

Knee: Meniscus

Back to Basics

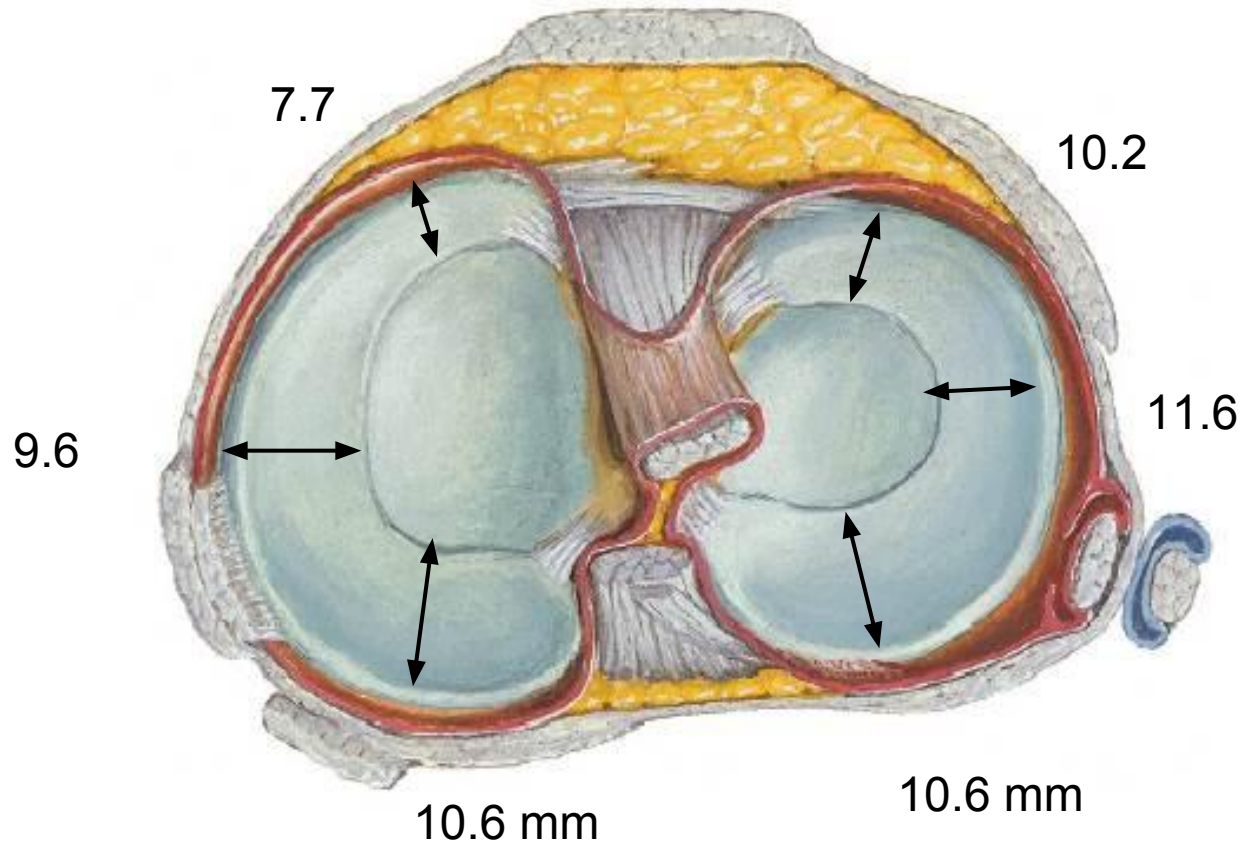
Kyung Jin Suh

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Doctor Radiology, Daegu, KOREA

