Imaging of the KNEE

• Plain film radiography
• MRI
• Ultrasound
Radiography

• Plain film radiographs
  – Initial imaging modality
  – Quick and widely available
  – Good over view of osseous structures
  – Some soft tissue assessments
  – Joint space evaluation
General Technique Comments

Lower Extremities;

Film size:

Knee; 8x10 or 10x12 with single view on each film.

Ankle; 8x10 or 10x12 with two views on each film (AP and Oblique on one film and Lateral and stress views together or on separate films.

Foot/toes; 8x10 or 10x12 (depending on foot size), with AP and Oblique on one film and lateral on separate film.
Knee

• Basic 3 View Series:
  – AP
  – Lateral
  – Tunnel (intercondylar)

• Optional views
  – Sunrise (Tangential)
  – Obliques
AP Knee:

FFD: 40”, kVp: 60, mA: 100

Sec/mAs: Dependant on measurement of part

Tube Tilt: 5 degrees ceph.

Patient position: AP, standing or recumbent with knee extended with patella on top.

Central Ray: 1cm inferior to inferior pole of patella.

Measure: through central ray

Breathing: hold
TABLE TOP TECHNIQUE

Cassette is on the table top. “Nonbucky” technique.

**Nonbucky technique will require less x-ray (1/2 the mAs) compared to a “bucky” technique.**

The grid absorbs some good, as well as scatter x-ray and thus requires more x-ray to make the exposure when a bucky technique is used.
Lateral Knee

FFD: 40”, kVp: 60, mA: 100

Sec/mAs: Dependant on measurement of part.

Tube Tilt: 0 - 5 degrees cephalad.

Patient Position: Affected side against bucky/table top. Knee flexed at 35-45 degrees. To place the patella is proper position.

Central Ray: At the femoral-tibial joint line.

Measure: Through the central ray.

Breathing: Hold
Lateral Knee:

Patient positioned with affected side against bucky. Knee is flexed.

For knee to be in true lateral position. Elevate and “block” the heel with a foam wedge.

If patient is standing, then strict, true lateral positioning must be obtained.
Tunnel Knee:

FFD: 40”, kVp: 60, mA: 100

Sec/mAs: Dependant on measurement of part.

Tube Tilt: 0 or 45 depending on lower leg position.

Patient Position: PA, standing or recumbent (prone or kneeling). Knee flexed

Central Ray: Through knee at popliteal fossa.

Measure: Through the central ray

Breathing: Hold
Tunnel Knee:

Kneeling and standing: 0 tube tilt. Knee flexed with femur at ~25 degree angle with central ray.

**Nonbucky technique:** Double the mAs or Time for the AP knee projection.

**Standing**

**NOTE:** Bucky technique and will require double the mAs of the nonbucky technique.

Kneeling
Tunnel Knee, Prone method

Knee flexed to 45 degrees with matching caudal 45 degree tube tilt.

Match cassette placement to steep tube tilt.
Tangential (sunrise) Knee

FFD: 40”, kVp: 60, mA: 100

Sec/mAs: Dependant on measurement of part.

Tube Tilt: 10 degree ceph.

Patient Position: prone with knee flexed maximally.

Central Ray: inferior pole of patella, between femur and patella

Measure: Through the central ray

Breathing: Hold
Fig. 1. The radiographic technique and patient position for the 30° view are illustrated. Note the goniometer used to assist in accurate measurement of knee flexion. The patient is holding the cassette on the thighs and the radiographic tube is low enough to be tangential to the patellofemoral joint.

http://radiology.rsnaajnls.org/cgi/reprint/137/1/57.pdf
Fig. 2. Normal Ficat views at (a) 30°, (b) 60°, and (c) 90°.
Tangential Knee:

Knee is flexed maximally, patient may need to hold knee flexed with a strap or belt around ankle and held by patient.

