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Epiphyseal Lesions of the Fingers in Adolescent Sport Climbers

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Abstract

Introduction: Typical injuries of the fingers in sport climbing are lesions of the flexor tendon pulley system. However, in adolescent high-performance sport climbers, epiphyseal lesions seem to be underestimated. Based on X-ray imaging, Salter-Harris Typ III epiphyseal fractures have already been described. Using magnetic resonance imaging (MRI), we believe, that the number of such lesions is higher than assumed in general. Furthermore, Salter-Harris Typ I and II epiphyseal fractures can also been found.

Methods and Materials: 13 high-performance sport climbers (14 – 16 y; m:f = 8:5) were seen with atraumatic, painful movement restriction of the proximal interphalangeal (PIP) joints (D3: n=10; D4: n=3). Following unsuspicious X-ray, MRI was performed in each case. Due to persisting symptoms digital volume tomography (DVT) was indicated in 3 cases.

Results: Growth plate associated bone bruise of the middle phalanx was seen in each case indicating epiphyseal fracture (Salter Harris °I=1, °II=1, °III=11). The majority of cases reported painlessness within 5 to 6 weeks. In three of our cases, DVT disclosed complex lesions of the epiphysis. Follow-up examinations showed the beginning of consolidation after 4 months.

Discussion: Acute pain of the PIP-joints in adolescent high-performance sport climber, without trauma, may indicate epiphyseal insufficiency fractures. This can easily be seen on MRI. Persisting painful movement restriction should lead to DVT or computer tomography (CT) to rule out complicated fractures, which need sport arrest for up to 6 months.

Keywords:

Epiphyseal fracture; MRI; Sport climbing

Introduction

In sport climbing lesions of the flexor tendon pulley system are frequent traumatic injuries [1,2]. They can be seen on ultrasound and more precise on magnetic resonance imaging (MRI) [3,4]. Trauma associated hematomas cause an increase of the tenophalangeal distance [4]. Adolescent high-performance sport climbers often present themselves with painful movement restriction of the proximal interphalangeal (PIP) joints without memorable trauma [5-8]. Radiography discloses epiphyseal fractures in only a small number of cases. On MRI, growth plate associated bone marrow edema clearly indicates epiphyseal lesions [9]. In a minority of cases digital volume tomography (DVT) or computer tomography (CT) is need to define the complexity of a lesion.

Methods and Materials

From 10/2016 till 04/2020, a total of 13 high-performance sport climbers (14 – 16 y; m:f = 8:5) were seen with atraumatic, painful movement restriction of PIP-joints (D3: n=10; D4: n=3). Following unsuspicious X-ray, MRI (MAGNETOM Aera 1,5T, Siemens, Erlangen D) was performed in each case using a 4-channel flex coil (Siemens, Erlangen, D). The Sequences used are listed in Table 1. Due to persisting symptoms, DVT (Multitom Rax, Siemens, Erlangen, D) was indicated in 3 cases.

Results

Fat-suppressed MR-sequences showed signal-hyperintensity adjacent to the growth plate of the middle phalanx in each case. Based on MR-imaging, the lesions were grouped according the Salter-Harris-classification (Salter Harris °I=1, °II=1, °III=11; FS, AV) [10]. In 8 cases symptoms disappeared within 5 to 6 weeks. DVT disclosed complex fractures of the epiphysis in 3 cases (Figure 1,2). Although no clinical symptoms were evident during their normal course of live, we kept sport arrest until consolidation was seen on control DVT. In neither case surgical treatment was needed.

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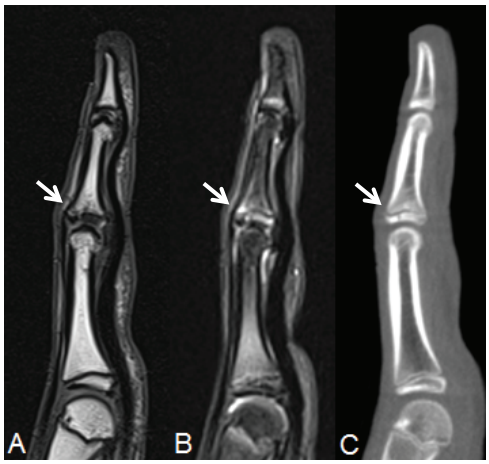

