MENISCAL INJURY

MRI and Arthroscopic Findings

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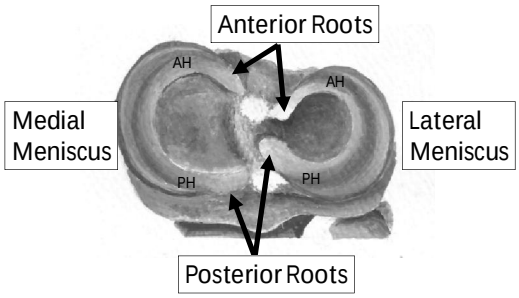
Naresuan University Hospital

Meniscus

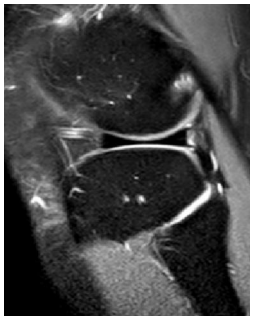


Meniscus

Normal Meniscus

Normal Meniscus

Normal Meniscus (LM)



Normal Meniscus (LM)

Normal Meniscus (MM)

Normal Meniscus (MM)

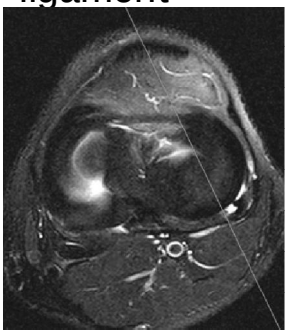
Surrounding anatomy

- Transverse meniscal ligament
- Meniscal femoral ligament (MFL)
- Popliteomeniscal fascicles
- Oblique meniscomeniscal ligament

Anterior Transverse Meniscal ligament

- Anterior Transverse Meniscal ligament
  - Connects and stabilizes anterior horns of the meniscus

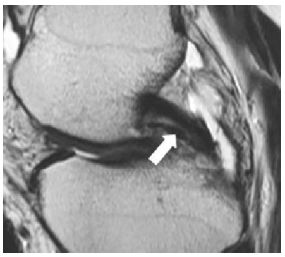
Anterior Transverse Meniscal ligament



Meniscofemoral ligament (MFL)

- Originate from the posterior horn of the lateral meniscus and insert onto the lateral aspect of the medial femoral condyle
  - Humphry (aMFL)
  - Wrisberg (pMFL)

Meniscofemoral ligament (MFL)



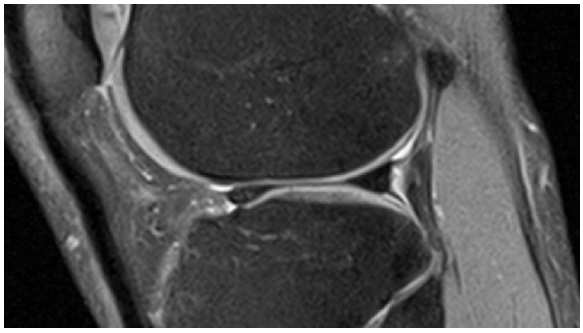
Humphry ligament (aMFL)

Wrisberg ligament (pMFL)

Popliteomeniscal fascicles

- Popliteomeniscal fascicles
  - Mimic a peripheral posterior horn flap tear
  - A tear of posterosuperior fascicle is highly associated with a tear of lateral meniscus

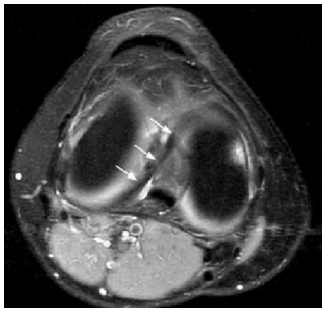
Popliteomeniscal fascicles



Oblique meniscomeniscal ligament

- Connects the anterior horn of the one meniscus with the posterior horn of the contralateral meniscus
- Present in 1-4% of knees
- Mimic a centrally displaced meniscal fragment

Oblique meniscomeniscal ligament



MRI criteria for diagnosis a tear

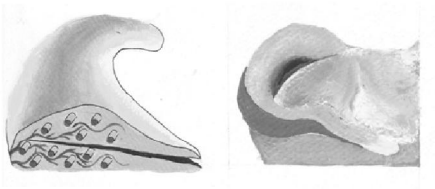
- Meniscal distortion without prior surgery
- Increased intrasubstance signal intensity unequivocally connecting the articular surface
- "two-slice-touch" rule

De Smet AA et al. AJR Am J Roentgenol 2006; 187(4):911–914.