Optional method: Seated method with patient sitting at the end of table with cassette on knee. Tube tilt up through patellofemoral joint.
MRI of THE KNEE
Knee MRI

• **Indications:**
  • Trauma; acute with or without effusion.
  • Bone bruise, ligament, tendon, muscle, meniscal injuries.
  • Joint locking - popping
  • Degenerative joint disease
  • Non-traumatic effusions of joint
  • Stress/repetitive stress injury
  • Abnormal x-rays; e.g. differentiate bone island from tumor.
Dedicated Surface Coil / knee coil

• 14 x 16 cm field of view
• 4mm thick slices.
• .4 mm slice gap - except for volume imaging
• matrix 256 x 192 or 256 x 256
Protocol:

- Sagittal – Proton density w/ fat sat. (true PD not FSE)
- Sagittal – FSE T2 w/ fat sat.
- Coronal – T1, FSE T2 w/ fat sat.
- Axial -- FSE T2 w/ fat sat.
- (3 planes of FSE T2 with fat suppression and Sagittal spin echo PD w/ fat suppression)
T1 weighted sagittal; above          T2 weighted sagittal; below
Coronal T1
Axial T2 - patellar cart. and trochlear cart.

- Retinaculum, collateral, and 2\textsuperscript{nd}/3\textsuperscript{rd} look at cruciates.
Relaxed state of knee positioning, not forced

- Knee 5 degrees external rotation for ACL on Sagittal
- Menisci seen best in sagittal plane
- Short TE to effectively see meniscal tears.
- e.g, conventional spin echo T1, PD, and gradient echo
- Best 4 mm thick sagittal SE-PD w/ fat Sat.
Cruciate Ligaments

• Sagittal – 4 mm thick FSE T2 w/ fat suppression.
• No need for coronal sequences for mensical eval.  Sagittal images find 99% of meniscal tears, not coronal.
• Coronal T2 images - FSE T2 w/ fat suppression
ACL Tear: Sag. T2 Fat Sat.
Fast Spin Echo PD are unacceptable for view menisci.

- 215 consecutive knees – compared PD and FSE-PD
- results: FSE-PD missed 42 tears that were seen on PD sequences
- PD sequences sensitivity of meniscal tears = 90-95%
- FSE-PD sequences = sensitivity of 80%.
Normal Menisci

• “C” shaped fibrocartilage
• Posterior horn of medial meniscus usually larger than the anterior horn.
• Anterior and posterior horns of lateral meniscus are equal in size.
• Posterior horn of either meniscus should never be smaller than the anterior horn, if it is normal.
meniscus
Normal meniscus is devoid of signal on all sequences.

- (exception is children and young adults, due to vascularity of meniscus)
- (Intermediate signal in meniscus, posterior horn near capsular attachments)
Tears

- Meniscal Tears
- Grading systems = several
- Most important – signal that disrupts the articular surface of the meniscus
- &
- Intrasubstance signal from myxoid degeneration
Myxoid degeneration

- Wear and tear or aging?
- Not clinically symptomatic
- Not tx surgically or clinically
- Etiology uncertain
- Report it so others know that we saw it and decided it was not a tear.
Meniscus Tear Grading

MENISCUS GRADING SCALE

GRADE 1  GRADE 2  GRADE 3
Meniscus Tear Grading

- Grade 1: Intrasubstance Degeneration
- Grade 2: Degeneration
- Grade 3: Frank Tear
If signal comes close to the articular surface but does not quite reach it, then not a tear.
ACL tears – associated with peripheral meniscus tears of the medial or lateral meniscus.

- And associated with posterior horn of lateral meniscus tears.
Oblique/ horizontal Tears;

- M.C. type of tear and involves under surface of posterior horn of medial meniscus

- Commonly degenerative nature instead of trauma.
Bucket Handle tears:

• Vertical, longitudinal tear
  – free edge of meniscus is pinched/caught between fem condyle and tibial artic surface on, for example, valgus injury, lateral meniscus is trapped and free edge pulled from body of meniscus, resulting in bucket handle tear.

• Is 10% of meniscus tears
Normal meniscus has body of 9 mm on 2 consecutive sagittal images.

