



Acute instability of the patella: is magnetic resonance imaging mandatory?

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Abstract

Purpose Acute dislocations of the patella represent 2 to 3% of traumatic injuries of the knee. When patients are seen in the emergency department with a dislocated patella clinical diagnosis is often very evident. However, in cases of short-lived subluxation or dislocations that have reduced spontaneously, the diagnosis can be challenging. The aim of this study was to evaluate the utility of MRI in the evaluation of acute patellar instability.

Methods This was a prospective study of 39 cases of acute patellar instability. The study protocol included a clinical examination by an emergency medicine doctor, a standardised series of radiographs and an MRI scan within 15 days after injury.

Results The series included 15 female and 24 male patients aged on average 23 ± 10.5 years (11–46). Twenty-four cases were following sporting accidents and 15 cases following domestic accidents. In ten cases, a blow to the medial side of the patella led to the injury and in 29 cases, a twisting mechanism with a valgus and external rotation force was responsible. Six patients presented with a clinically dislocated patella and 31 patients were deemed to have a “swollen knee”. Nineteen patients described an episode of subluxation of the patella and 14 an odd sensation within the knee without being able to specifically describe what had happened. Radiographs demonstrated trochlear dysplasia in 97.5% of cases and osteochondral lesions in 20.5% of cases. MRI scan confirmed the diagnosis of acute patellar instability in 37 cases giving a sensitivity of 95%. MRI findings included 25 MPFL lesions, 31 patella lesions of which 25 were bone oedema and six medial facet fractures, 31 lateral femoral condyle bone oedema type lesions, 11 chondral lesions of which seven were osteochondral in nature and also three acute associated ACL injuries and two MCL injuries.

Conclusion MRI scan is an important tool in the diagnosis and management of acute patellar dislocation and subluxation. When symptoms are subtle, MRI facilitates a diagnosis with relative ease. MRI is particularly useful in identifying the exact nature of lesions most notably chondral lesions which are frequently of significant size and therefore often require expedited surgical treatment.

Keywords Patella · Acute dislocation · Subluxation · MRI

Introduction

Acute patella dislocations represent around 2–3% of knee trauma [1, 2] and represent the most frequent cause of traumatic hemarthrosis in children and after ACL rupture, the second most frequent cause of traumatic haemarthrosis in adolescents [3]. When patients are seen with an acutely dislocated patella, the diagnosis is usually obvious. However, the diagnosis can be challenging when patients are seen after a transient patellar subluxation or after a dislocation which has reduced spontaneously. A careful history and focused examination can help identify the characteristic signs of a patellar dislocation: “swollen knee”, intra-articular effusion, no ligamentous laxity, tenderness around the medial

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edge of the patella and positive Smillie sign in comfortable patients. However, in some cases, clinical examination is negative which can lead to the diagnosis being missed. This can be further confounded when the radiological signs of patellofemoral instability [2, 4, 5] are missed or misinterpreted.

For over ten years now, MRI has played an important role in the diagnosis and management of traumatic knee injuries [6]. MRI has become standard of care in ligamentous injuries but its role in other traumatic knee injuries and particularly in acute patellar instability is less well-defined. Early descriptions of the indirect signs of patellar dislocation date back over 25 years [7, 8]. These are contusion of the lateral femoral condyle along with oedema of the medial side of the patella and haemarthrosis. These signs were further reported by Pope [9] and Elias et al. [10] a few years after these original descriptions. Since these early reports, several publications have demonstrated the utility of MRI in the diagnosis of associated chondral lesions, particularly those requiring urgent surgical treatment [11–16].

The aim of this study was to evaluate the use of MRI in cases of acute patellar instability. Our hypothesis was that MRI is essential in making an accurate diagnosis of patella instability and its associated injuries including chondral lesions, meniscal lesions or ligament damage.

Methods

This is a prospective study of 39 cases of acute patellar dislocation collected between April 2015 and May 2018. The initial series included 70 patients but exclusions were made due to incomplete patient records, patients from out of area, patients refusing to participate in the study and loss to follow-up. All remaining patients consented to participate in the study.

The study protocol included clinical examination in the emergency department performed by an emergency medicine doctor, a standardised series of plain radiographs (AP, lateral in 30 to 45 degrees flexion, patella femoral view) allowing for the evaluation of trochlea dysplasia using Dejour's criteria [2, 4, 5], patellar height using Caton-Deshamps [17] and Picard-Saragaglia [18] methods, the presence of osteochondral lesions and intra-articular foreign bodies. In cases of unreduced dislocation, immediate reduction preceded radiographic evaluation. All patients then underwent an MRI scan within 15 days of injury and were also reviewed by an orthopaedic surgeon within this timescale once all investigations had been completed.