Meniscal tear classification

- Horizontal tear
- Longitudinal tear
- Radial tear
- Root tear
- Complex tear
- Displaced tear
- Bucket-handle tear
- Fraying

Horizontal tear

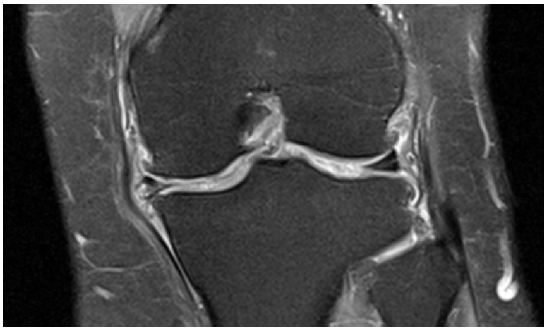


Horizontal tear

- MRI shows a horizontally oriented line of high SI that contacts the meniscal surface or free edge.
- Parameniscal cyst formation is associated with complete tear

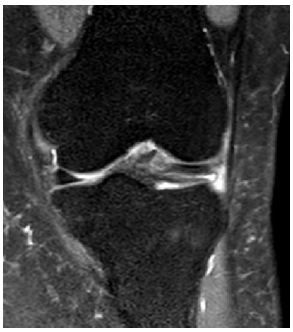
Ferrer-Roca O, Vilalta C.
Clin Orthop Relat Res 1980;(146):301–307.

Lt Knee/Horizontal Tear of LM

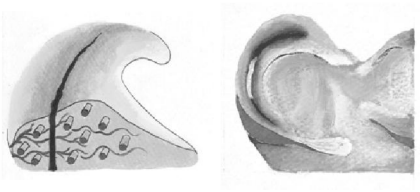


Horizontal Tear (LM, Lt. Knee)

Parameniscal Cyst



Longitudinal tear

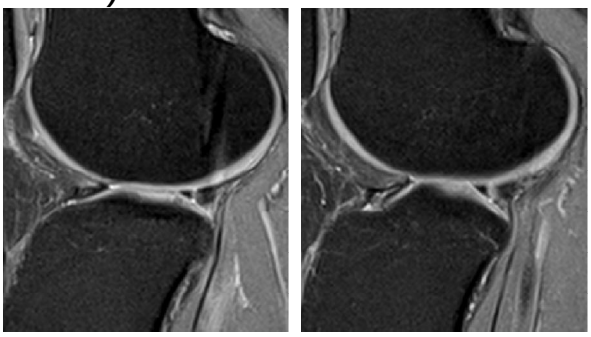


Longitudinal tear

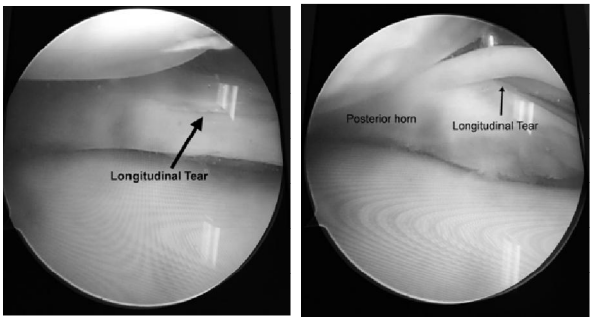
- MRI shows a vertical oriented line of high SI that contacts one or both articular surface
- It have a propensity to involve the peripheral third of the meniscus and posterior horn
- There is a close association between peripheral longitudinal tear and ACL torn, specificity, 90% of MM and 83% of LM.

De Smet AA, Graf BK.
AJR Am J Roentgenol 1994;162(4):905–911.

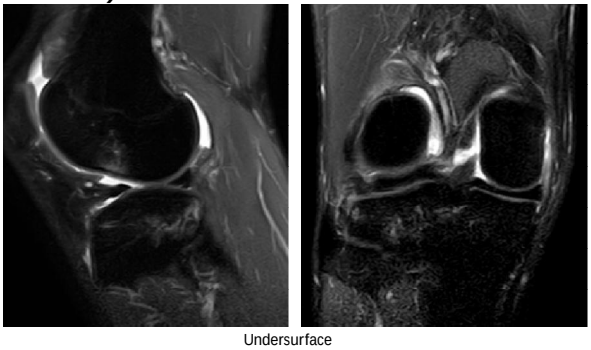
Longitudinal Tear (LM, Rt. knee)



Longitudinal Tear (LM, Rt. knee)