Medial

Lateral



Posterior > Anterior horn

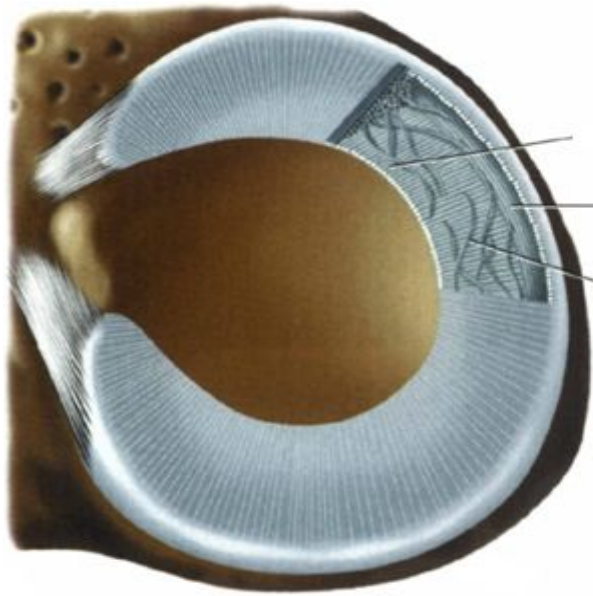
Posterior = Anterior horn

Medial



Lateral

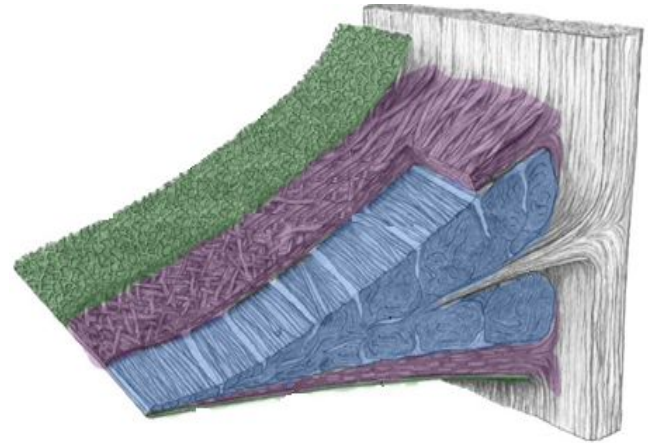




Radial fiber

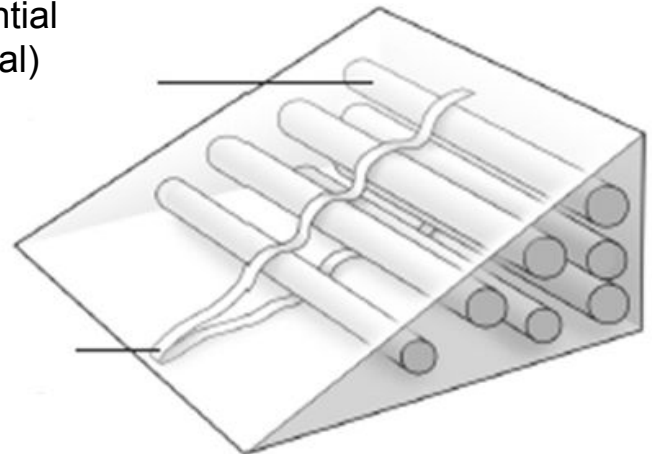
Circumferential
fiber

Perforating
fiber

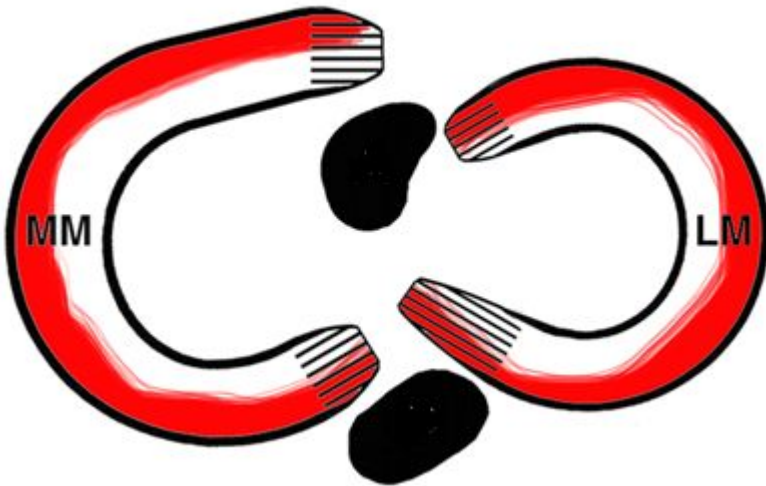


Circumferential
(longitudinal)
fiber

Radial (tie)
fiber



Red zone and White zone



Red zone (3 mm): repair

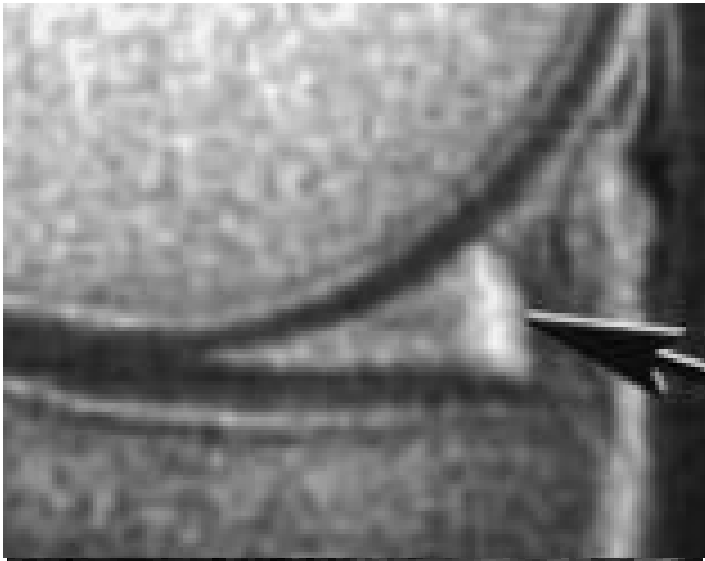
Medial meniscus: 10-30%

Lateral meniscus: 10-25%

White zone (5 mm): meniscectomy



Hauger O. *Radiology* 2000



Hauger O. *Radiology* 2000

Red zone vs white zone

Perimeniscal tissue

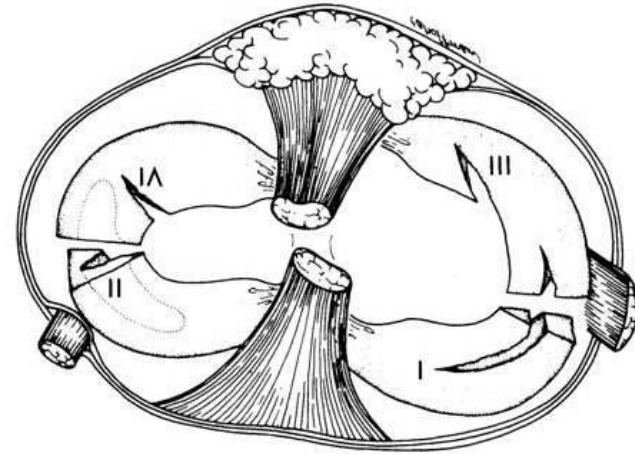
: blood vessels, adipose tissue, irregular collagen fibers

Meniscal Tear

Classifications by O'Connor



Surg Annu 1977;9:267



1. Longitudinal tears
2. Horizontal tears
3. Oblique tears
4. Radial tears
5. Variations
 - Flap, complex, degenerative
 - bucket-handle tear

Meniscal Tear

Longitudinal

Horizontal tear

Flap tear

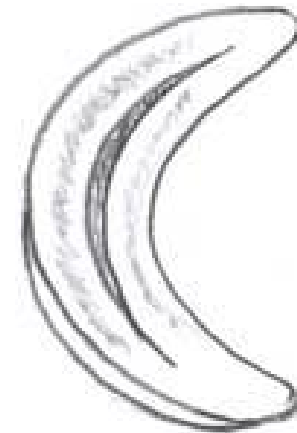
Flipped horn tear

Vertical tear

Bucket handle tear

Ramp tear

Oblique tear



Radial

Radial tear

Root tear

Parrot beak tear

Complex Tear

Free edge tear
Meniscocapsular separation
Meniscal contusion

Meniscal Tear Types

Describe Based on Classification

Longitudinal horizontal tear

Longitudinal vertical tear

Longitudinal oblique tear

Flap tear

Flipped tear

Radial tear

Parrot beak tear

Bucket handle tear

Ramp tear

Root tear

Complex tear

Free edge tear

Meniscal contusion

Meniscocapsular separation

Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears



Horizontal
Longitudinal

Tear Depth

- Partial
- Complete

Location (Rim Width)

- Zone 1
- Zone 2
- Zone 3

Radial Location

- Anterior
- Mid
- Posterior

Central to Popliteal Hiatus

- Yes/no

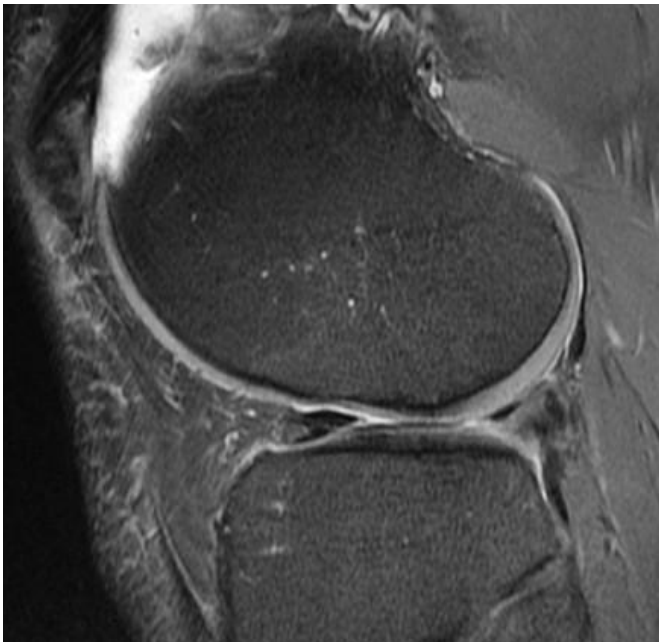
Quality of Tissue

Tear length

Percentage of meniscus excised

An anatomical diagram of a knee joint in a sagittal view. The femur is at the top, and the tibia is at the bottom. The meniscus is shown as a wedge-shaped structure between the two bones. The meniscus is divided into three zones: Zone 1 (red, anterior), Zone 2 (yellow, mid), and Zone 3 (blue, posterior). A dashed red line indicates the radial location, with numbers 1, 2, and 3 corresponding to the zones. The diagram also shows the popliteal hiatus and the quality of the tissue.

Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears



Tear Depth

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- Zone 3

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- Posterior

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Tear length

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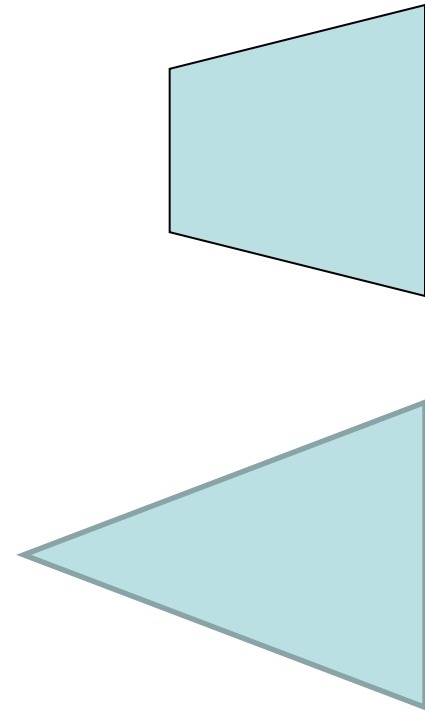


Meniscal Tear Imaging Criteria

Meniscal contour
Meniscal signal intensity

Meniscal morphology alteration
Displaced meniscal fragment
Abnormal intrameniscal signal intensity
 Extending to articular surface
 At least 2 sections

Sensitivity/specificity= 93/88%
Medial/lateral meniscus=79/95%



Meniscal Tear Imaging Criteria

Meniscal contour
Meniscal signal intensity

If seen on single image

50% of medial meniscal torn

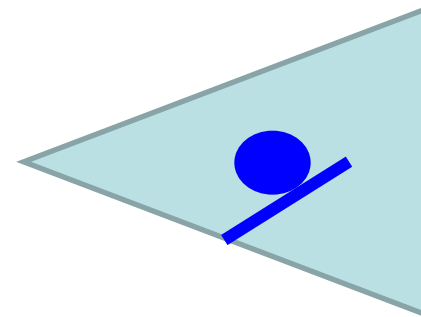
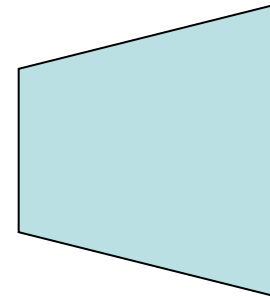
30% of lateral meniscal torn

Associated with radial and parrot-beak tears

Exception

Discoid shape with intrameniscal signal

Meniscal cyst



Meniscal Tear Imaging Criteria

Meniscal contour
Meniscal signal intensity

If seen on single image

50% of medial meniscal torn

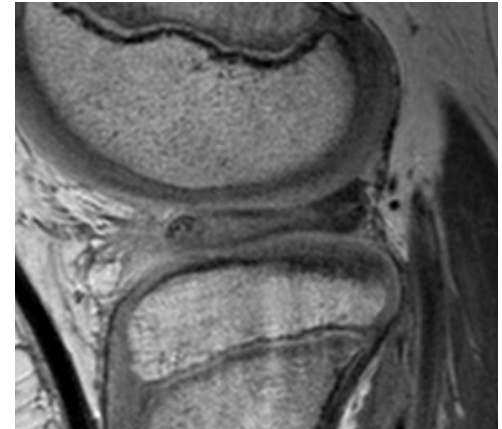
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Meniscal cyst



Meniscal Tear

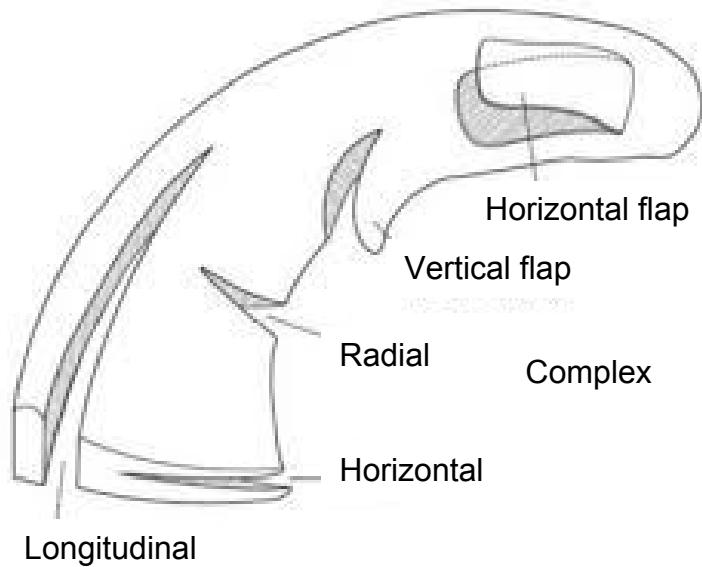
Role of Imaging

What I report should include

- Location
- Type
- Partial vs complete
- Zone
- Length
- Associated abnormalities
- Stability vs instability

