

## CONTINUING EDUCATION

# MRI SPECTRUM OF MEDIAL COLLATERAL LIGAMENT INJURIES AND PITFALLS IN DIAGNOSIS

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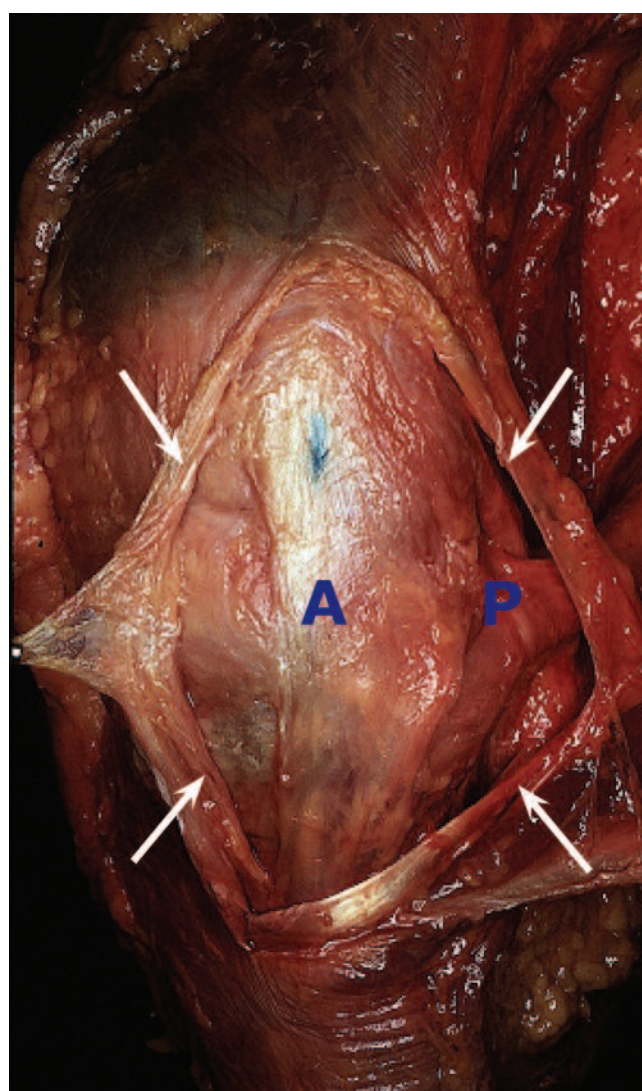
**The medial collateral ligament (MCL) is made up of different components and spans the medial aspect of the knee. With injuries the superficial or deep and posterior components may be involved. A variety of conditions including MCL bursitis, medial osteoarthritis, medial cellulitis, medial bursitis, medial meniscal cyst, meniscocapsular separation, and retinacular tear may present with high signal surrounding the MCL fibers and simulate an MCL tear.**

**Key-words:** Knee, ligaments and menisci – Knee, MR.

The MCL is covered by the superficial medial fascia (Fig. 1). The MCL itself is deep to this fascia and is composed of an anterior part and posterior part. The anterior part is loosely attached to the meniscus, and shows a superficial band and deep meniscomfemoral and meniscotibial bands (Fig. 2). Anteriorly the MCL is in continuity with the medial retinaculum patellae. The posterior part of the MCL does not show the layered appearance of the anterior part, and in this region only one bandlike structure is apparent (1, 2).