- Displaced frag. in intercondylar notch.
- Double PCL sign

- Two consecutive slices Should be solid in second sag. Slice
Normal meniscus has body of 9 mm on 2 consecutive sagittal images.

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- Two consecutive slices Should be solid in second sag. Slice
Bucket Handle Tear
Bucket Handle Tear

Double PCL sign
Bucket Handle Tear

Anteriorly flipped posterior horn fragment
Medial Flipped meniscus;

- Seen with MRI but overlooked at arthroscope
- Flap tear of medial men. with the flap of men. flipped into the medial gutter underneath the meniscus. Body segments look thinner than normal on MRI.
- Medial men. Will have a piece missing from the undersurface.
- Flipped flap, seen on coronal images.
Medial Flipped Meniscus
Radial or Free edge tears;

• Absent bowtie sign – small gap in bow-tie
• Free edge tears are common
• Unusual source of symptoms, unless large.
Free Edge Tear

Left: The first sagittal image shows a normal body segment and the next one (see right) shows a two-millimeter gap. It is not big enough to be a bucket-handle, plus the blunted anterior fragment or edge is a giveaway that this is clearly chronic and abnormal. This patient had a parrot-beak tear at surgery.
Cysts;

- Can be seen w/o tear to the articular surface of meniscus.
- Fluid expressed out to adjacent soft tissues on weightbearing, called parameniscal cyst.
- W/o tear, cyst can be missed at arthroscope.
- Surgeon may decompress meniscal cyst by extra-articular approach, rather than via arthroscope.
Meniscal cysts, don’t show markedly high T2 signal (Intrasubstance degen)

- Parameniscal cyst is usually very high T2 signal.
- Meniscal cyst – signal is like intrasubstance degen. If mass effect (swollen) meniscus then meniscal cyst. If no mass effect and normal sized meniscus, then intrasubstance degeneration.
Meniscal Cyst
Discoid Meniscus

- > than 2 consecutive sagittal slices, consider discoid meniscus.
- Lateral meniscus is more frequently affected. ~3% incidence.
- Anterior and lateral horns are enlarged and larger than the other meniscus.
- Discoid meniscus prone to undergo cystic degeneration with subsequent tear.
Discoid Meniscus
Abnormalities w/ absent bow tie sign.

- Bucket handle tear
- Radial tear
- Medially flip flap tear
- Meniscal cyst
Pitfalls in Absent Bow-tie Sign;

- Children or small adults
- Post op.
- Severe osteo-arthritis (worn down free edge, leaving thin body segment of men.)
- Older patients (>65 yoa).
Pitfalls

- Conditions that cause an appearance similar to a pathology or mimic the pathologic process or can hide pathology and cause reviewer to falsely interpret images.

- Must be aware of pitfalls to prevent false positives or false negatives.
Speckled anterior horn of lateral meniscus.

- Mimics a macerated or torn anterior horn.
- Caused by fibers of ACL inserting into meniscus
- Up to 60% of normal patients
Pitfalls involving the posterior horn of Lateral meniscus

- Meniscofemoral ligament insertion
- Pulsation artifact from the popliteal artery
- Magic angle phenomenon
- Popliteus tendon
- Concomitant ACL tear
Transverse ligament

- Insertion on anterior horn of meniscus.
- Runs across anterior aspect of the knee in Hoffa’s fat pad from anterior horn to anterior horn.
- Function – not known-, not present in every knee.
- Insertion of anterior horn of lateral meniscus – often has appearance of tear. D.D. by following it across knee on sequential sagittal images.
Meniscofemoral ligament insertion:

• (Posterior Horn lateral meniscus pitfall)
• Insertion of meniscofemoral ligament of Humphry (anterior to PC) or Wrisberg (posterior to PCL) can give appearance of a meniscal tear.
• Meniscofemoral lig. is present in 75% of knees.
• Originates on med. femoral condyle and runs obliquely across the knee in the intercondylar notch. Anterior (lig of Humphry) or posterior (lig. Of Wrisberg) to the PCL and inserts into the posterior horn of the lateral mensicus.
Meniscofemoral Ligament
Meniscofemoral ligament insertion: continued.