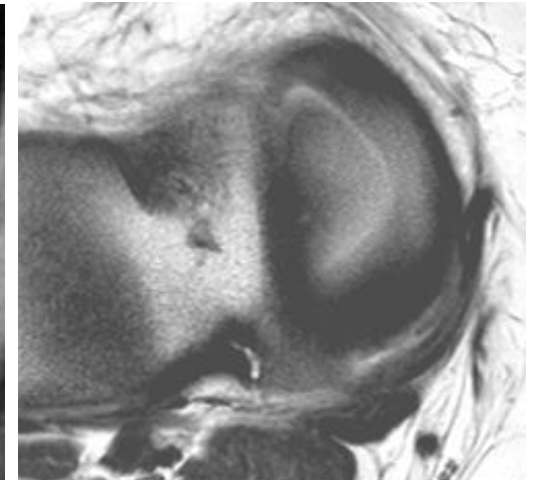
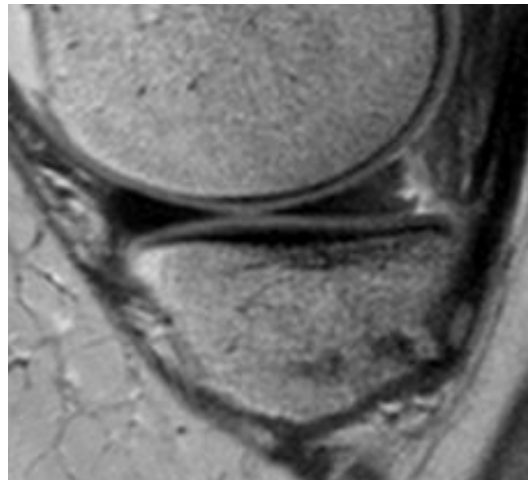


Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears

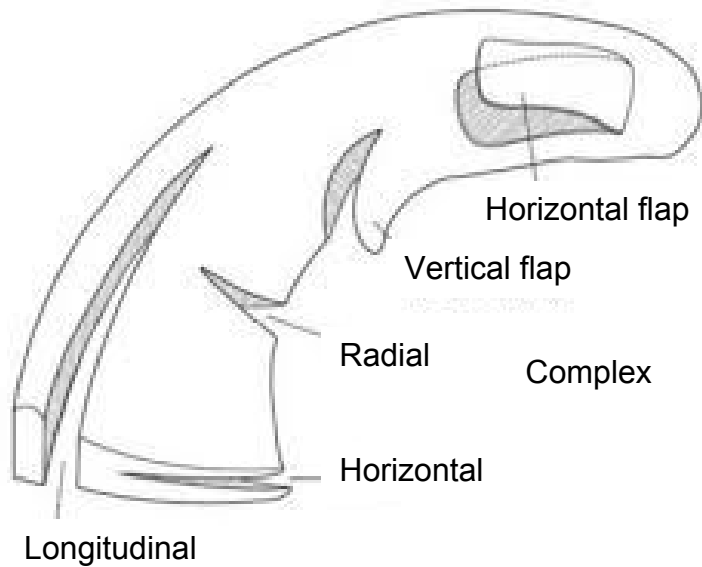


Longitudinal Tear

Longitudinal vertical tear
Trauma



Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears



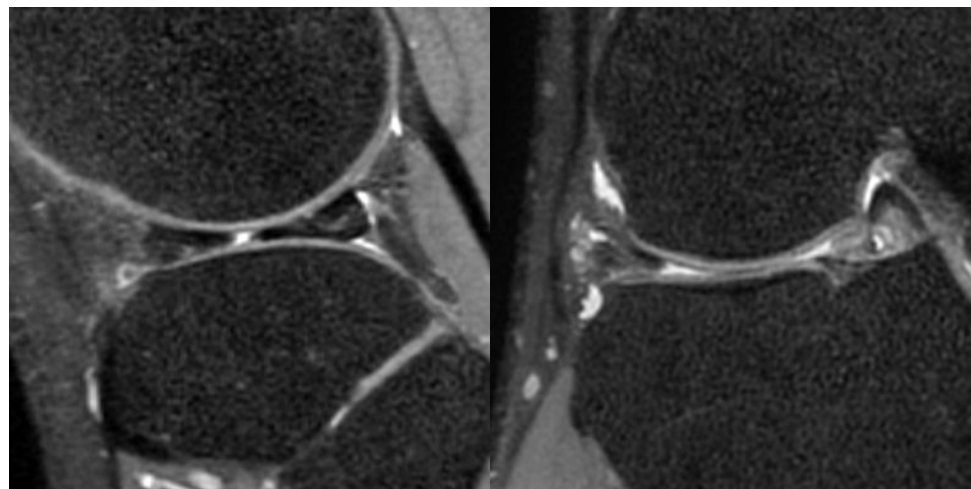
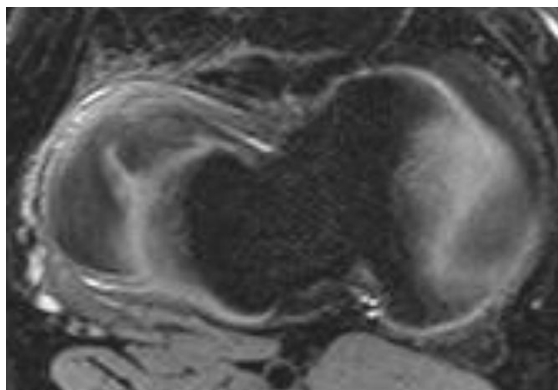
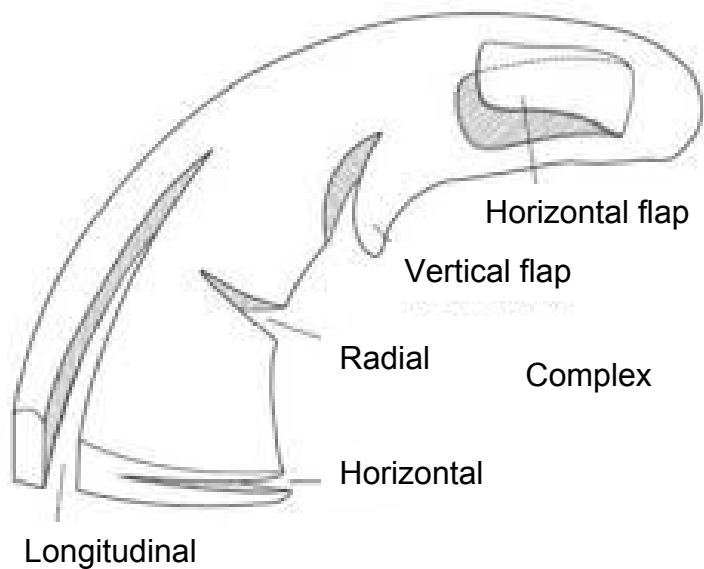
Horizontal Tear

Longitudinal horizontal tear

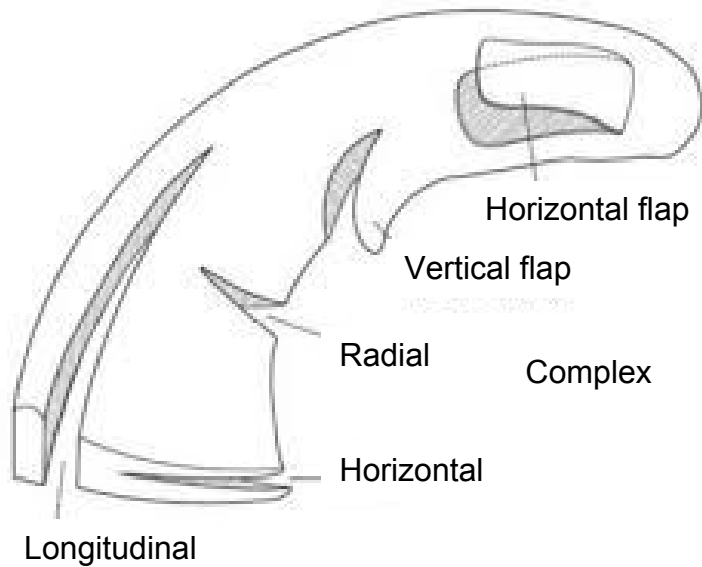


Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears

Radial Tear

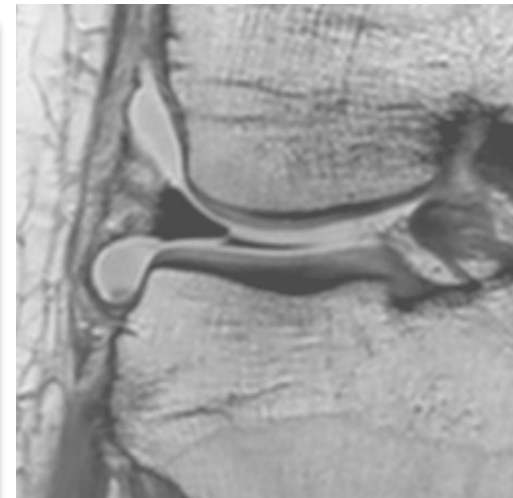
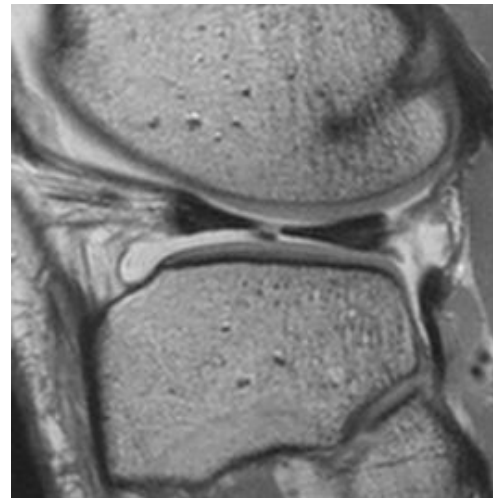


Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears



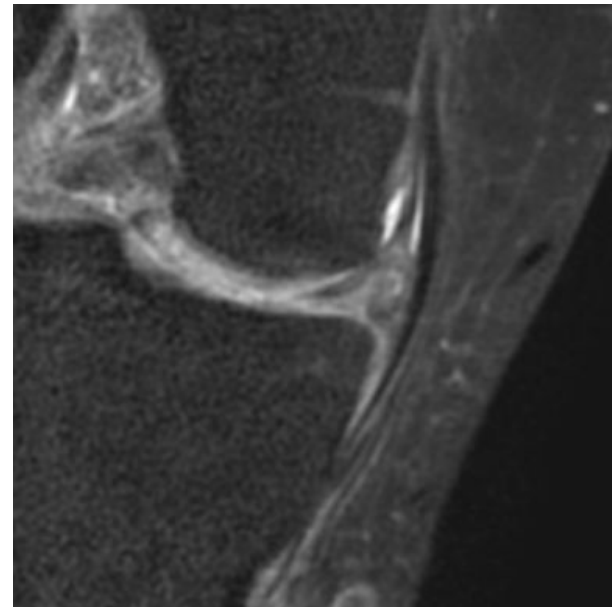
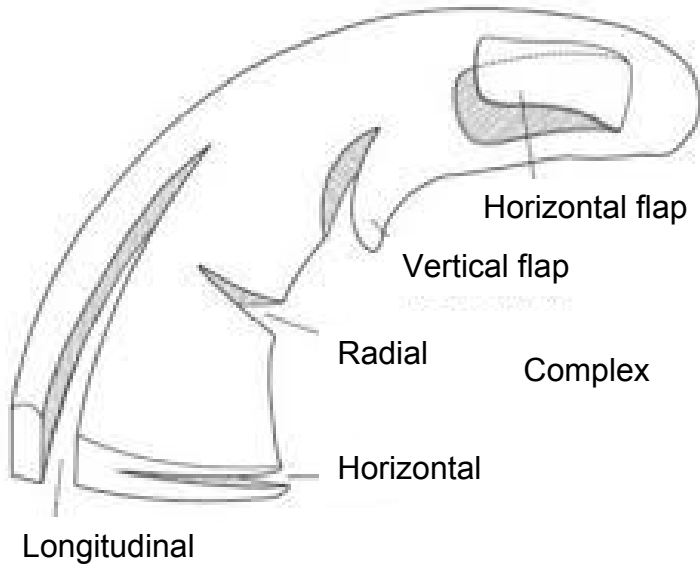
Vertical Flap Tear

Oblique tear
Parrot-beak tear



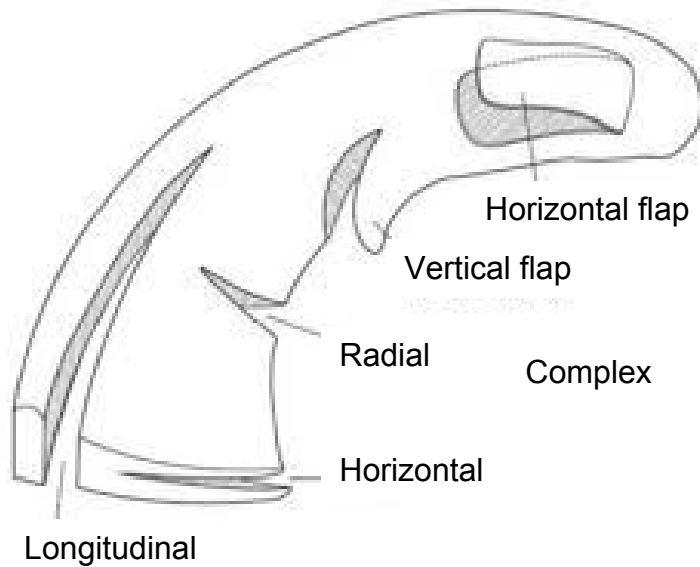
Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears

Horizontal Flap Tear

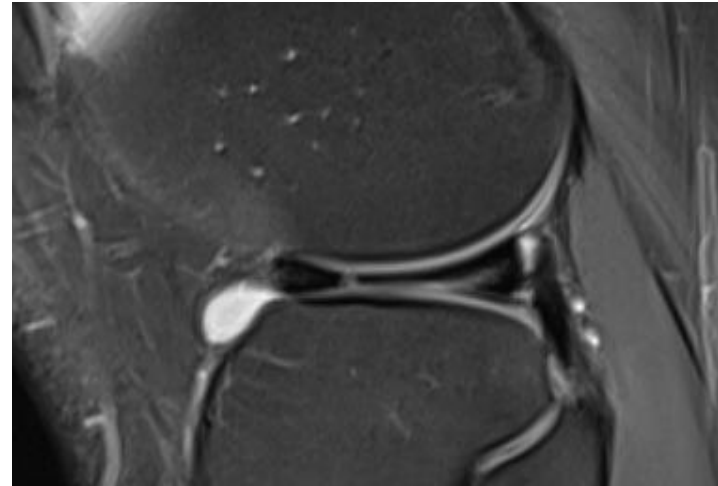


DDx
MM: SM tendon anterior horn

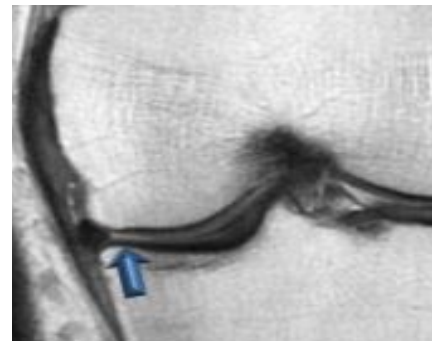
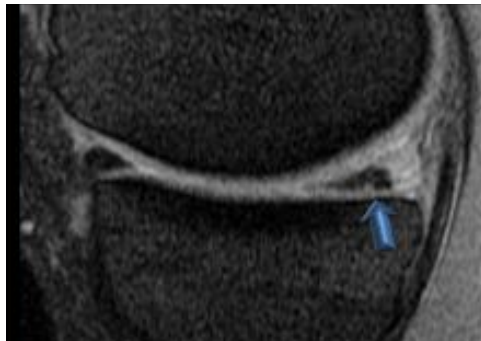
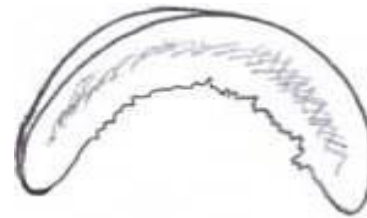
Interobserver Reliability of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) Classification of Meniscal Tears