Results

The series

The series included 15 women and 24 men with an average age of 23 ± 10.5 years (11–46). There were 20 right and 19 left

knees. Twenty-four of the injuries occurred during sport (61.5%) of which, six occurred during football, four whilst skiing, two whilst playing basketball, Rugby, badminton and combat sports for the most frequent aetiologies. Fifteen injuries occurred in a domestic setting. The mechanism of injury in ten cases was a blow to the medial side of the patella and in 29 cases, a jump and an awkward landing leading to a twisting injury where a valgus external rotation force was identified.

On clinical examination, there were six dislocated patella (15.5%) which were reduced in the emergency department, 31 “swollen knees” (79.5%) of which seven had a haemarthrosis and 24 large subcutaneous ecchymoses related to bleeding through a breach of the joint capsule, 34 painful MPFL and medial edge of the patella. Five patients complained of lateral compartment pain. Nineteen patients reported an episode of patellar subluxation or dislocation which spontaneously reduced and 14 an abnormal feeling within the knee without a clear understanding of events, making it difficult to make the diagnosis of acute patellar dislocation in 36% of cases.

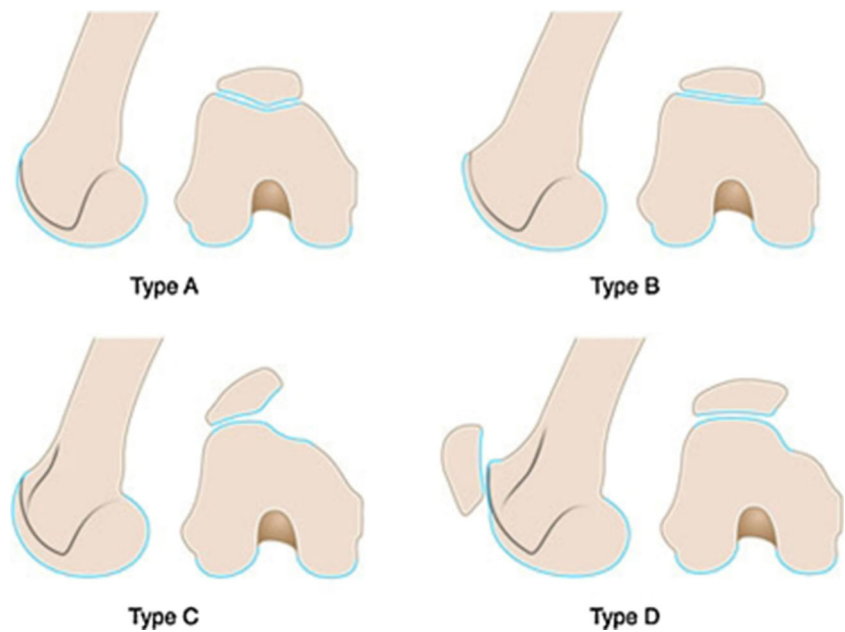
When considering the radiological parameters, the Caton-Deshamps index was on average 1.15 ± 1.1 . In 28 cases, it was normal (between 0.8 and 1.2), in ten cases the index corresponded with a patella Alta (greater than 1.2) and one case it demonstrated a patella Baja and was less than 0.6. The Picard-Saragaglia index was normal in one case (between 0.35 and 0.85) and abnormal in 38 cases (> 0.85). In regard to trochlea dysplasia in one case, there was no dysplasia; in 24 cases, there was grade A dysplasia; in seven cases, there was grade B dysplasia and in seven cases, a grade C dysplasia (Fig. 1). There were also eight osteochondral lesions (20.5%) visible on plain radiographs of which five were fractures of the medial border of the patella, two were fractures from the posterior patella and one was from the lateral trochlea.

MRI results

MRI confirmed the diagnosis of acute patellar dislocation in 37 cases giving a sensitivity of 95%. One case was, in fact, an anterior cruciate ligament rupture demonstrated on MRI with a coincidental finding of trochlear dysplasia on plain radiographs. In another case, there were no demonstrable findings consistent with patellar instability despite radiographs suggesting possible patellar instability (dysplastic trochlea and patella alta).