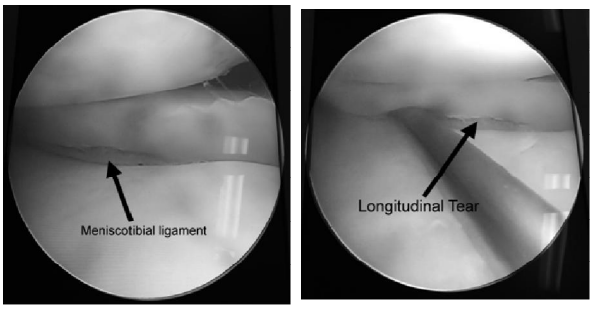


Longitudinal Tear (LM, Rt. knee)



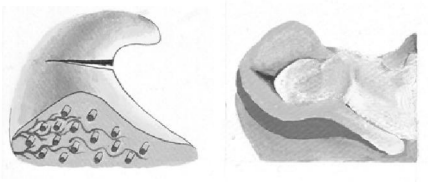
Undersurface

Longitudinal Tear (LM, Rt. knee)



Undersurface

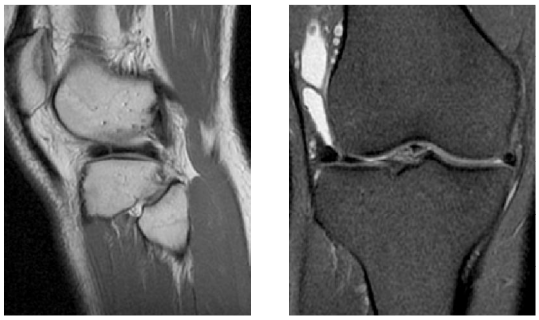
Radial tear



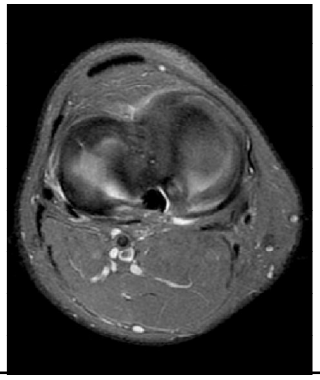
Radial tear

- Commonly involve the posterior horn of the MM or junction of anterior horn and body of the LM.
- MRI shows a cleft oriented perpendicular to the free edge.
- Variable appearances
  - Truncated triangle
  - Cleft
  - Marching cleft
  - Ghost meniscus

Radial tear



Radial tear

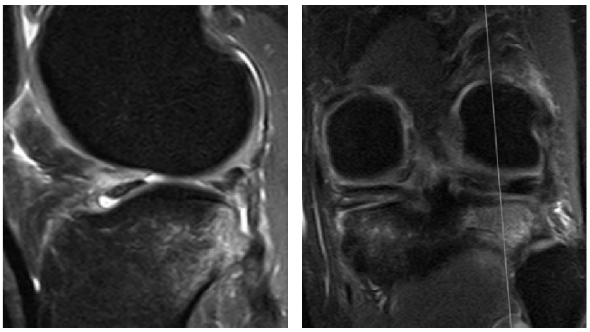


Radial Tear (LM, Rt. Knee)

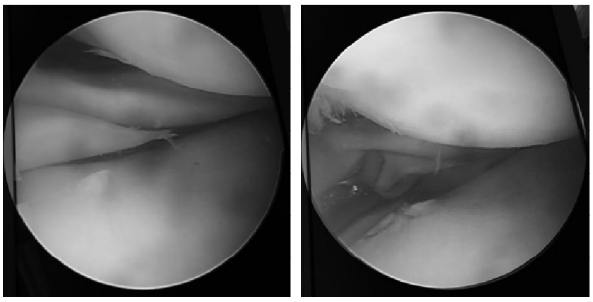
Complex tear

- A combination of radial, horizontal and longitudinal components

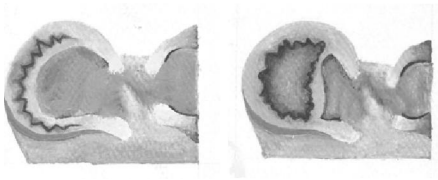
Complex/radial tear



Complex/Radial Tear(LM, Lt. Knee)



Bucket-handle tear



Bucket-handle tear

- Occurs frequently in MM

Shakespeare DT, Rigby HS.
Bone Joint Surg Br 1983;65(4):383–387.