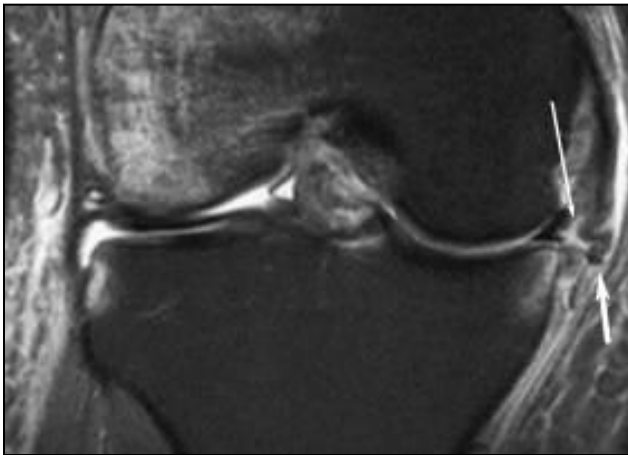
Complex Tear



Free Edge Tear



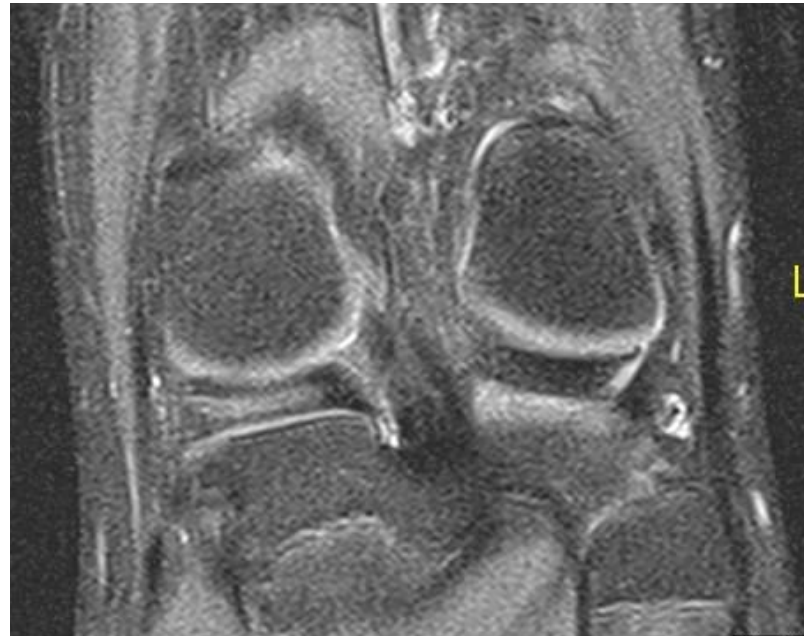
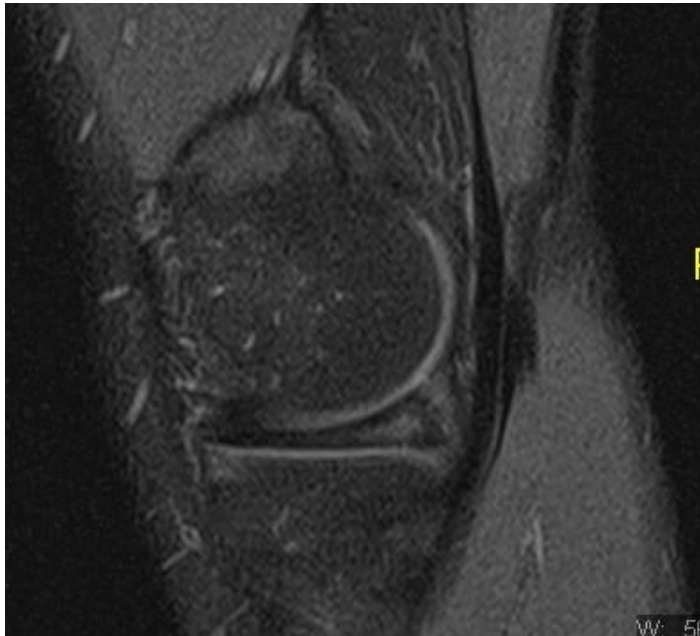
Meniscocapsular Separation



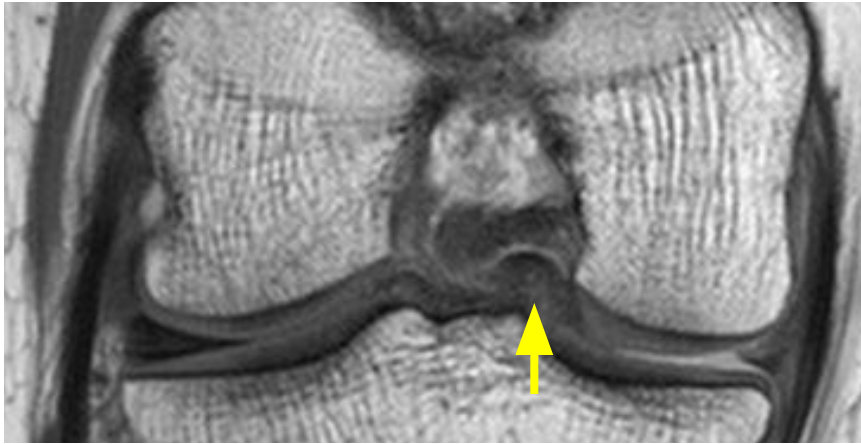
Meniscal Contusion

14/M

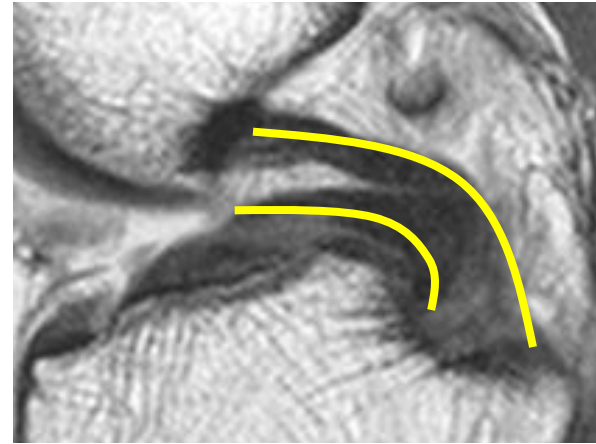
Football injury 5 days ago



Bucket-handle Tear



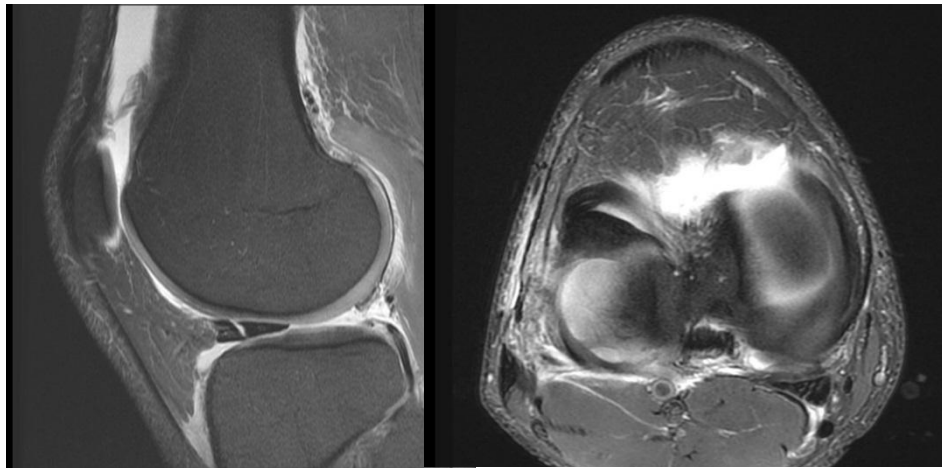
Meniscal fragment
in intercondylar notch



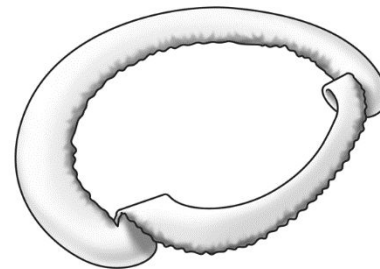
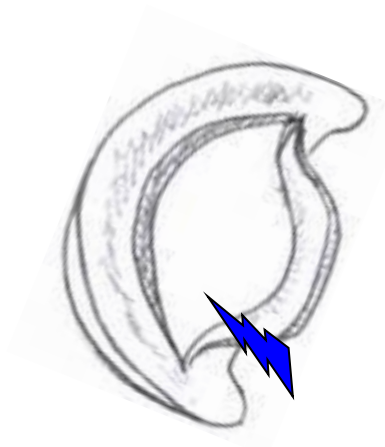
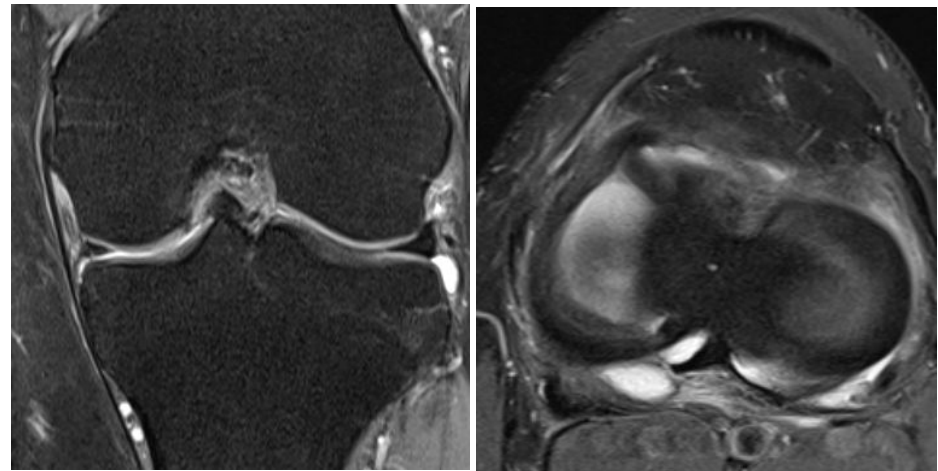
“Double PCL sign”