### MCL tears

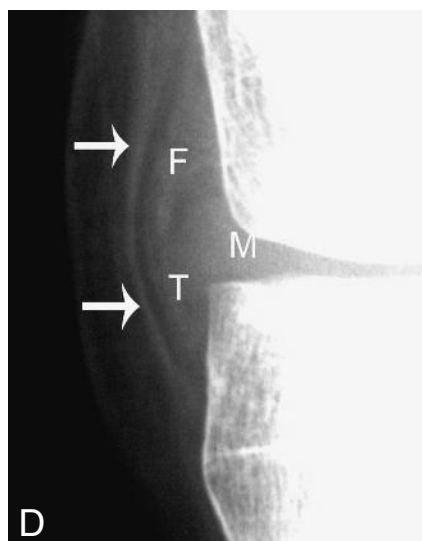
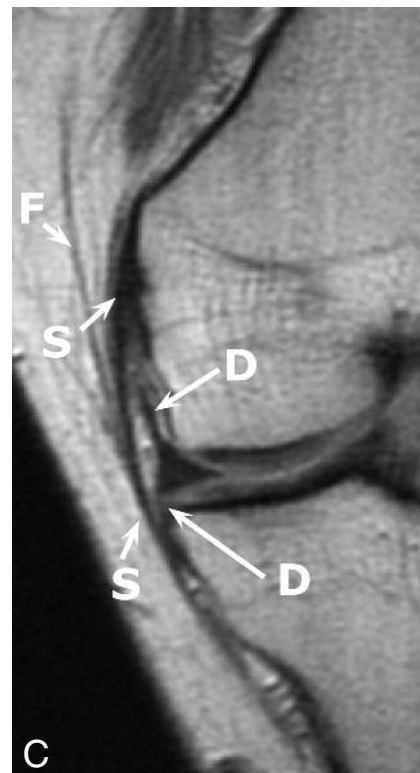
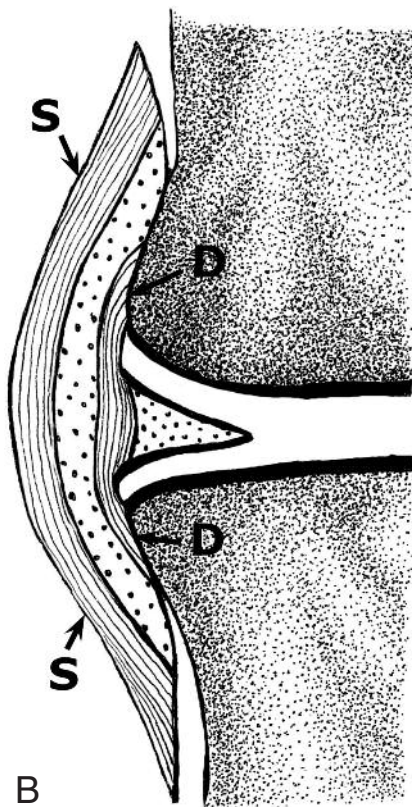
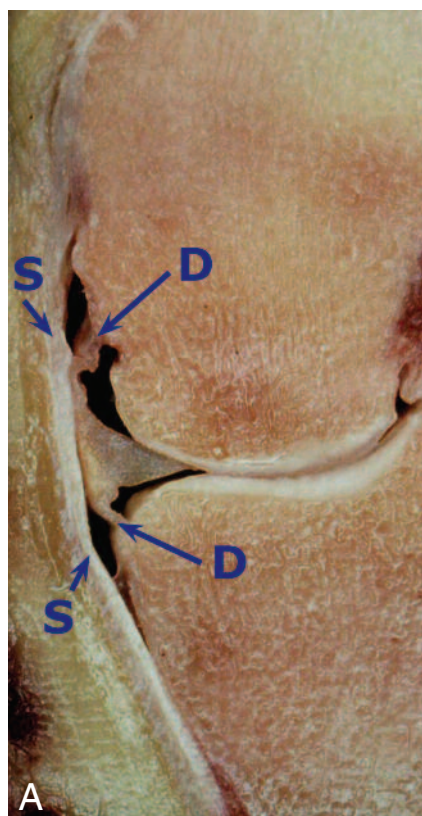
The present grading system only focuses on the anterior portion of the MCL. In addition only the superficial band is taken into account. A grading system has been proposed for MCL injuries but is limited by the lack of a gold standard (Fig. 3) (3, 4). Indeed MCL injuries are rarely treated surgically and hence correlation with surgical findings is absent. Fluid-sensitive sequences are considered ideal to display the characteristics used in the classic grading system. In a grade 1 injury the MCL may appear thickened and surrounded by high signal intensity (Fig. 4). In a grade 2 injuries there is partial disruption of fibers, and in a grade 3 injury there is complete disruption of fibers (Fig. 5). Anatomically only the deep fibers of the MCL may be injured, and it is unclear how to classify this using the present grading system. Also the injury may be confined to the posterior MCL which is not taken into



