

Suprapatellar fat pad inflammation in step aerobics athletes: MR imaging evaluation of two cases

Case report

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Abstract: Step aerobics is one of the most popular exercises with established benefits to cardiovascular status. This activity is associated with injuries which include patellar or talar chondral lesions, quadriceps tendinopathy, Achilles tendinopathy or tear, shin splints and muscle soreness. The purpose of this case report is to present two step aerobics athletes, suffering from anterior knee pain. We observed that their knee MR examination disclosed only suprapatellar fat pad edema. No other findings were noticed. In addition, we discuss the possible pathogenetic mechanism of this entity which has not been previously reported in the literature.

Keywords: *Step aerobics/injuries • Suprapatellar fat pad edema • MR imaging/diagnosis*

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1. Introduction

Step aerobics is one of the most popular exercises and is believed to provide effective cardiovascular workout [1]. Step aerobics is associated with injuries such as suprapatellar tendinopathy, chondral lesions of patellar or talus, Achilles tendon strain or tear, shin splints and muscle soreness [1-3].

During step aerobics, most of the anatomical structures which might induce anterior knee pain (AKP) could be injured. One of the reported causes for AKP is inflammation of the suprapatellar fat pad (SPFP) [2,4]. The spectrum of disorders involving the SPFP is relatively wide [5].

SPFP edema is one of the least understandable and under recognized conditions. It is not yet clear whether SPFP edema contributes to AKP. MR imaging is the best means of establishing the diagnosis of SPFP edema [6,7]. Although there are previously reports on SPFP edema with mass effect that could provoke AKP, to the best of our knowledge, there is no previous report on

SPFP edema without mass effect as a causative reason for AKP [5-7]. In addition, there are no reports correlating SPFP edema with step aerobics athletes.

We present herein two step aerobics athletes with AKP and SPFP edema. We aim in addition to discuss possible pathogenetic mechanisms and to report the outcome.

2. Case report

Two female recreational step aerobics athletes, without any previous experience on this sport, 41 and 42 year-old respectively, were referred for consultation due to persistent AKP. Both of them were practicing for the last 12 weeks, with a 4-5 times a week on the average. The onset of AKP occurred during the last week of exercise. The bench height ranged from 10 to 15cm. Physical examination did not reveal any specific pathology. The pain was insidious and continuous, exaggerating with

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knee motion, mostly flexion. Patients were referred for MR imaging due to non specific AKP.

MR imaging examination was performed at 1.5 Tesla scanner (Vision Hybrid, Siemens Erlangen, Germany) using a phased-array knee coil. Each patient was positioned supine with the knee in a 10° flexion and 15° external rotation. The examination protocol included axial and sagittal fat-saturated turbo spin echo PD-w, sagittal T2*-w MEDIC and coronal T1-w spin echo MR sequences, all with a slice thickness of 4 mm. No intravenous media contrast was administered.

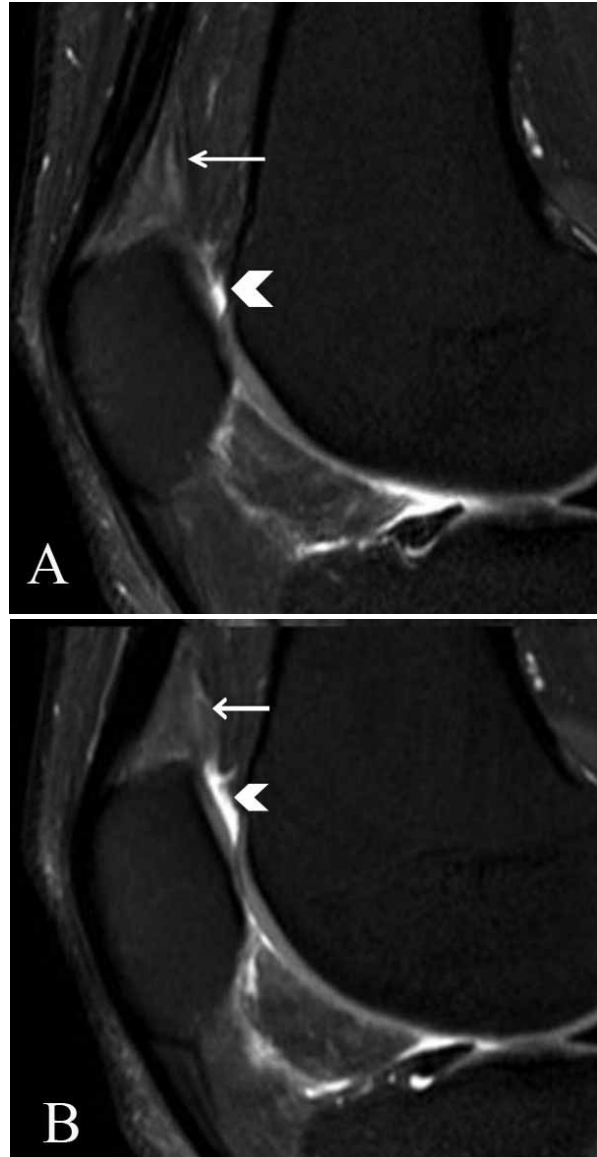
The fat suppressed PD-w MR images revealed a focal area of high signal at the anatomic region of suprapatellar fat pad, in keeping with edema. A small intra-articular effusion, not extending to the suprapatellar recess was disclosed. The focal edematous lesions was not associated with mass effect on the suprapatellar recess. No other abnormalities of the ligamentous, meniscal, cartilaginous and bone marrow structures were detected. SPFP edema was diagnosed with MR imaging (Figure 1,2). All the basic MR imaging measurements, such as sulcus angle, sulcus depth, Insall-Salvati index, tibial tuberosity-trochlear groove distance and lateral patellofemoral angle, for evaluating patellar congruency and possible maltracking were found to lie within normal limits. The sports injuries physician suggested a conservative treatment (pain killers, non steroidal anti-inflammatory medication) and discontinuity of sports activities with a clinical follow up in 6-8 weeks. In addition, rehabilitation for quadriceps strengthening with closed chain movements using light weight was suggested. No AKP was reported in the clinical follow up examination. Patients were allowed to start again step aerobics with lower intensity and reduced frequency achieving the previous performance six months after the onset of symptoms. In the one year clinical follow up, there were no complaints.