Bucket-handle Tear

Broken-handle Tear



Condylar Entrapment

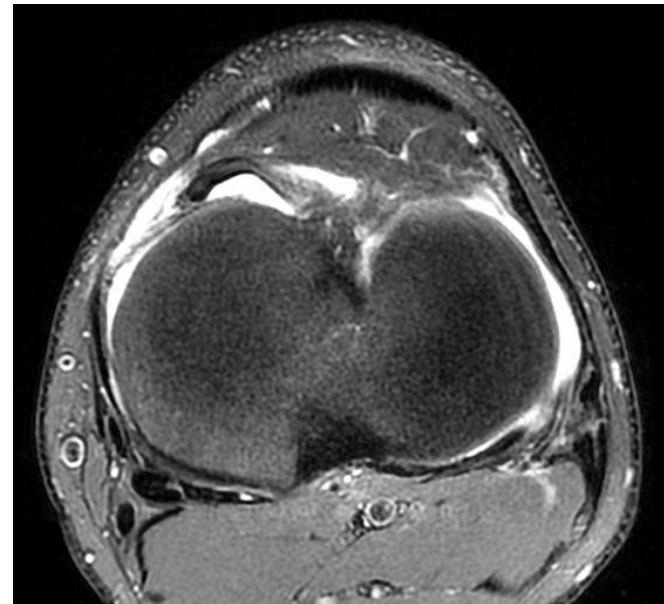


Jack and Jill Lesions

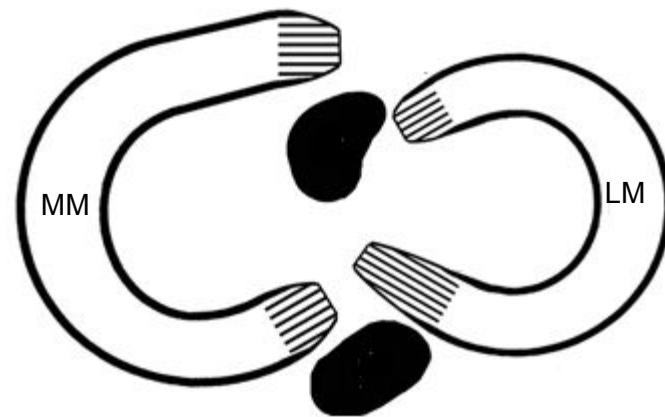


Leaking Bucket

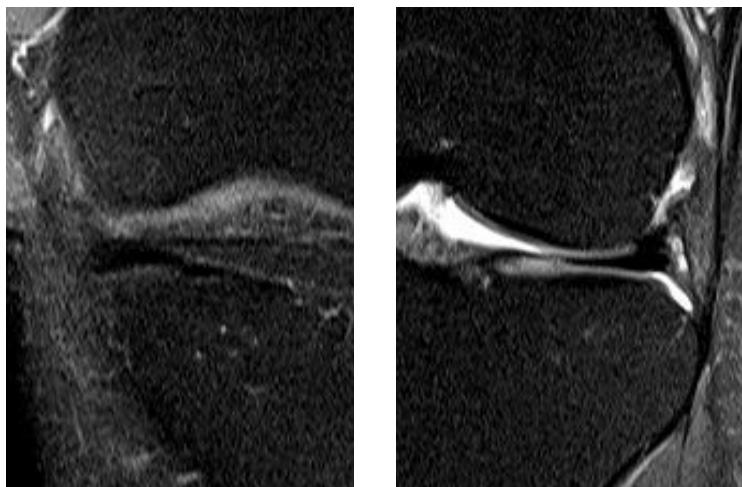
Peripheral (rim) failure
Radial, horizontal
Meniscocapsular separation



Meniscal Root Tear



Ant



Med



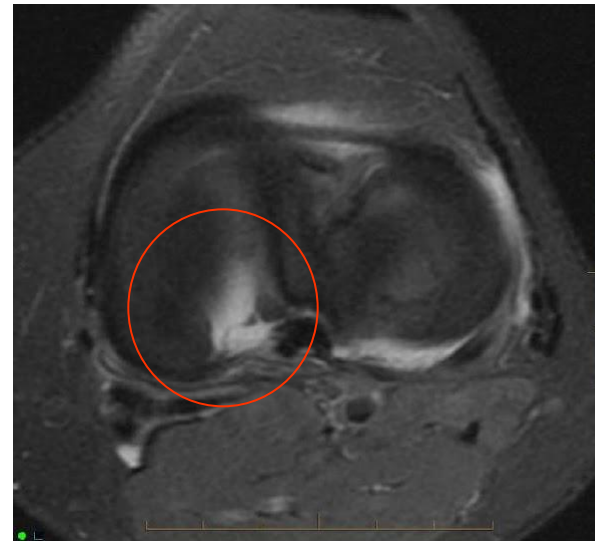
Post



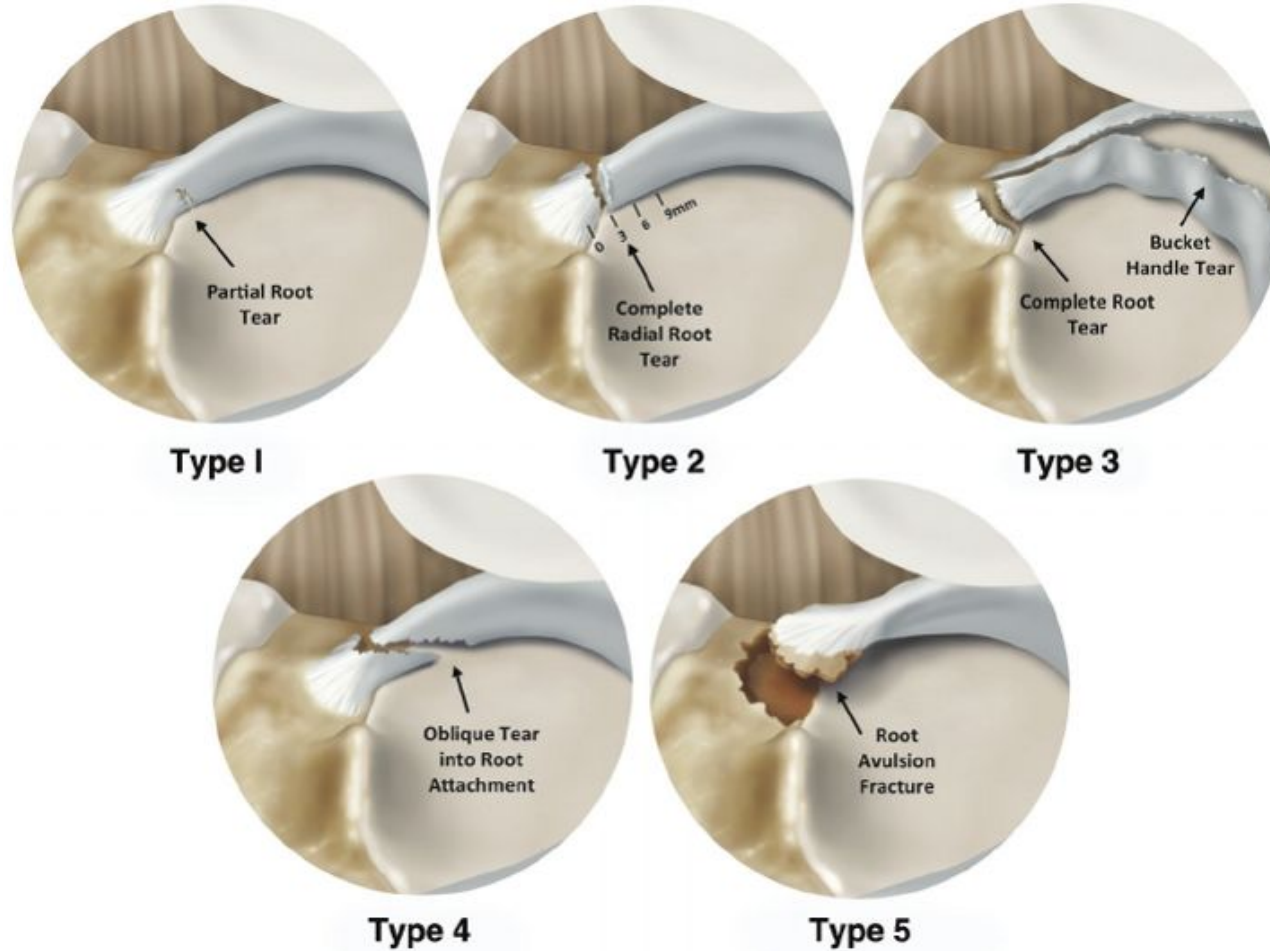
Lat



30/M
"Pop"
when squatting weights



LaPrade Classification of Meniscal Root Tears Based on Tear Morphology

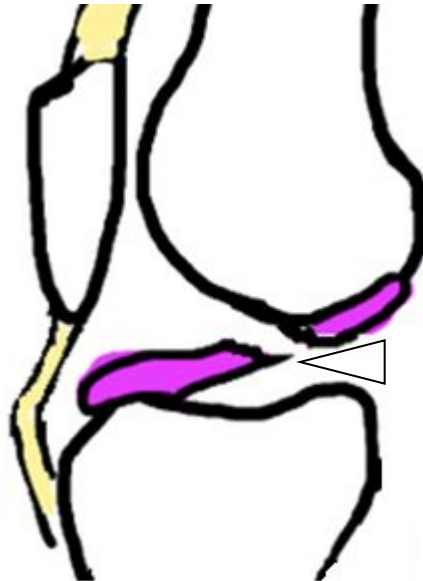
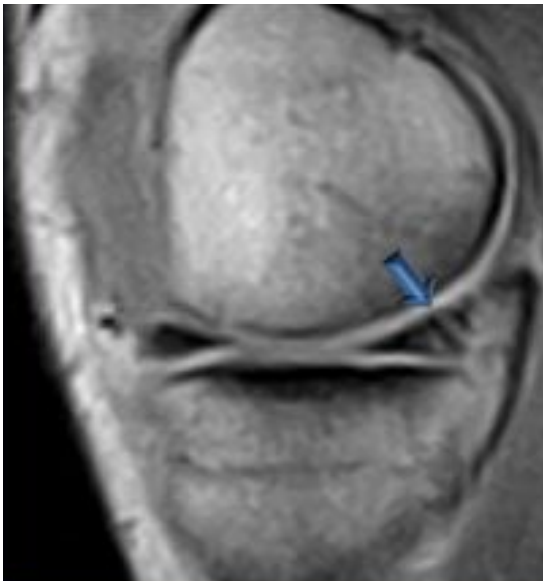