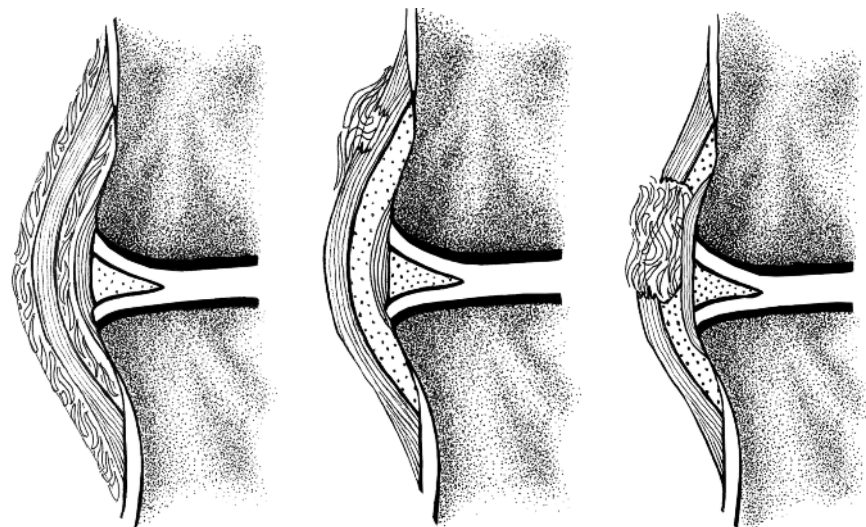
*Fig. 1. — The superficial fascia has been opened (arrows). Note the anterior (A), and posterior (P) portion of the MCL.*

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**Fig. 2.** — A. Coronal anatomical slice. The superficial (S) and deep (D) bands of the MCL can be seen. The deep band is made up of a menisofemoral and meniscotibial portion. B. Coronal drawing illustrates superficial (S) and deep (D) bands of the MCL. C. Coronal proton density weighted MR image in cadaver. Note fascia (F) and superficial (S) and deep (D) bands of the MCL. D. Spot film of the knee. The superficial MCL can be seen (arrows) outlined by fat. Also note menisofemoral band (F), meniscotibial band (T) and meniscus (M).



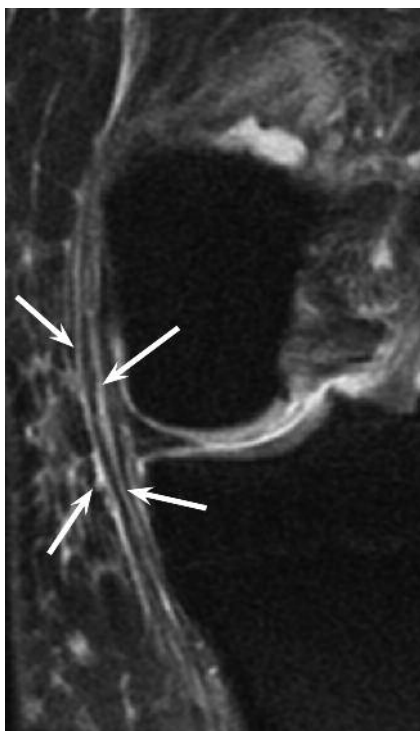
**Fig. 3.** — Drawing illustrating classification of MCL tears. Sprain on the left (grade 1) with fluid surrounding the MCL. Partial tear in the middle (grade 2) with partial disruption of the MCL, and complete tear on the right (grade 3) with a complete disruption of the MCL.

account in the present grading system. Superiorly, a fascial tear may also extend to the vastus medialis muscle (Fig. 6, 7). In some instances only the deep fibers are involved. (Fig. 8). Sometimes the MCL lesion extends posteriorly (Fig. 9). Posteriorly the lesion may extend to the oblique popliteal ligament which plays a role in knee stability).

#### MCL bursitis

A bursa is present between the superficial and deep bands of the anterior MCL. Sometimes a femoral and a tibial component may be separate from each other (Fig. 10). Although this is a rare event, occasionally the bursa may become distended with fluid. Since the fluid is





