

J.J. Patel

Intra-articular entrapment of the medial collateral ligament: radiographic and MRI findings

Received: 18 March 1999
Revision requested: 17 May 1999
Revision received: 1 July 1999
Accepted: 2 July 1999

J.J. Patel, M.D.
Department of Radiology,
Baystate Medical Center,
759 Chestnut Street, Springfield,
MA 01199, USA

Introduction

Many published articles have described a variety of signs of MCL injury on magnetic resonance imaging (MRI). Presented herein is a case of intra-articular entrapment of the MCL and adjacent subcutaneous fat with distinctive radiographic and MRI findings.

Case report

A 47-year-old intoxicated man tripped and fell while exiting a bus and severely twisted his right knee. Clinical examination revealed a locked knee and skin dimpling along the medial aspect of the knee. Radiographs demonstrated medial joint space widening and a curvilinear lucent stripe, isodense with subcutaneous fat, interposed between the me-

Abstract Displacement of the medial collateral ligament (MCL) into the medial knee joint is an extremely rare finding associated with MCL tears, and is easily diagnosed on magnetic resonance imaging. A case of intra-articular interposition of the MCL during a severe knee injury is presented. A radiolucent “fat stripe” sign and adjacent skin dimpling on radiographs may be relatively specific indicators of this injury.

dial femoral condyle and medial tibial plateau (Fig. 1).

Multiple abnormalities were noted on MRI, including central displacement of the MCL and overlying subcutaneous fat, widened medial joint space and infolding of the overlying skin (Fig. 2). Associated findings included a torn and folded medial patellar retinaculum displaced into the medial patellofemoral joint, lateral patellar subluxation, posterior cruciate ligament (PCL) tear, anterior cruciate ligament (ACL) tear, tear of the posterior horn of the medial meniscus, moderate size joint effusion, chondromalacia patella, mild patellar tendon injury, and osseous changes in the lateral patellar facet related to chondromalacia or trauma.

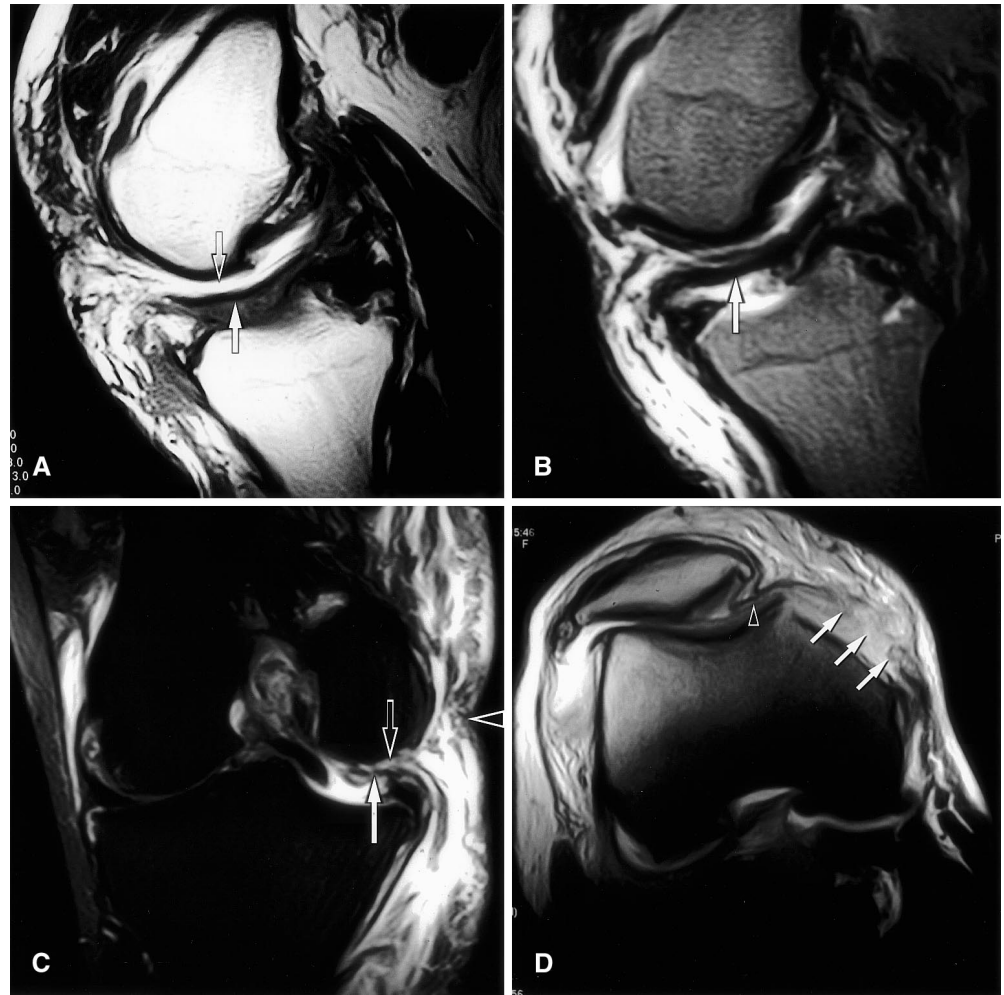
Arthrotomy was performed on the following day, at which time the MCL was noted to be avulsed at both its proximal and distal attachments and displaced into the medial