Ramp Tear

Medial meniscus posterior horn

Resist anterior translation of tibia

Association with chronic ACL tears



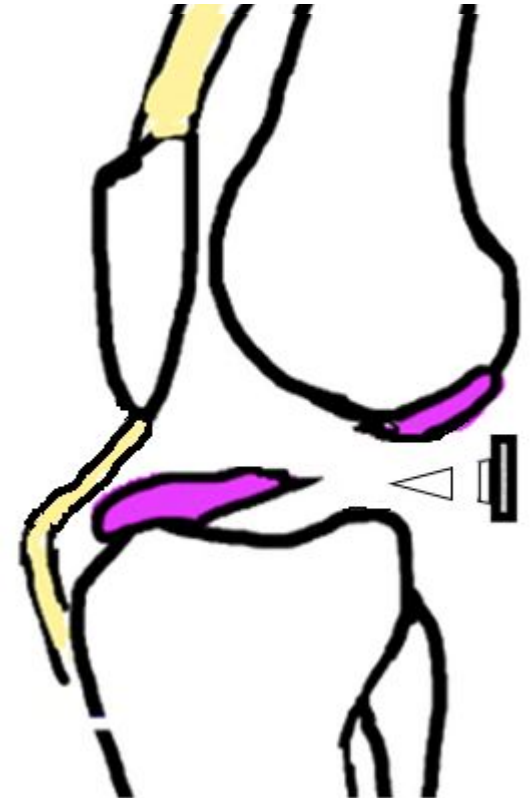
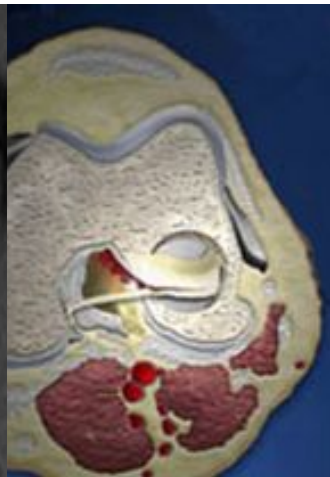
Ramp lesion

Wrisberg Rip

Lateral meniscus posterior horn

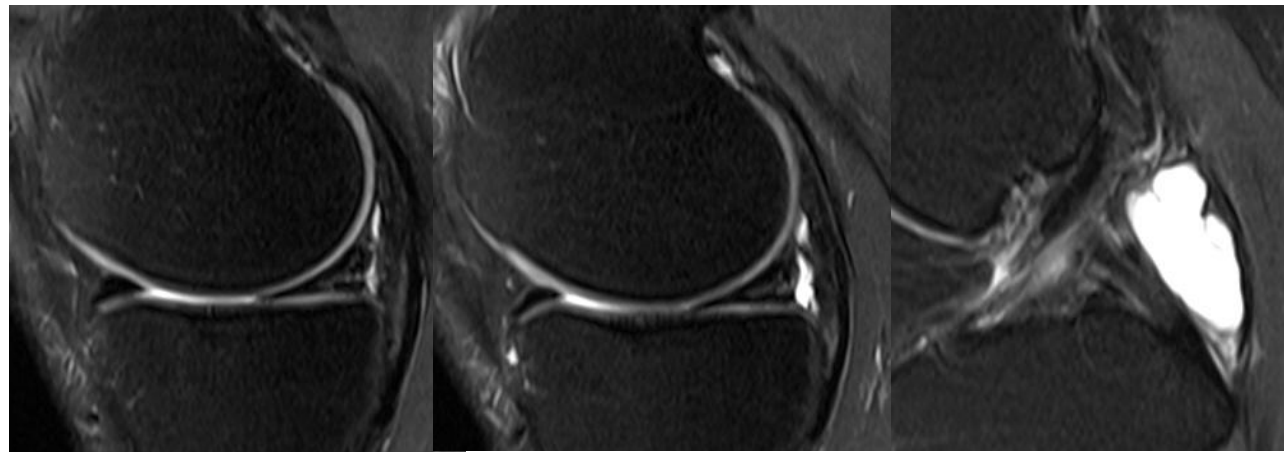
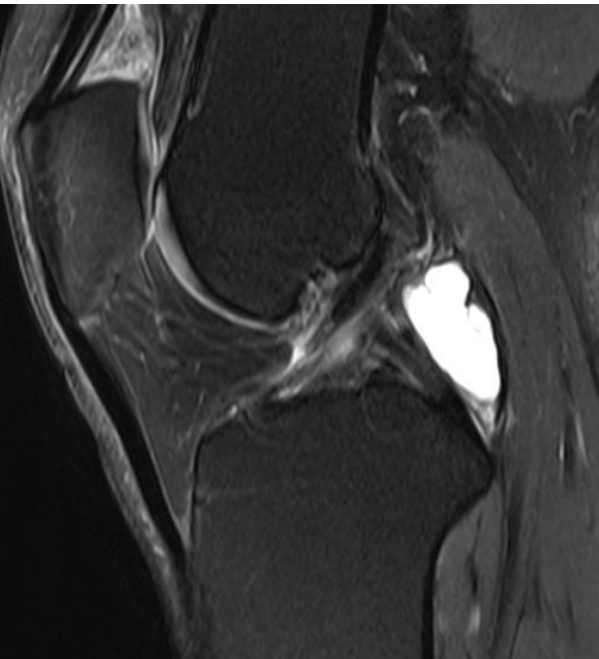
Peripheral failure

Association with ACL tear



meniscus
tear of the posterior horn of the lateral meniscus and/or Wrisberg ligament

Meniscal Cyst



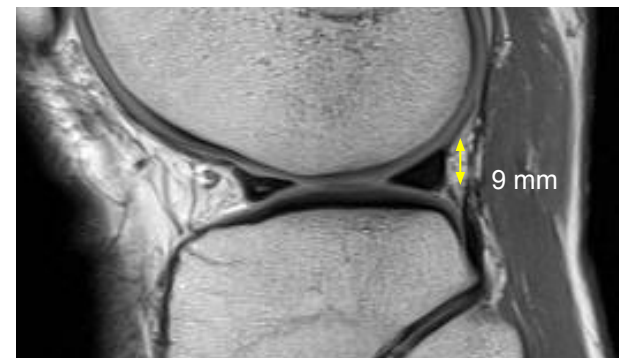
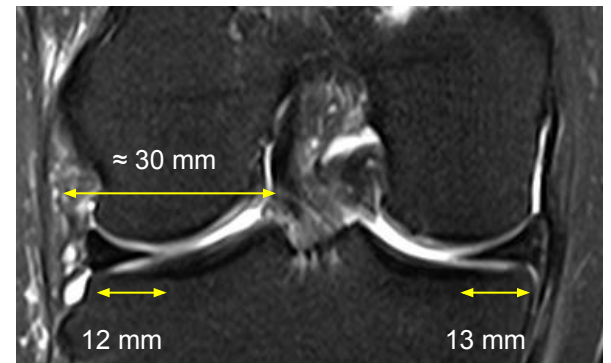
Meniscus

Unstable meniscus

Definition

A tear in which the meniscus or a meniscal fragment is displaced or can be displaced by a probe

1. A tear that on inspection of probing is greater than 9 mm in length
2. ... has multiple directions
3. A large radial tear of a radial tear with wide separation at the site of tear
4. A gap at the site of tear that may collect fluid