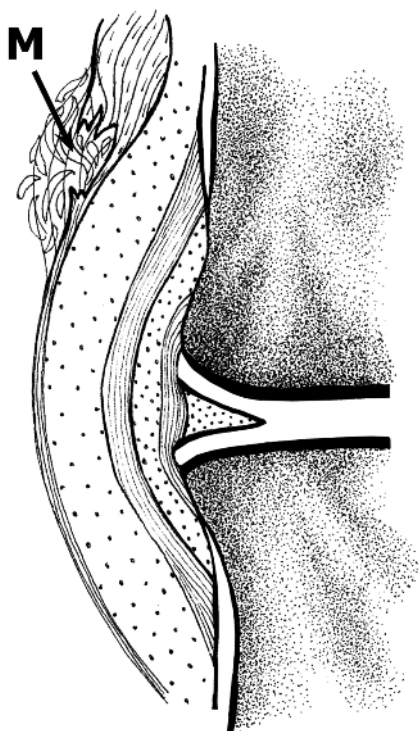
*Fig. 4.* — Coronal T2 weighted MR with fat saturation. Note fluid superficially and deep to the superficial band of the MCL (arrows) compatible with grade 1 tear (sprain).



*Fig. 5.* — Coronal T2 weighted image with fat saturation. Note complete discontinuity of superficial MCL fibers (arrows) compatible with grade 3 tear. The deep meniscomfemoral part is also ruptured.



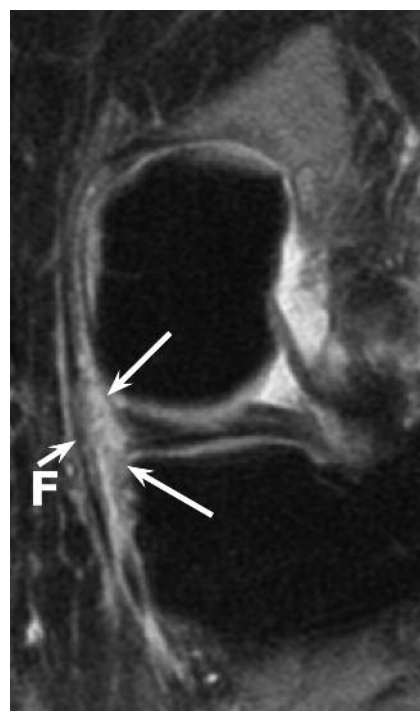
*Fig. 6.* — Coronal T2 weighted MR image with fat saturation. Partial tear of the fascia is seen and lesion extends into fibers of the vastus medialis (M).



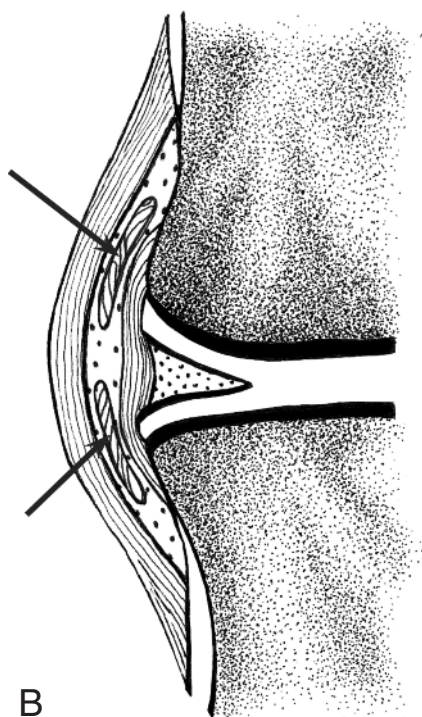
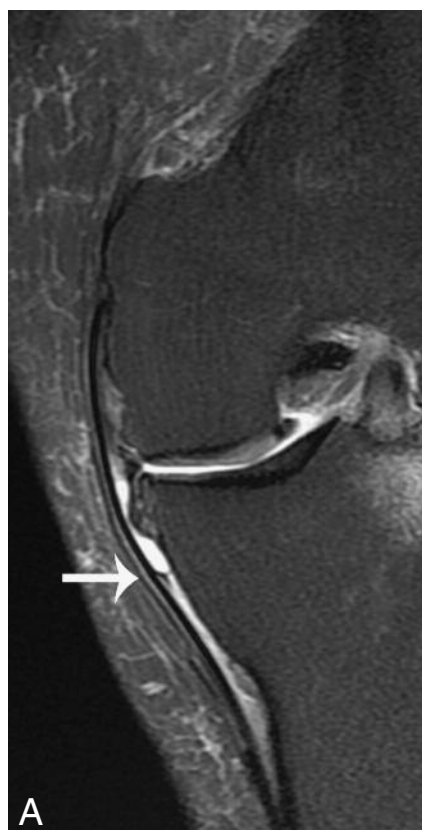
*Fig. 7.* — Corresponding drawing showing extension in vastus medialis (M). Compare to Figure 6.