3. Discussion

AKP is a frequent issue among adolescent and young adult athletes, mostly females [4,8]. AKP may result from various causes which can be classified according to the involved anatomical structure or the pattern of pain. The most frequent and important causes of AKP include the following: patellar or quadriceps tendon pathology, Osgood Schlatter's disease, Sinding-Larsen-Johansson's disease, patellar chondromalacia, fatigue or traumatic fractures, painful bipartite patella, maltracking disorders and Hoffa's disease [4,8].

Various theories have been proposed to explain AKP in the absence of associated injuries [5-7,9,11].

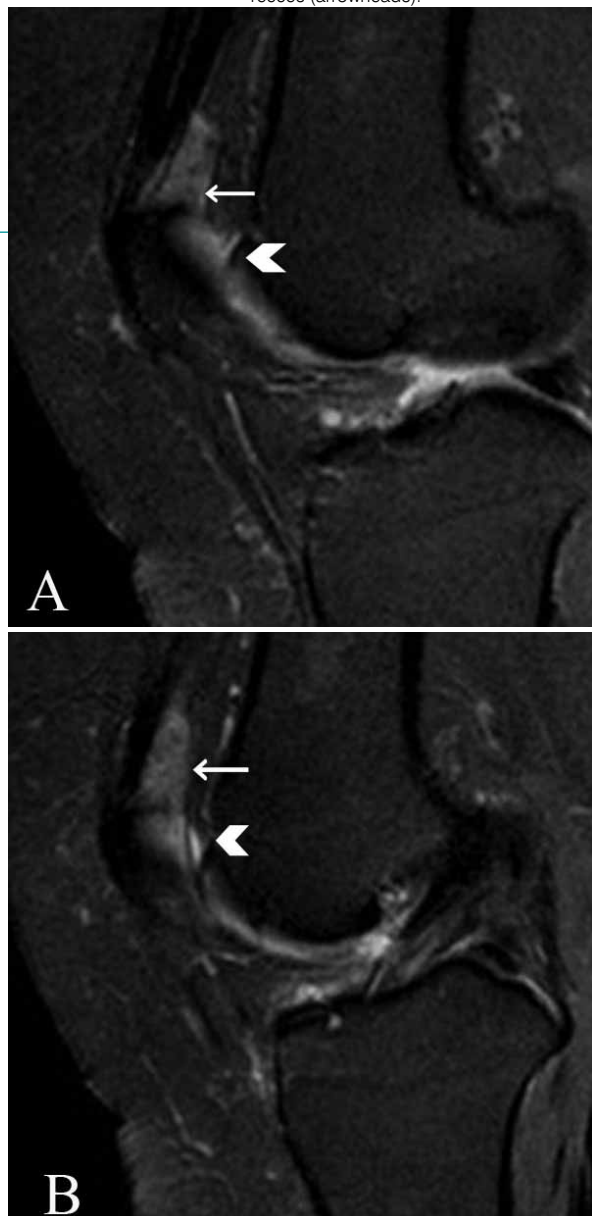
Figure 1 (a, b). A 41 year-old step female aerobic athlete with anterior knee pain. The fat suppressed PD-w (TR/TE 3500/14 ms) sagittal MR images show high MR signal intensity at the suprapatellar fat pad (arrows) in keeping with edema. A small amount of fluid is shown at the suprapatellar recess (arrowheads).