MRI findings included 25 MPFL injuries (64%), of which 12 were complete ruptures (8 from the patella side and 4 from the femoral side) and 13 incomplete injuries looking like distension. There were 31 patella injuries (79.5%), of which 25 were bone oedema (Fig. 2) and six avulsion-fractures from the medial border. We also identified 31 bone bruises (79.5%) on the lateral femoral condyle (Fig. 3). In addition, MRI demonstrated 11 chondral lesions (28%); four of these were demonstrated by high signal on the lateral femoral trochlea and seven were chondral or osteochondral lesions (excluding the

Fig. 1 Types of trochlear dysplasia. Type A: crossing sign with a shallow trochlea. Type B: crossing sign, supratrochlear spur, flat or convex trochlea. Type C: crossing sign, double contour, asymmetry of trochlear facets with a hypoplastic medial facet. Type D: crossing sign, supratrochlear spur and double contour (asymmetry of trochlear facets plus vertical join and “cliff pattern”)



avulsion-fractures of the medial border of the patella), of which, three required surgical treatment to fix the fragment because of its large size (Fig. 4a–d). MRI therefore identified four additional fractures that were not demonstrable on conventional plain radiographic imaging. Finally, we identified two medial femoral condyle bone bruises, three injuries to the ACL (2 complete ruptures and 1 partial), as well as two injuries to the medial collateral ligament on the femoral side in continuity with the MPFL.

Discussion

This study confirms the utility of MRI in acute patellar instability. Overall, in 95% of cases, MRI identified either direct

signs of patellar instability (MPFL lesion) or indirect signs (lateral femoral condyle contusion and medial border patella contusion). These signs were first described in 1993 [7, 8]. When patients present with a dislocated patella, the diagnosis is evident clinically and the practitioner does not need MRI to make the diagnosis. In case of subluxations or injured knees without evident aetiology, the diagnosis can, of course, be evoked on the X-rays which are often abnormal [2], but it is the MRI which will confirm the diagnosis. So, in our series, MRI allowed an early diagnosis to be established where there were limited clinical signs (36% of cases). In the study by Lance et al. [8], the rate of missed diagnosis in the emergency department before MRI was 50%. Bone contusions were

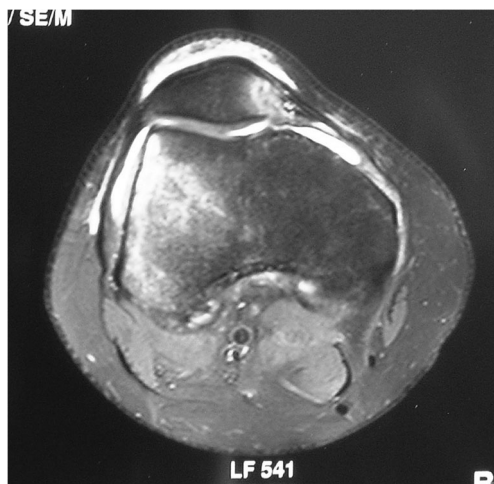


Fig. 2 Oedema of the medial border of the patella and of the lateral condyle which is specific of acute patellar instability (MRI axial view)

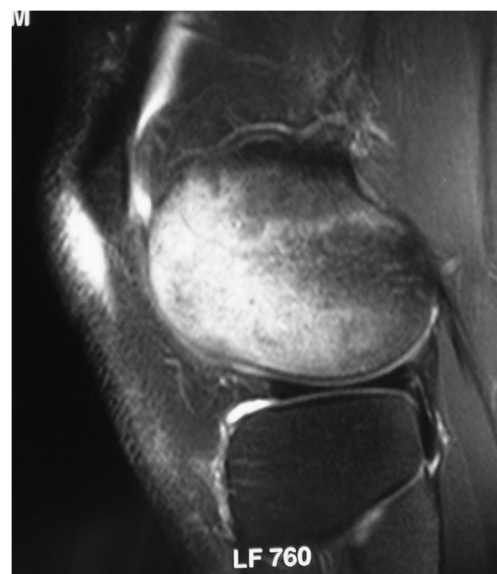
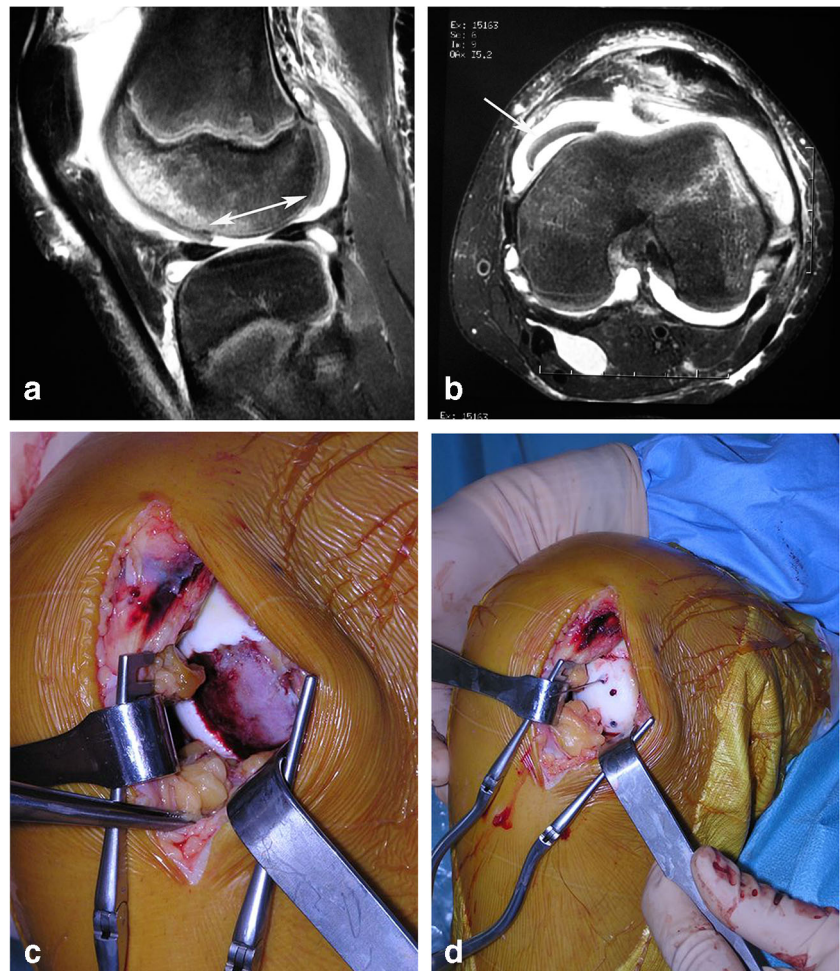