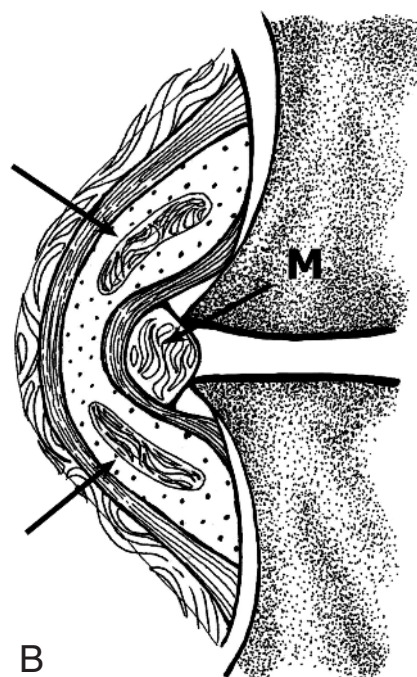
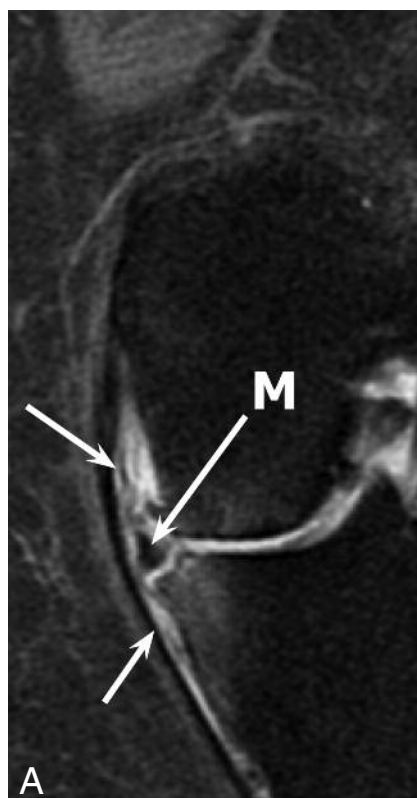
*Fig. 8.* — Coronal proton density weighted MR image. Arrows outline normal superficial fascia. Arrowhead points to disrupted deep meniscomfemoral band of the MCL.



*Fig. 9.* — Coronal T2 weighted MR image with fat saturation. Note superficial fascia (F, arrow). Arrows point to injury of posterior part of the MCL showing high signal intensity.



**Fig. 10.** — A. Coronal T2 weighted MR image with fat saturation. Fluid is seen filling up the meniscotibial portion of the MCL bursa (arrow) deep to the superficial band of the MCL. In B drawing shows meniscofemoral and meniscotibial part (arrows) of MCL bursa.



**Fig. 11.** — A. Coronal T2 weighted MR image with fat saturation. Degenerative expulsed meniscus is seen (M) with fluid extending deep to the MCL (arrows). In B drawing shows corresponding findings.

located adjacent to the MCL, it could be mistaken as evidence of an MCL tear. The bursa usually becomes distended due to mechanical friction such as in horseback riding and motorcycling. Less commonly rheumatological disorders may cause distention of this bursa.

### Osteoarthritis

Degenerative disease commonly affects the knee joint (Fig. 11). Signs include chondromalacia, subchondral bony edema, meniscal extrusion, and bulging of the MCL (5). Often fluid will accumulate deep to the MCL. This is however a reactive phenomenon and not an indication of an MCL sprain.

### Medial cellulitis

The soft tissues on the medial aspect of the knee may become affected in an ailment termed medial cellulitis (Fig. 12). This may be a rather focal area of cellulitis or may be more generalized such as in anasarca. The fluid in this instance collects mainly superficial to the medial fascia and hence differentiation from a MCL sprain is thus possible.