- ? of pseudotear follow the insertion of one of the meniscofemoral ligaments through the intercondylar notch to the PCL on sequential sagittal images.
- 2-3% of knees both meniscofemoral ligaments are present (both Humphry and Wrisberg).
- Function is not known and injury to it has not been described.
Pulsation of Popliteal Artery

- Popliteal artery just posterior to the posterior horn of lateral meniscus.
- Pulsations artifacts project over posterior horn of lateral men. And cause areas of increased signal and mimic vertical tear.
- Corrected by swap of phase and frequency directions to make pulsations superior to inferior rather than anterior/posterior.
Pulsation artifact popliteal art.
Magic Angle Phenomenon

- Ill defined, hazy, diffuse intermediate signal in meniscus, on PD and T1 images. Magic angle phenomenon. Seen on sagittal and coronal T1 and PD at posterior horn of lateral meniscus. Due to slope of the meniscus at 55 degrees and causes increased signal on short TE sequences. Disappears on T2 or if 55 degree angle is changed.

- Can rotate knee some to change angle.
Magic Angle Phenomenon
Popliteus Tendon Pseudotear

- Tendon originates on the lateral femoral condyle and extends inferiorly between the posterior horn of the lateral meniscus and the joint capsule.
- Where tendon passes between the meniscus and the capsule it can give appearance of meniscus tear.
- Don’t confuse tear with normal tendon.
- Vertical tear of posterior horn of lateral meniscus often occurs with ACL tears.
Popliteus Tendon vs. Tear

Pseudotear; Above.

*True posterior horn lateral meniscus tears;* right top and bottom. (if tear then posterior horn is smaller than anterior horn.)
Concomitant ACL Tear

Tears of the lateral meniscus, Posterior horn are more commonly missed when there is a concomitant ACL tear.
Ligaments:

- Patella
- Patella Tendon
- Edge of Lat. Femoral Condyle
- Lat. Femoral Epicondyle
- Lat. Tibial Condyle
- Tibial Tub.
- Fibular Head
ACL

- Straight taut fibers that parallel roof of the intercondylar notch.
- Typically striated with some high signal within it, especially at the insertion on the tibia.
  T2 sagittal recommended for evaluation of ACL.
- MRI accuracy of ACL tear is 95-100%.
- Torn ACL is obvious – no normal appearing fibers of ACL can be identified.
- When it tears it explodes leaving nothing with which a surgeon can do a primary repair.
ACL

- Occasionally ACL tear seen with fibers intact but flatter than normal
  Angle of ACL (fibers should be parallel with intercondylar roof).

Partial tear of ACL is treated non-operatively. Little info. Concerning accuracy of DX of partial tears in imaging literature.
Chronic ACL tears.

Angle of ACL is too flat, not parallel with roof of intercondylar fossa.
Partial ACL tear

9/5/2014
Pitfall

- **ACL cyst.** Unknown cause, ACL is distended with mucinous fluid
- normal ACL fibers are not seen and appear disrupted.
- Patient has no instability and are asymptomatic or have feeling of swelling or fullness in the knee and are unable to fully flex the knee, because of the mass effect.
- Seen in 1% of knees.
ACL repair

- Reconstructed via tendon graft from the patellar tendon.
  (occasionally an donor allograft can be used but there are not enough from donors to go around) Dr. Jannsen lecture 11/15/03). 1/3 of patients do ok without repair of ACL. However, the amount of DJD that occurs in knees without repair will result in knee replacement later.
ACL repair

- Tendon graft is dead tissue and the body uses the graft as a lattice work and slowly incorporates and replaces it with living tissue. You actually grow a new tendon on and through the graft. Japanese have done DNA studies on post-surg patients and have shown that the donor DNA is replaced by the host's DNA over time.
ACL repair

• Prosthetic/synthetic ligament repairs are not as successful because you never grow a living ligament and the synthetic ligament will eventually fail, due to the many cycles of motion the knee goes through (bend a wire until it breaks).
Post Op ACL reconstruction.