- MRI signs
  - An absent bow tie
  - A fragment within the intercondylar notch
  - A double PCL
  - A double anterior horn or flipped meniscus
  - Disproportionally small posterior horn

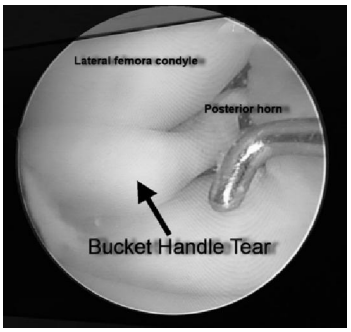
Dorsay TA, Helms CA. Skeletal Radiol 2003;32(5):266–272.

Magee TH, Hinson GW. Skeletal Radiol 1998;27(9):495–499.

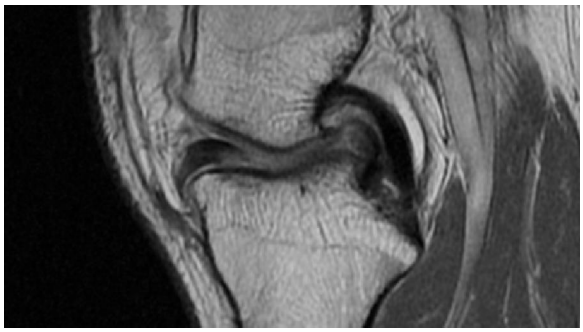
Haramati N, et al. Skeletal Radiol 1993;22(4):273–277.

Rt Knee/Bucket Handle Tear of LM

Bucket Handle Tear (LM,Rt Knee)



Double PCL sign

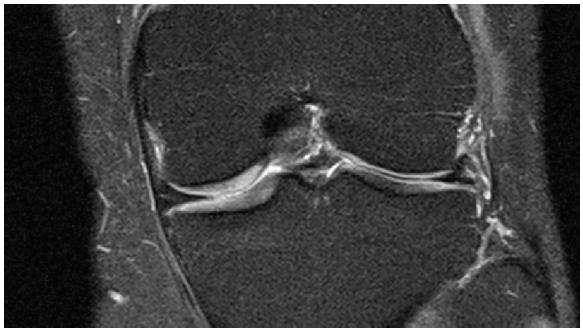


Fraying

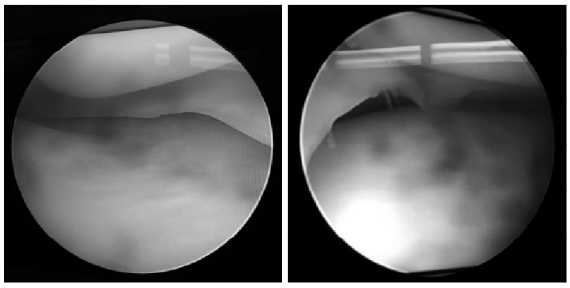
- At arthroscopy, fraying is defined as surface irregularity along the meniscal free edge without a discrete tear.
- MRI findings
  - At the free edge shows loss of its sharp tapered central edge.
  - At the posterior root shows subtle, ill-defined, horizontally oriented increased intrameniscal SI contacting the articular surface
    - DDx shallow partial-thickness tear, fraying and surrounding synovitis

Jie C. Nguyen et al.
Radiographics. 2014 Jul-Aug;34(4):981-99

Fraying



Fraying



INDIRECT SIGN OF MENISCAL TEAR

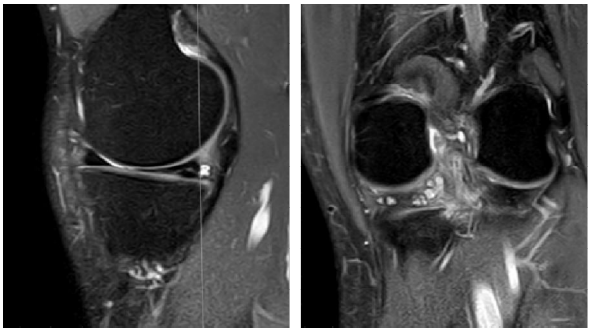
Indirect sign of meniscal tear

- Parameniscal cyst
- Meniscal extrusion
- Subchondral marrow edema

Parameniscal cyst

- Direct contact to the meniscus or via a fluid track,
- Typically contains a horizontal tear component

Parameniscal Cysts

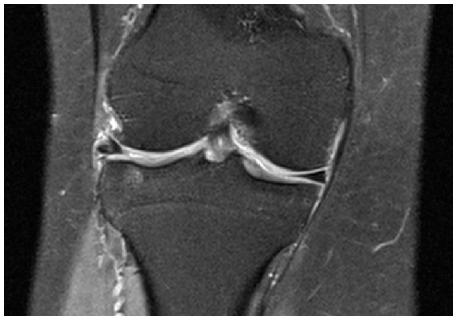


Meniscal extrusion

- Peripheral margin of the meniscus extends ≥ 3 mm beyond the edge of tibial plateau
- Close association between meniscal extrusion and root tear
  - 76% of medial root tears have extrusion
  - 39% of extrusion have medial root tear
- Can also be seen with complex tear, large radial tear and severe meniscal degeneration.