Key words Medial collateral ligament, tear, interposition · Knee · MRI · Posterolateral dislocation



Fig. 1 Anteroposterior radiograph of the right knee reveals a curvilinear lucent band (arrow) between the medial femoral condyle and medial tibial plateau associated with medial joint space widening

Fig. 2 T1-weighted sagittal (A), T2-weighted sagittal (B), T2-weighted fat-saturated fast spin echo coronal (C), and spin density fat-saturated fast spin echo axial (D) images of the right knee. A MCL (arrow) and fat (open arrow) are trapped between the medial femoral condyle and the medial tibial plateau. B Sequestered MCL (arrow) and anterior subcutaneous edema are identified. This appearance resembles a bucket-handle meniscal tear. C Centrally displaced MCL (arrow) and edematous fat (open arrow) are present. A normal MCL is not seen. Note nearby skin dimpling (open arrow-head). Extensive edema in the medial subcutaneous tissues is seen. D Lateral patellar subluxation is noted with rupture (arrows) and infolding (arrow-head) of the medial patellar retinaculum into the medial patellofemoral joint. Note the edema in the region of the proximal MCL



joint space. A torn medial patellar retinaculum was also identified. Re-approximation of the medial retinaculum to the medial femoral epicondyle was initially performed, followed by repositioning and repair of the MCL. The ACL and PCL were also noted to be torn, although repair was not attempted. The patient eventually was able to ambulate with some difficulty and pain but without significant clinical instability. Nine months after his initial surgery, he developed severe patellofemoral pain and arthritis. After 11 months of conservative therapy, the patient underwent patellar debridement and partial medial meniscectomy and was almost pain free 1 week later.

Discussion

Multiple signs of MCL injury on MRI have been described, including proximal or distal discontinuity, subcutaneous or fascial edema, abnormal morphology, increased T2-weighted internal signal, internal longitudinal striations, loss of sharp demarcation of the adjacent fat and bone bruise [1–5]. Cases of interposition of the MCL between the femur and tibia with “button-holing” of the medial femoral condyle through the torn MCL and capsule and puckering of the overlying skin at the joint line had been published well before the advent of MRI [6, 7]. No case of a radiographic intra-articular “fat stripe” sign and overlying skin dimpling has been described to the au-

thor’s knowledge. Presumptively, this appearance must be very rare and is likely a result of extremely severe valgus stress with transient posterolateral dislocation and possibly an external compressive force on the MCL. A solitary case demonstrating MRI findings of MCL interposition after posterolateral knee dislocation has been described [8], but the findings were preoperatively mistaken for a medial meniscal tear. Detachment of the distal MCL was not discovered in any of these cases [6–8].