Figure 1: Sagittal images of a Salter-Harris Typ III epiphyseal fracture of the middle phalanx in a 15-years-old, high-performance sport climber (A: T1w TSE, B: PDw TSE fs, C: DVT)

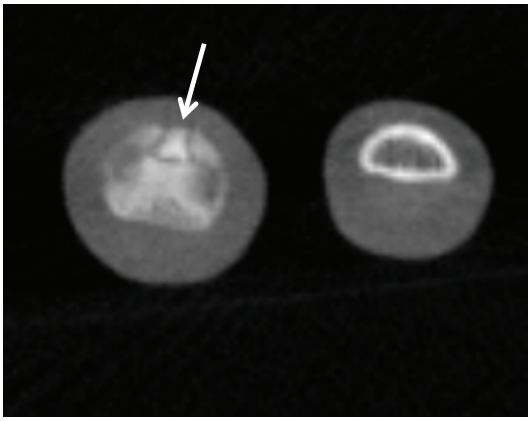

Figure 2: DVT in paratransversal orientation of the epiphysis of the middle phalanx D3 in a 15 years old, high-performance sport climber, demonstrating an isolated fragment following Salter-Harris Typ III epiphyseal fracture (arrow).

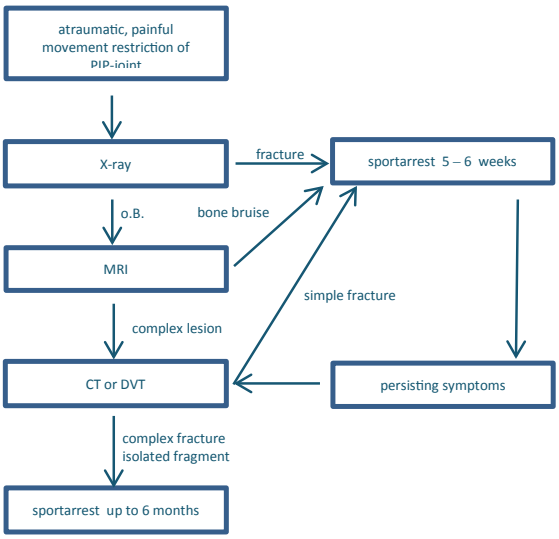

Figure 3: Proposal for an algorithm for diagnosing and treatment of epiphyseal fractures of the middle phalanx in high-performance sport climbers

Orientation	Sequence	Fat-saturation
Coronal	PDw TSE	+
	T2w TSE	
	T2w de3D	
Sagittal	PDw TSE	+
	T1w SE	
Transversal	PDw TSE	+
	T1w SE	
Reformation: MPR (T2w de3D)		

Table 1: MR-sequences used

Discussion

We treated a 15-years old male high performance sport climber with atraumatic painful movement restriction of the PIP-joint DIII. MR-imaging showed bone marrow edema adjacent to the growth plate of the middle phalanx. As symptoms persisted, a second MRI as well as a DVT was performed (Figure 1). These examinations disclosed an isolated fragment of the epiphysis (Figure 2). It took 4 months until DVT showed beginning consolidation of the fragment.

In high performance sport climbers, atraumatic epiphyseal insufficiency fractures seem to be common injuries, which frequently are underestimated. To our knowledge the first case report in an international journal was presented by Chef et al. in 1999 [11]. Bone marrow edema adjacent to the growth plate is a clear sign for such an injury on MR-imaging. According to the literature, the majority of cases showed Salter-Harries Typ III fractures [12]. Detailed analysis of our MR-images however, disclosed single cases of Slater-Harris Typ I and II fractures, which has not been reported so far. In the majority of our cases a sport arrest of 5 to 6 weeks was necessary, as reported previously [6].

There are only few cases with a longer course of disease. We propose DVT or CT for further evaluation due to the higher spatial resolution of these techniques. Using DVT, the required radiation dose seems to be reasonable in the face of the clinical consequences (Figure 3). Complicated epiphyseal fractures, such in the case presented above, need up to 4 months until a consolidation can be proven on DVT. Therefore, high-performance training should not be restarted prior to 4 to 6 months after the diagnosis.

Conclusion

According to our experience, it is quite likely that stress-associated epiphyseal fractures in high performance sport climbers are underestimated. We strongly believe MRI to be the method of choice for detection, and DVT or CT for defining the complexity of a lesion, which is of major importance to determine the proper period of sport arrest.

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