Costa CR, et al.
AJR Am J Roentgenol 2004;183(1):17–23.

Meniscal extrusion



MENISCAL CONTUSION

Meniscal contusion

- Occurs when the meniscus gets trapped between the tibia and the femur during a traumatic event

Cothran RL Jr, et al.
AJR 2001;177:1189–1192

- Indistinct and amorphous increased signal intensity in the periphery of the meniscus

ANATOMICAL VARIATION AND PITFALLS

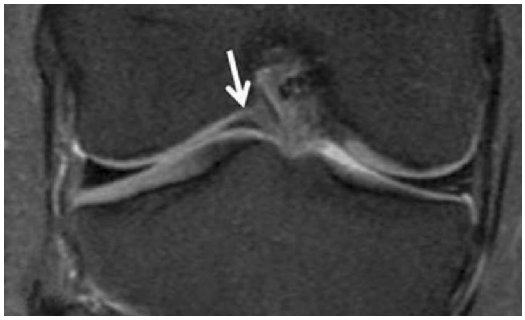
Anatomical variation and pitfalls

- Discoid meniscus
- Meniscal flounce
- Meniscal ossicle
- Chondrocalcinosis

Anatomical variation and pitfalls

- Discoid meniscus
  - The variant: ring-shape meniscus with connection between the roots can mimic a medially displaced meniscal fragment
- Meniscal flounce
- Meniscal ossicle
- Chondrocalcinosis

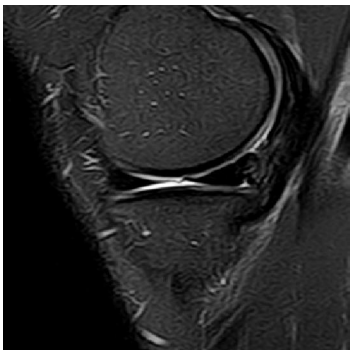
Ring-shaped discoid meniscus



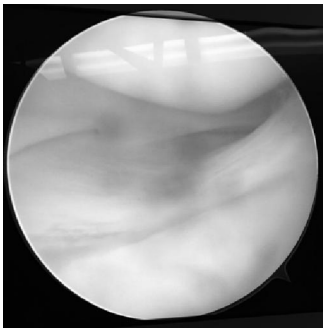
Anatomical variation and pitfalls

- Discoid meniscus
- Meniscal flounce
  - A rippled appearance of the free nonanchored inner edge of the MM
  - Typically, secondary to flexion of the knee and redundancy of the free edge of the MM
- Meniscal ossicle
- Chondrocalcinosis

Meniscal Flounce (MM, Lt. Knee)



Meniscal Flounce (MM, Lt. Knee)



Anatomical variation and pitfalls

- Discoid meniscus
- Meniscal flounce
- Meniscal ossicle
  - A predilection for the posterior horn of the MM
  - Increased SI can mimic a tear

Jie C. Nguyen et al.
Radiographics. 2014 Jul-Aug;34(4):981-99

- Chondrocalcinosis

Meniscal ossicle

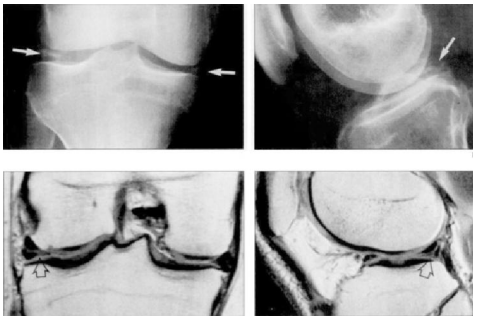
Rakesh Mohankumar, et al.
AJR Am J Roentgenol. 2014;203: 1040-1046

Anatomical variation and pitfalls

- Discoid meniscus
- Meniscal flounce
- Meniscal ossicle
- Chondrocalcinosis
  - Increased SI can mimic a tear

Jie C. Nguyen et al.
Radiographics. 2014 Jul-Aug;34(4):981-99

Meniscal chondrocalcinosis



B.J Burke, et al.
AJR Am J Roentgenol. 1998;170: 69-70.