Fig. 3 Oedema of the lateral condyle (MRI sagittal view)

Fig. 4 **a** MRI showing severe chondral lesion of the lateral condyle following traumatic dislocation of the patella (lateral view). **b** Skyline view of Fig. 4a MRI showing the chondral fragment. **c** Operative view of the cartilage lesion of Fig. 4a. **d** Deferred fixation of the chondral fragment of Fig. 4a and b



extremely common (79.5%) and these were found at the level of both the lateral femoral condyle as well as the medial patella. This rate is comparable to other series in the literature [10, 11].

As well as confirming the diagnosis of acute instability, the MRI also clarifies the nature of any MPFL lesion and its location [10, 11, 15, 16]. In our series, the MPFL was injured in 64% of cases which is less than that described in other series which report injury rates as high as 85%. MPFL lesions are not always easy to identify and if we include the six avulsion-fractures of the medial border of the patella which, in effect, correspond to an MPFL lesion, we reach an injury rate of 79.5%. Paradoxically, a study in children by Wilson et al. [19] found only a 33.5% rate of injury to the MPFL.

MRI also provides important information in regard to chondral and osteochondral lesions. Osteochondral lesions in experienced eyes can be identified with plain radiography provided a radiopaque bony fragment remains attached to the cartilage. By contrast, only MRI permits visualisation of pure chondral lesions. In our study, only three lesions could be identified with plain radiography (if we exclude avulsion-fractures of the medial border of the patella). Using MRI,

seven further lesions were identified, of which, four were chondral lesions not seen on initial radiographs. Three of these four lesions were sufficiently large to warrant an early surgical fixation (7.5%). Two of these fragments were situated on the bearing surface of lateral femoral condyle (Fig. 4a–d) and the remaining lesion was from the undersurface of the patella representing 2/3rds of its posterior surface. Several studies in the literature confirm the fundamental interest of MRI for the diagnosis of cartilage lesions [10–16].

Finally, MRI permits both the elimination of erroneous diagnoses (for example ruptured ACL in the context of a dysplastic patella femoral articulation but without instability – 1 case in our series) and also clear visualisation of associated injuries of ligaments or menisci. In our series, in association with patellar instability, we identified three ACL lesions and two medial collateral ligament lesions (13% ligamentous injury rate). This was similar to other reported series [10–16] but without associated meniscal tears.

The strengths of this study are its prospective nature with a clear protocol and the fact it was carried out in a specialist unit with an emergency department, a specialist orthopaedic service for knees and a radiology department specialised in

musculoskeletal imaging. One weakness of the study is that patients were at times seen by trainees in the emergency department. In some cases, the initial clinical examination could be biased by these relatively inexperienced examiners.

Conclusion

This study confirms our initial hypothesis and validates the use of MRI in acute patella dislocation or subluxation. When the symptomatology is not clear, it allows to easily confirm the diagnosis. In all the cases, MRI scanning permits an accurate assessment of the lesions, especially from the cartilage, which, in some cases, may require urgent surgical treatment.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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