Anatomically, the medial collateral ligament has been divided into three layers [9, 10]. Layer one is the deep or crural fascia. Layer two is the superficial MCL, which merges posteriorly with layer three and the semimembranosus tendon sheath to

form the ligaments of the posteromedial corner. Layer three comprises the medial joint capsule and the deep MCL. Layers one and two merge anterior to the superficial medial ligament and join with the medial patellar retinaculum. In the case under discussion, both the proximal and distal attachments of the MCL and the medial patellar retinaculum were severed, which may have allowed for greater mobility of the torn MCL. Rupture of the ACL and PCL likely contributed to an even greater degree of medial instability, thereby allowing more room in the medial joint space during valgus stress. Previous reports [6, 7] state that the mechanism of injury is related to posterolateral dislocation from a severe force producing abduction and medial rotation of the tibia with respect to the femur when the knee is flexed. Once the medial femoral condyle is dislocated, the free torn edge of the MCL engages the intercondylar notch preventing complete reduction of the dislocation and trapping the MCL between the femur and tibia. Fat trapped in the medial joint likely represents subcutaneous fat adjacent to the MCL fascia. Open reduction is mandatory in these patients. Unlike

this case, associated medial meniscal injury was uncommon and thought to be related to absence of axial loading during the injury. Care must be taken not to misinterpret the interposed MCL as a medial meniscal tear.

Differential diagnosis of intra-articular lucency on radiography includes intra-articular gas due to trauma or surgery and vacuum phenomenon of the meniscus. In either case, the radiographic density of the intra-articular lucency would likely be lower than that of fat. Intra-articular fat from an articular fracture could potentially mimic the findings in this case report, but is usually manifested as a bursal lipohemarthrosis on a horizontal beam lateral film.

An intra-articular "fat stripe" sign may be a specific indicator of rupture and intra-articular displacement of the MCL. Central ligamentous displacement, although quite uncommon, should be included as one of the signs of MCL injury.

References

- Schweitzer ME, Tran D, Deely DM, et al. Medial collateral ligament injuries: evaluation of multiple signs, prevalence and location of associated bone bruises, and assessment with MR imaging. *Radiology* 1995; 194:825-829.
- Yao L, Dungan D, Seeger LL. MR imaging of tibial collateral ligament injury: comparison with clinical examination. *Skeletal Radiology* 1994; 23:521-524.
- Garvin GJ, Munk PL, Vellet AD. Tears of the medial collateral ligament: magnetic resonance imaging findings and associated injuries. *Can Assoc Radiol J* 1993; 44:199-204.
- Mirowitz SA, Shu HH. MR imaging evaluation of knee collateral ligaments and related injuries: comparison of T1-weighted, T2-weighted, and fat-saturated T2-weighted sequences: correlation with clinical findings. *J Magn Res Imaging* 1994; 4:725-732.
- Turner DA, Prodromos CC, Petasnick JP, et al. Acute injury of the ligaments of the knee: magnetic resonance evaluation. *Radiology* 1985; 154:717-722.
- Quinlan AG, Sharrard J. Posterolateral dislocation of the knee with capsular interposition. *J Bone Joint Surg Br* 1958; 40:660-663.
- Quinlan AG. Irreducible postero-lateral dislocation of the knee with button-holding of the medial femoral condyle. *J Bone Joint Surg Am* 1966; 48:1619-1621.
- Tsiagadigui JG, Sabri F, Sintzoff S, et al. Magnetic resonance imaging for irreducible posterolateral knee dislocation. *J Orthop Trauma* 1997; 11:457-460.
- Warren LF, Marshall JL. The supporting structures and layers on the medial side of the knee. *J Bone Joint Surg Am* 1979; 61:56-62.
- Miller RH. Knee injuries. In: Canale St (ed) *Campbell's operative orthopedics*. St. Louis: Mosby-Year Book, 1998: 1120-1123.