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Original Article

Role of MRI in assessment of patello-femoral derangement in patients with anterior knee pain

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ABSTRACT

Objective: To assess the diagnostic accuracy of magnetic resonance imaging (MRI) in evaluating patello-femoral instability as a cause of anterior knee pain (AKP) and its predisposing factors.

Methods: 55 knees of 50 adult patients below 40 years complaining of AKP underwent MRI between February 2013 and February 2015. The patients were analyzed prospectively for the presence of bone, hyaline cartilage and soft-tissue abnormalities, as well as anatomic variants that may contribute to patello-femoral maltracking or impingement abnormalities. Our results were compared to those of the arthroscopic and mini open exploration procedures.

Results: In the 55 knees analyzed for patello-femoral instability cartilaginous injuries were found in 58%, with an MRI sensitivity of 88%, disruption of the medial patello-femoral ligament (MPFL) in 31% with an MRI sensitivity 84%, joint morphology abnormalities in 74.5% of patients, bone edema in 27% of patients and Hoffa's fat pad edema in 30 patients (55%). MRI had a sensitivity of 84% and accuracy of 81% in determining the injury site and pattern.

Conclusion: MRI is reliable imaging modality in identifying the risk factors that may contribute to the development of patello-femoral maltracking or impingement permitting individual tailored treatment.

1. Introduction

Young patients aged less than 45 years suffering from anterior knee pain syndrome may be related to underlying patellar maltracking or patello-femoral impingement [1]. The role of a radiologist is to pay close attention on imaging of the patello-femoral joint while evaluating a knee MRI to help in early detection of patello-femoral articular cartilage loss in these patients [2].

Patello-femoral maltracking is abnormal translation of the patella, whether medially or laterally in relation to the trochlear groove. *Patello-femoral impingement* refers to abnormal contact of the patella with the femur. Both conditions are more common to occur in concordance rather than in isolation [3]. Articular compatibility of the patello-femoral joint is considered as the most important static stabilizer against patellar maltracking and impingement. Therefore, it is crucial to assess the different

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anatomic parameters of the patello-femoral joint on any routine extended MRI study [4].

MR imaging is now acknowledged as a well established technique which has replaced diagnostic arthroscopy as the primary non-invasive diagnostic modality. It is a highly sensitive cross-sectional imaging modality which can identify injuries related to the capsule, ligaments, cartilage, and bone that are associated with patellar dislocation. MRI is also an important tool used in evaluating the different anatomic variants that may contribute to patellar instability [5].

There are multiple factors that can contribute to patellar instability. The most important of them are patella alta (high position of the patella), trochlear dysplasia and increased lateral distance between the tibial tubercle and the trochlear groove (lateralization of the tibial tuberosity) [6].

Dynamic maltracking abnormalities have been assessed by various static parameters of trochlear geometry and patello-femoral joint alignment. These include the Insall-Salvati ratio, trochlear sulcus angle, sulcus depth, lateral patello-femoral angle, patellar translation, and tibial tubercle–trochlear groove distance [7]. Anatomic and biomechanical abnormalities as such are thought to lead to early osteoarthritic changes, chondrosis, proliferation of the synovium, subchondral cysts or sclerosis, and fat pad impingement, all of which can cause anterior knee pain [8].

Aim of the work: To assess the diagnostic accuracy of magnetic resonance imaging (MRI) in evaluating patello-femoral instability as a cause of anterior knee pain and its predisposing factors.

2. Materials and methods

2.1. Patient selection

MRI scans of 55 knees from 50 patients were analyzed prospectively, and 5 patients presented with bilateral clinical conditions and underwent MR imaging on both knees. 35 were men and 15 were women. 31 of the patient's complaints were on the right side and 24 on the left side. 34 cases presented clinically with knee pain, 21 with patellar maltracking, 13 cases with pain following trauma and 3 cases with swelling.

The age of the patients studied ranged from 14 to 40 years, with a mean of 26 years (±10) and median of 28 years.

The patients were referred by an orthopedic surgeon specialized in knee surgery, complaining clinically of anterior knee pain.

2.2. MRI

MRI studies were conducted over a period of two years. MR images were acquired on a 1.5 and 3-T scanner (GE Healthcare units) with an extremity coil, a field of view of 14- to 16-cm and a 256 × 256 matrix. Our sequences included sagittal and coronal intermediate-weighted fast spin-echo (FSE) (TR range/TE range, 1400–3000/19–33), coronal and sagittal fat-suppressed T2-weighted FSE (1720–4200/60–84) or fat-suppressed intermediate-weighted FSE (1520–3000/20–26), axial intermediate-weighted FSE (1500–2500/20–27), and axial fat-suppressed T2-weighted (1720–3340/60–84) or fat-suppressed intermediate-weighted FSE (1500–3000/20–27) images.

2.3. Image interpretation

The presence of morphological or joint geometrical abnormalities that would predispose toward patello-femoral instability was evaluated using the following criteria:

(a) High patella: Insall-Salvati index greater than 1.3 (Fig. 1) [9].
(b) Morphological abnormalities in the intercondylar fossa of the femur (trochlea dysplasia), based on the Dejours radiographic classification [10]:
Type A – trochlea with morphology preserved, but with a shallow trochlear sulcus (angle greater than 145°).
Type B – Flat oriented sulcus.
Type C – Asymmetrical trochlear facets, with hypoplasia of the medial facet and convexity of the lateral facet.
Type D – Type C + presence of a supra-trochlear ventral prominence ⩾7 mm.
(c) Lateral inclination of the patella: normally, the lateral patellar facet forms an angle with the posterior bicondylar line that is open laterally and >8° in flexion. A lateral inclination angle that opened laterally but ⩽8° on axial images was considered to be

Fig. 1. Insall-Salvati ratio. Mid sagittal intermediate-weighted MR image. The length of the patellar tendon (line A) is measured posteriorly from the patellar apex to its attachment to the tibial tuberosity and is divided by the longest superoinferior diameter of the patella (line B) to obtain Insall-Salvati ratio as follows = A/B. A ration >1.3 indicates a patella alta. A ratio <0.9 indicates a patella baja.

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