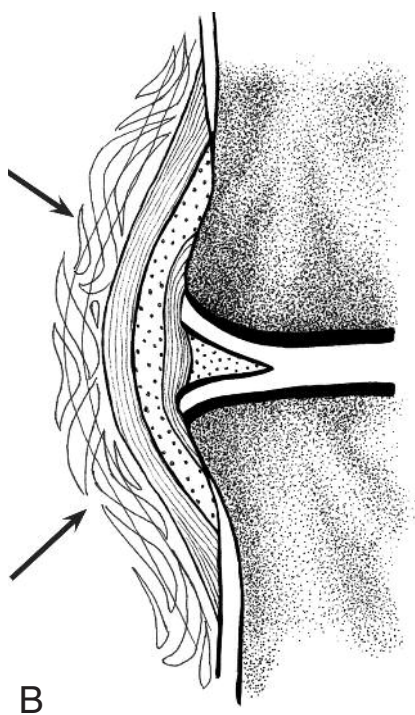
### Medial meniscal tear

Meniscal tears are very common on the medial aspect of the knee (Fig. 13). With such tears it is not uncommon to depict reactive fluid deep to the superficial band of the MCL (5). This fluid could be erroneously mistaken for evidence of an MCL sprain.

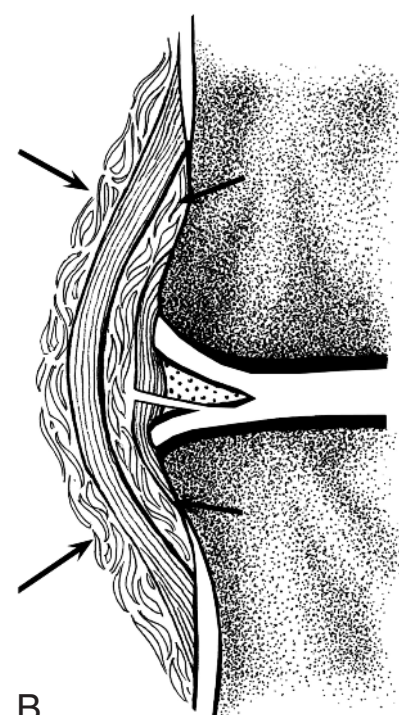
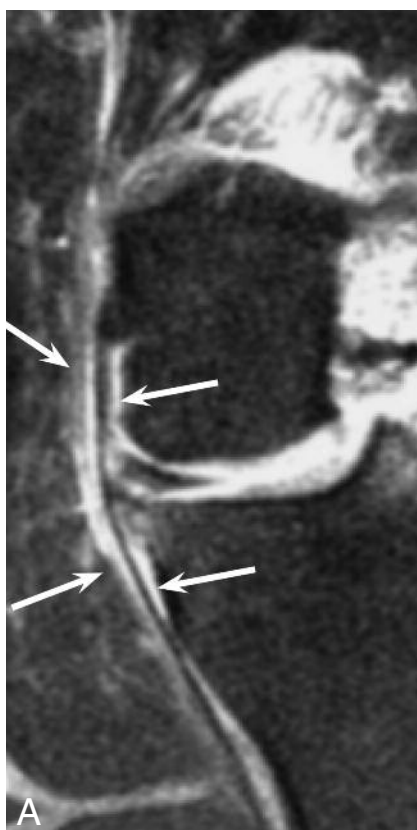
### Medial meniscal cyst

A meniscal cyst usually presents as an oval shaped collection between the superficial and deep MCL (Fig. 14) (6-8). Meniscal cysts are most often associated with a horizontal tear of the meniscus. However, this is not always the case. Occasionally an area of mucoid degeneration may occur in the meniscus without an associated tear. A meniscal cyst is rather rounded or oval shaped whereas an MCL bursa usually appears as an elongated collection adjacent to the femur or tibia or both. When it is located postero-medially it may present as an elongated collection deep to the MCL and be mistaken for evidence of MCL sprain.

