on both extended wrists. Examination revealed tenderness and swelling on the radial palmar aspect of her left wrist. There were no other joint or bony tenderness. Left wrist X-Ray revealed widening of the physeal plate with adjacent metaphyseal sclerosis and irregularities of the left distal radius (Figure 1A and B). Her right wrist X-Ray showed similar changes but to a milder degree. Bilateral knee X-Rays were normal. She was also found to have vitamin D insufficiency (25 hydroxy Vitamin D 32nmol/L). Her serum parathyroid hormone (PTH) was mildly elevated 6.92pmol/L (1.58-6.03), but other bone metabolic screening was normal (Calcium 2.23mmol/L, phosphate 1.2mmol/L, alkaline phosphatase (ALP) 368IU/L). What is the aetiology of her wrist pain?

Answer

Radiological physeal abnormalities in paediatric gymnasts with wrist pain, also known as gymnast's wrist, is due to compressive forces on the physis, usually affecting the radius.[1,2] The chronic compressive and shearing forces on the physis result in ischemia of the physeal hypertrophic zone and failure of ossification with the risk of subsequent microfracture.[1] This process is amplified between 10 to 14 years of age during growth spurts.[2,3] In the case of our patient, she was 13 years of age and was in mid puberty (Tanner stage 3) at initial presentation. The relationship between physeal injury and its preponderance during puberty may be explained by transient physeal weakness during growth spurts and greater ligament laxity due to estrogen exposure.[3-5]

Eventhough this patient had insufficient 25 hydroxyvitamin D levels and slightly raised PTH, her ALP remained normal which could not explain the metaphyseal abnormalities seen. Besides that, the radiological changes in her were not typical of rickets i.e. fraying, cupping, splaying and osteopenia. Furthermore, ricket changes are commonly also seen in the distal femur, which was missing in our case. In gymnast's wrist, the radiological changes described are physeal plate widening with metaphyseal irregularities and sclerosis, which were also seen in our patient.[1,5] Concomitant vitamin D insufficiency increases the risk of physeal stress fracture and should also be treated.

Management is cessation of all impact activities to the upper extremities for 6 weeks to 6 months depending on severity.[2,5,6] Other adjunct therapy is physiotherapy to regain mobility and strength as well as bracing in the rehabilitation phase.[5,6] Unawareness of this entity may lead to vitamin D replacement only but inadequate period of rest. The patient was instructed to refrain from intensive training activities, and to wear a thermoplastic splint after which there was improvement in her radiological findings with reduced pain and swelling after 3 months. She was also treated with vitamin D and calcium supplements with normalization of vitamin D and PTH levels noted. Delayed diagnosis and improper management may result in premature physeal growth arrest of the radius with positive ulnar variance, a

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debilitating sequelae that can lead to ulnar impaction, wearing of the triangular fibrocartilage complex and chronic wrist pain.[1,3,5]

Gymnast's wrist can be prevented by usage of proper equipment and proper technique. Early detection is by actively screening for symptoms of wrist pain especially in gymnasts with long hours of practice. This condition has three clinical stages.[1,5] In stage 1, there are symptoms of wrist pain without radiological findings.[1,5] In stage 2, physeal irregularities are present while in stage 3, positive ulnar variance in addition to physeal changes is present.[1,5] Early diagnosis and proper treatment is crucial to limit the extent of injury. Individualized training with reduced high loads during growth spurts, alternate loading activities and usage of wrist orthosis during training can be considered to prevent the development of this condition.[5]

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Figure Legends:

Figure 1A and B: Widening of the physeal plate with adjacent metaphyseal sclerosis and irregularities of the left distal radius.