Previous studies have shown that step aerobics may demonstrate AKP [1,2]. No previous reports evoked step aerobics for SPFP edema correlated with AKP. Our patients had no previous history of major knee trauma, showed no abnormalities of the anterior compartment osseous and chondral structures and the patellofemoral congruency measurements were normal.

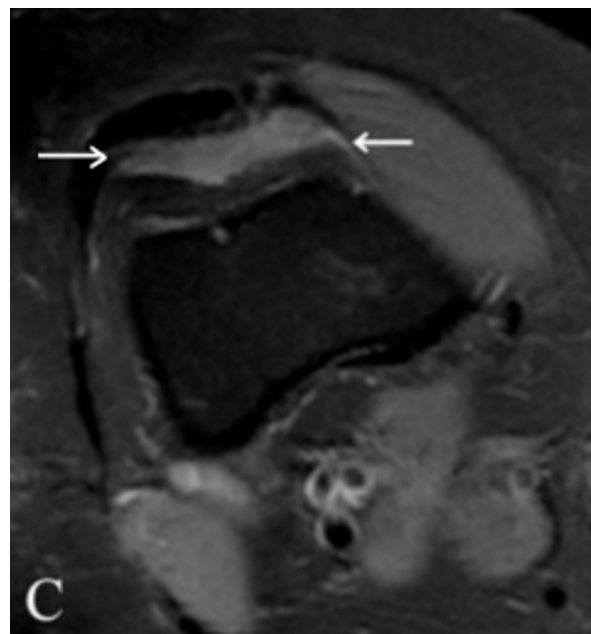
Peripatellar fat pads, SPFP and Hoffa's, could be injured during step aerobics. It is well established that many of the reported injuries are caused by technical errors or by using a bench height that is too high for

Figure 2(a, b, c). A 42 year-old step female aerobic athlete with anterior knee pain. The fat suppressed PD-w (TR/TE 3500/14 ms) sagittal (a, b) and axial (c) MR images show high MR signal intensity at the suprapatellar fat pad (arrows) in keeping with edema. No fluid was present at the suprapatellar recess (arrowheads).



the participant's leg size [1,2]. As the bench height increases, a greater force load is induced on the knee joint and patellar tendons in the step up position, since the knee needs to flex more to accommodate the step height. Another common error relates to poor foot placement on the bench and pattern of bouncing or hopping up and down off the bench.

To avoid knee injury, athletes should choose the bench height to match a flexion of around 90° at any



point while stepping up. At 90° degrees of flexion, the knee is loaded with slightly more than three times body weight. According to this mechanism, injury of the SPFP could occur during training. In our case patients were trained for at least 5 times per week (400 minutes in total). Although the benches were strictly chosen to the proper size for the patient's height and the knee flexion was apparently normal, MR imaging showed SPFP edema in our patients.

Schweitzer *et al.* showed that fluid in the suprapatellar recess correlates with edema at the SPFP [9]. This may be explained by the fact that the recess is not covered by joint capsule and the posterior surface of the SPFP is lined solely by synovium [9,10]. No joint effusion was present in the suprapatellar recess in our patients.

Bohnsack *et al.* and Lahner *et al.* showed that in the soft tissue of the knee joint, especially in the fat pads, there is a large amount of free nerve endings which may explain AKP [11,12]. Roth *et al.* suggested that AKP may be explained from impingement caused by an enlarged and edematous SPFP [7]. MR imaging did not disclose any significant posterior mass effect of the edematous SPFP.

In our case presentation, the clinical diagnosis was based on the imaging findings. The suggested treatment was conservative with rest and cease of physical activity for a period of 6 to 8 weeks [13]. The outcome was excellent with no complaints at the 1-year clinical follow up.

We assume that the AKP in the patients presented herein, may have been related to SPFP edema provoked by repetitive microtrauma in the context of stress overuse injury during step aerobics. However, a

pathomechanism cannot be definitely provided due to limited data from only two patients.

No kinematic MR imaging study was performed. Therefore, a mild underlying mal-alignment, not obvious on static images might exist. However, this does not alter the explanation of the cause of the AKP. Another limitation of our case report is the lack of arthroscopic

confirmation which however was not possible to apply as imaging was negative for intra-articular pathology.

In conclusion, we present two step aerobics athletes with AKP, demonstrating SPFP edema on MR imaging. This finding may explain the AKP in the absence of other abnormalities, guiding thus the clinical management.

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