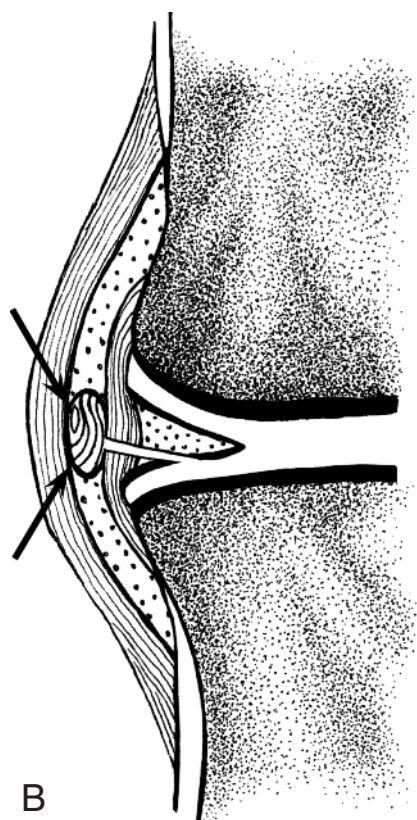
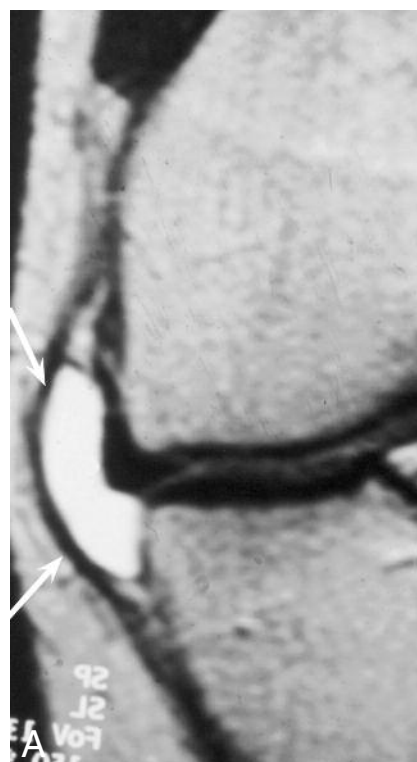




*Fig. 12.* — A. Coronal T2 weighted MR image with fat saturation. Note diffuse soft tissue infiltration superficial to the MCL (arrows). In B corresponding drawing shows soft tissue edema (arrows).



*Fig. 13.* — A. Coronal T2 weighted MR image. Note meniscal tear with fluid superficial and deep to the MCL. In B corresponding drawing shows similar findings (arrows).



*Fig. 14.* — A. Coronal proton density weighted MR image. Meniscal cyst is shown adjacent to meniscus and deep to MCL (arrows). In B anatomical drawing shows similar findings.

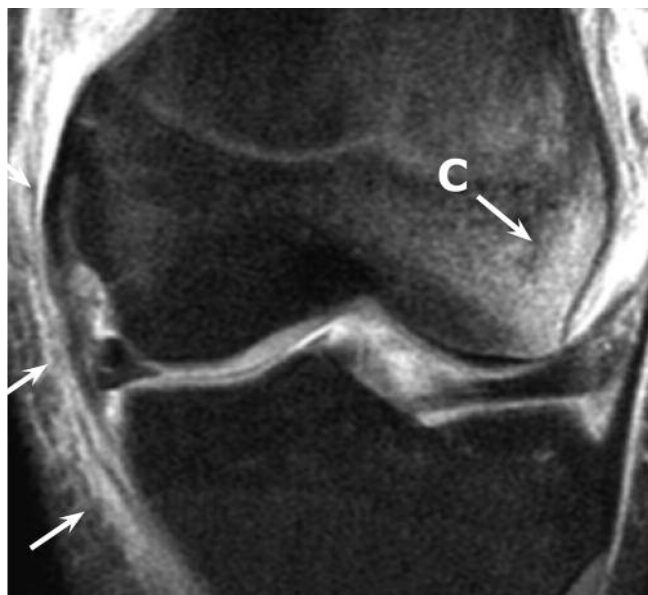


Fig. 15. — Coronal T2 weighted MR image. Note fluid superficial to MCL (arrows) in the setting of a patellar dislocation with retinaculum involvement. Note corresponding typical bone contusion at lateral condyle (C).