Meniscus

Unstable meniscus

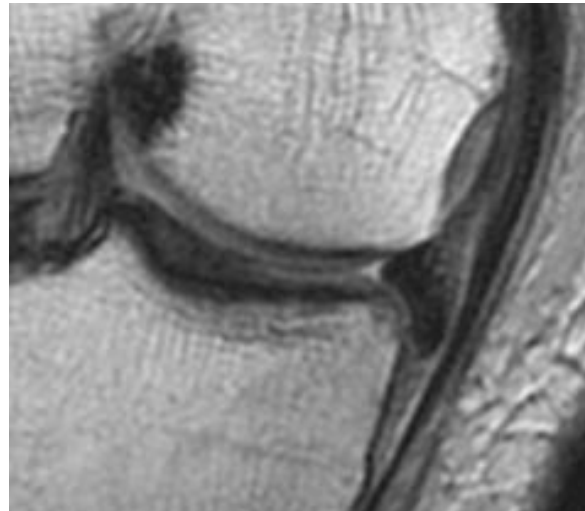
Greater than 1 cm in length tear

More than one morphologic tear pattern

Displaced meniscal fragment

High signal on T2 within tear plane

Radiology 2016;281: 23-40



Discoid Meniscus

Watanabe Classification



Complete type



Incomplete

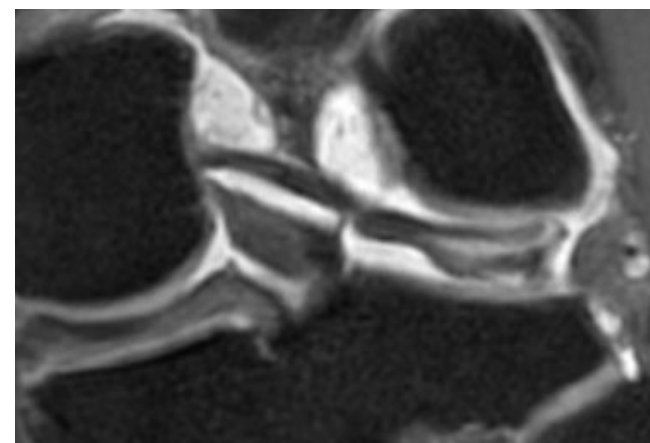
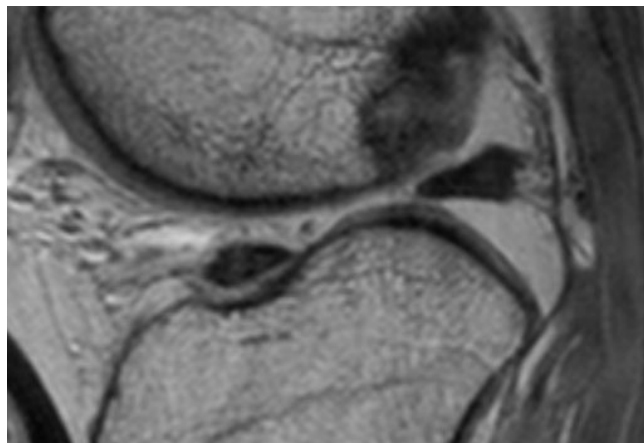
Cover <80% of plateau



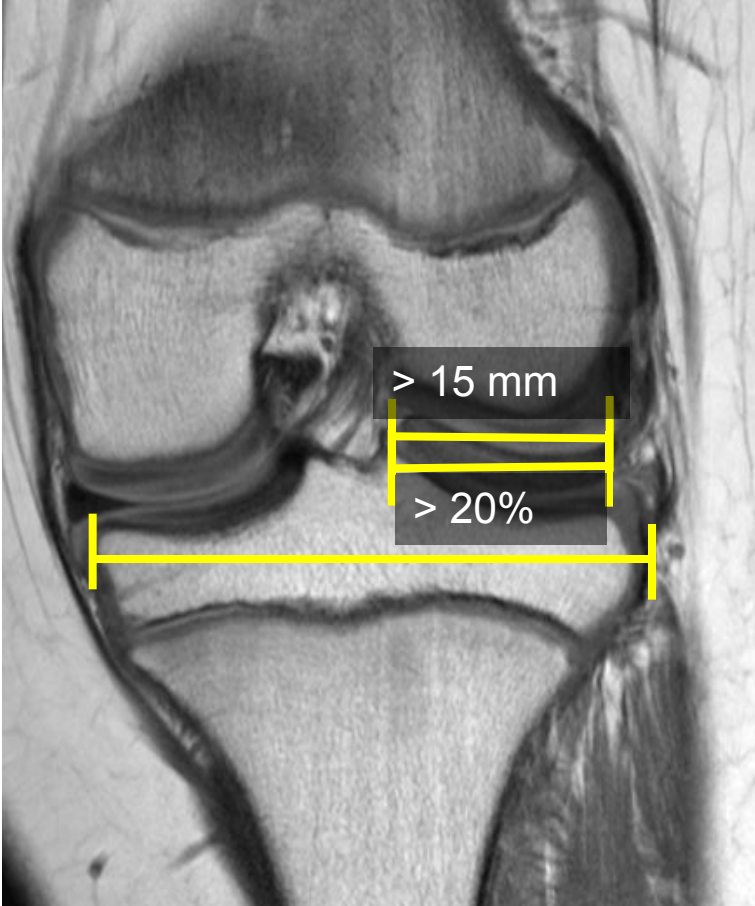
Wrisberg-ligament

Wrisberg-ligament Type

Lack posterior capsular attachment
"Snapping knee"



MRI Criteria



Meniscal Tear

Role of Imaging

What I report should include

- Location
- Type
- Partial vs complete
- Zone
- Length
- Associated abnormalities
- Stability vs instability

ISAKOS Classification

1. Tear depth
2. Location
3. Radial location
4. Central to the popliteal hiatus
5. Tear pattern
6. Quality of tissue
7. Length of tear
8. Indicate the amount of meniscus that was excised by drawing on the diagram and crosshatching the part that was removed.
9. What percentage of the meniscus was excised?

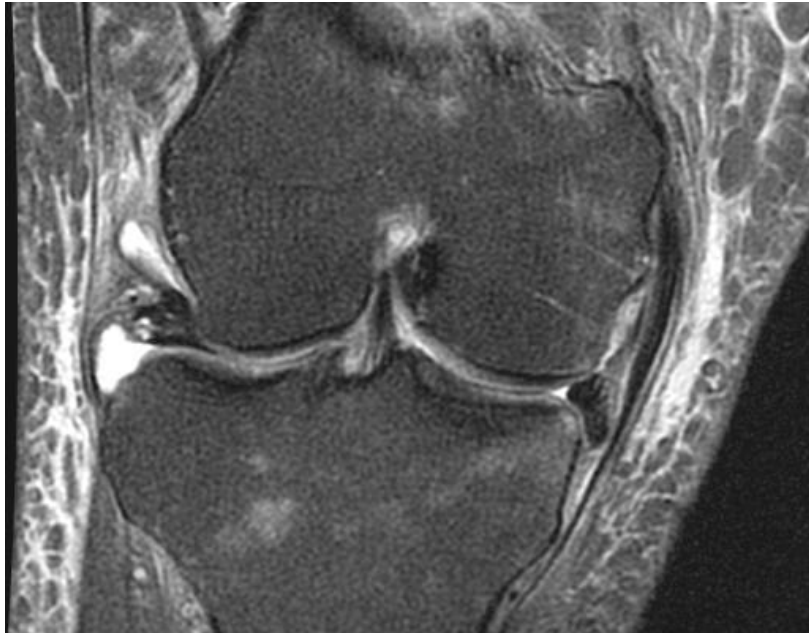


ISKOS: Horizontal

Resnick: Longitudinal horizontal

Stoller: Horizontal cleavage

Other: Degenerative fish- mouth



ISKOS: Horizontal flap

Resnick: Displaced longitudinal horizontal

Stoller: Radial with longitudinal vertical component flap tear of oblique

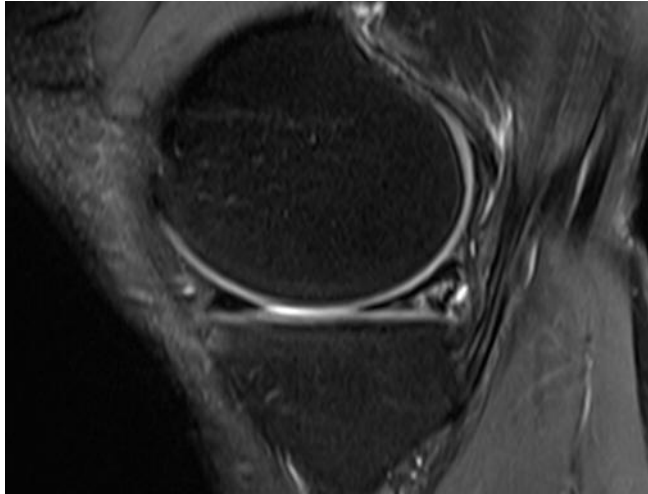


ISKOS: Bucket-handle

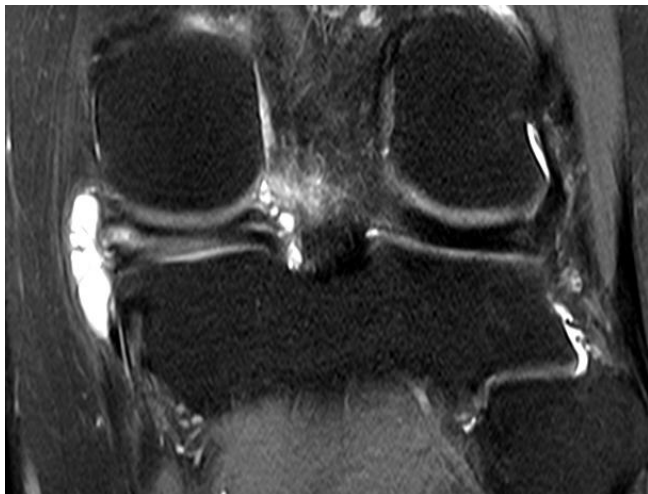
Resnick: Bucket-handle

Stoller: Bucket-handle

47/M MVA



Medial meniscus:
Posterior horn tear, Mixed type tear with posterior Root extension, LaPrade type 3. Partial depth and Zone 1 to 3 location, Tear maximal length about 16 mm, Good Poor quality of tissue. No central to popliteal hiatus. Multiseptated meniscal cyst in medial and posterior extensions.



Lateral meniscus: Normal shape and signal intensity