Clinical History:

The patient was referred two weeks after a twisting injury during a basketball game, complaining of pain in the knee and limited joint flexion.

Physical examination disclosed tenderness of the upper medial posterior part of the knee and limited range of motion during knee flexion.

Imaging Findings:

MR imaging of the right knee on referral two weeks after injury was performed using the standard protocol (Fig. 1). No radiographs were available. The sagittal fat suppressed PD-w (Fig. 1a), sagittal PD-w (Fig. 1b) and axial T2-w (Fig. 1c) images demonstrate a 9 x 2 mm posteriorly displaced avulsion fracture in the femoral origin of the medial head of the gastrocnemius muscle. The coronal fat-suppressed PD-w MR image (Fig. 1d) disclosed bone marrow oedema at the posterior-medial femoral epicondyle. No meniscal, ligamentous or chondral injuries were depicted.

A follow-up MR imaging examination of the right knee was performed at 8 months after injury. The sagittal fat suppressed PD-w (Fig. 2a), sagittal PD-w (Fig. 2b) and axial T2-w (Fig. 2c) MR images demonstrate healing of the avulsion fracture.

Discussion:

A. Avulsion fracture of gastrocnemius muscle-medial head (GMMH) is a rare type of avulsion knee injury, which has not been systematically reported in the literature. It has been suggested that knee extension with simultaneous plantar flexion of the foot induces strong tensile forces at the femoral insertion of the GMMH tendon. In passive external rotation, as well as in active knee flexion, the GMMH tendon is elevated from the tibia due to the underlying insertion of the semimembranosus muscle at the tibia. Thus the induced force is enhanced and in skeletally immature patients leads to an avulsion fracture. In adolescents chronic avulsive injury can lead to lesions such as cortical desmoids or metaphyseal cortical defects at gastrocnemius insertion [1].

B. The patient typically seeks medical consultation because of persistent localized pain in the knee despite conservative measures [1]. The patient may report an audible popping sound with subsequent pain right after the injury, as well as difficulty in ambulation lasting for weeks after the injury. The clinical findings usually disclose swelling of the knee, limitation of knee flexion and posterior medial knee tenderness. McMurray's test may provoke apprehension, but no clicking sound is produced [2, 3].

C. Plain radiographs are accurate in depicting the avulsion fracture and the joint effusion [2]. However, plain films
are not routinely performed in injured athletes to avoid radiation exposure. MRI may show bone marrow oedema, which is indicative of traction injury of the tendon, but it may also show avulsion of the tendon and surrounding tissue oedema.

U/S is increasingly used for disclosing information about GMMH tendon integrity, provided that the user is experienced. U/S shows the avulsed fragment and fluid and oedema of the surrounding tissues [4].

D. The disease usually resolves with conservative treatment, activity limitation and physiotherapy [2]. Our patient was managed conservatively and at 9 weeks post injury, there was full range of motion with mild pain upon palpation. At 12 weeks, participation in non-contact sports activities was suggested. At 16 weeks, the patient was allowed to achieve high levels of competition. The surgical treatment depends on the degree of displacement and the level of athletic performance. Imaging plays a major role both for early diagnosis and treatment planning.

E. Pain and tenderness in upper medial posterior part of the knee following a twisting injury (e.g. forced external rotation), should raise the suspicion of GMMH avulsion fracture. MRI is accurate in diagnosis and treatment evaluation.

**Differential Diagnosis List:** Avulsion fracture of gastrocnemius medial head., Referred pain (lumbar spine), Other avulsion fracture of the knee (e.g PCL), Meniscal tear

**Final Diagnosis:** Avulsion fracture of gastrocnemius medial head.

**References:**


Figure 1

Description: Fat-suppressed PD-w sagittal MR image of the right knee 2 weeks after injury showing a 9x2mm posteriorly displaced avulsion fracture at the origin of the medial head of the gastrocnemius muscle (arrow). Origin: Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece
Description: PD-w sagittal MR image showing the displaced avulsion fracture (arrow). Origin: Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece

Description: Axial T2-w MR image demonstrating the posteriorly displaced avulsion fracture at the origin of the medial head (arrow). Origin: Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece
Description: Fat-suppressed PD-w image of the knee. There is associated bone marrow oedema at the posterior-medial femoral epicondyle (arrow). Origin: Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece
**Figure 2**

Description: Sagittal fat-suppressed PD-w MR image of the right knee at 8 months after injury, demonstrating healing of the avulsion fracture (arrow). **Origin:** Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece
Description: Sagittal PD-w MR image showing healing of the avulsion fracture. Origin: Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece
Description: Axial T2-w MR image of the knee showing healing of the fracture. Origin: Image origin: Karantanas A, Department of Radiology, University of Crete, Heraklion, Greece