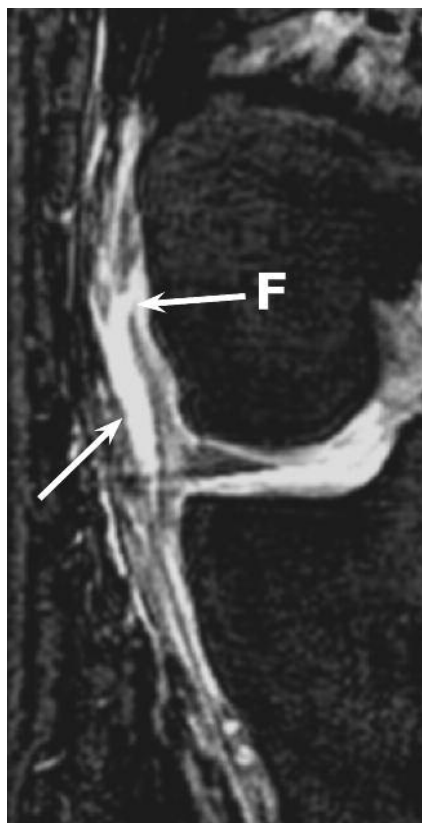


Fig. 17. — Coronal proton density weighted MR image. Note tear of meniscofemoral band (F, arrow), a type of meniscocapsular separation and leaking of fluid deep to the MCL (arrow).



Fig. 16. — Coronal proton density weighted MR image. Meniscocapsular separation is shown (arrow).

### Medial retinaculum tear

MCL injury may extend to the medial retinaculum (Fig. 15). The opposite situation also occurs. In patellar dislocation involvement of the retinaculum typically is associated with involvement of MCL fibers (9). In a retinacular tear a typical bone marrow edema pattern may be seen on the lateral condyle.

### Meniscocapsular separation

With meniscocapsular separation fluid may be detected between the meniscus and the deep bands of the MCL (Fig. 16, 17). This could also be mistaken for evidence of an MCL sprain (10, 11). Deeper involvement may include peripheral meniscal tears.

### Conclusion

MCL injuries present a varied spectrum with involvement of deep and superficial components and also

possible involvement of the posterior MCL. Various soft tissue structures adjacent to the MCL may present with reactive fluid around the components of the MCL and may simulate MCL tears.

### Acknowledgment

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## NEWS FROM THE UNIVERSITIES

### WETENSCHAPPELIJKE PRIJS EM. PROFESSOR DOCTOR A. L. BAERT PERIODE 2009-2010

#### Artikel 1

Een tweejaarlijkse prijs voor een bedrag van € 2500 wordt opgericht door de stichting "Wetenschappelijke Prijs Em. Prof. Dr. A. L. Baert te Leuven, met als doel het fundamenteel en klinisch wetenschappelijk onderzoek in de radiologie aan te moedigen.

#### Artikel 2

Deze prijs kan worden toegekend aan een radioloog, opgeleid aan één van de vier Nederlandstalige universiteiten in België, op basis van een met goed gevolg verdedigde doctoraatsthesis, door een jury die zal benoemd worden door het stichtingscomité.

#### Artikel 3

Slechts werken die minder dan 2 jaar oud zijn op de datum van hun indiening kunnen in aanmerking worden genomen. Het werk moet opgesteld zijn in het Nederlands of in het Engels, met in beide gevallen, een uitgebreide samenvatting van minstens 15 bladzijden in het

Nederlands (interlinie 1, ca. 47 regels per blz.).

#### Artikel 4

De prijs kan slechts toegekend worden aan een nog niet bekroond werk. De auteur van het bekroonde werk krijgt de titel "Laureaat Wetenschappelijke Prijs Em. Prof. Dr. A. L. Baert".

#### Artikel 5

De jury van de prijs is samengesteld uit 7 personen, aangeduid door het stichtingscomité volgens de regels van het intern reglement. Em. Prof. Dr. A. L. Baert is voorzitter van de jury. Het staat de jury vrij de prijs al dan niet toe te kennen.

#### Artikel 6

De gevallen waarin door het reglement van de prijs niet is voorzien of betwistingen die zouden kunnen ontstaan betreffende de interpretatie ervan, de beoordeling van de ontvankelijkheid van de werken en/of van de kandidaten e.a. worden onherroepelijk door de jury beslecht.

Er wordt geen briefwisseling gevoerd over de uitspraak van de jury.

#### Artikel 7

De kandidaten moeten hun werk samen met hun curriculum vitae indienen in 6 gedrukte exemplaren bij Em. Prof. Dr. A.L. Baert en 1 exemplaar bij de secretaris, **uiterlijk op 30 september 2010**. Het stichtingscomité bepaalt de exacte datum van de toekenning van elke tweejaarlijkse prijs, voorzien in de maand december. De eerste toekenning van de prijs is uitgereikt in december 1998.

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