- ACL graft should be present as taut strux. Some increased signal on T2 sag.
- If graft is disrupted or absent – it has failed.
- Tibial tunnel (graft tunnel) should be parallel to roof of femoral intercondylar notch. If too sharp, graft can impinge by femur on extension. If too flat graft can be too lax and lead to instability.
Arthrofibrosis

- One of most common reasons for pain post-op is presence of arthrofibrosis (scar) in Hoffa’s fat pad. May require re-operation.
  - Several appearances can be seen.
  - Cyclops lesion-- Round mass of scar in Hoffa’s fat pad. Can decrease knee extension and needs resection.
  - Linear scar that extends to inferior pole of the patella can restrict patellar motion and cause pain.
PCL

• Low signal, gently curving structure in the intercondylar notch.
• Infrequently torn and even less frequently surgically repaired.
• PCL tears missed because don’t get high signal on T2. **Can be high signal on STIR.**
• Uncommon – but can avulse from tibial insertion – easily diagnosed.
PCL

• If torn, most surgeons will not repair and won’t inspect at arthroscopy.
• Cunningham
• Tweitmeyer
MCL

- Origin – medial distal femur, inserts medial proximal tibia. Fibers interlaced with joint capsule at the level of the joint.
- Medical meniscus is directly attached
- Extrasynovial – not seen or repaired arthroscopically
- Accuracy of MRI not established but agreed that MRI is highly accurate in depicting the MCL.
MCL Injuries

• 3 – grades of injury. Clinically correspond to 3 appearances of MCL w/ coronal T2 image.

• Grade I- sprain – Increased signal of soft tissue medial to MCL (increased signal outside of MCL from jt.)

• Grade II – severe sprain – Partial tear – Increased signal in soft tissue medial to MCL and also increased signal or partial disruption of MCL.

• Grade III – complete tear – disruption of MCL
MCL

Grade II MCL sprain

9/5/2014
Grade II MCL sprain with meniscocapsular separation. Fluid between MCL and medial meniscus. 
Additionally note bone bruise lateral femoral condyle.
MCL Repair:

- MCL is seldom repaired even if completely disrupted, unless multiple other ligaments are torn.
- Casting works very well for good result healing.
- Bracing can work but the patient must wear the brace 24-7 for good result.
MCL repair, continued

• Grade I and II sprains usually treated conservatively with bracing and continue athletic activity as pain allows.
• High signal medial to the MCL may occur from causes unrelated to MCL sprain, Such as Sub Q edema.
Mensicocapsular Separation:

- Easily dx on coronal T2 by noting fluid between the MCL and the medial meniscus. Can be overlooked on T1 Coronal.
- Brace is not acceptable for treatment of Mensicocapsular separation.
- The vascular interface of between the MCL and meniscus can become avascular with continued activity – resulting in meniscus not healing.
- **Meniscocapsular separation** – needs immobilized or surgery.
LCL complex:

- Composed of many structures;
- 3 are well evaluated with MRI
- From posterior to anterior;
  - Biceps femoris tendon
  - Fibulocollateral ligament (true LCL)
  - Iliotibial band (ITB)
LCL tears are less common than MCL tears

• However, Nearly emergency situation because associated with injury to the “posterior lateral corner”. Posterior lateral corner injuries result in instability if not treated within 3-4 days of injury (surgical).
LCL tears are seen with:

• 1. Popliteus tendon tears
• 2. Arcuate ligament tears (posterior lateral capsular thickening)
• 3. ACL or PCL tears.
Popliteus Tendon Tears;

- Isolated or associated with other injuries of the posterior lateral corner.
- Tears demonstrated by;
  - Lax popliteus tendon
  - Increased signal in and around popliteus muscle and
  - Increased fluid in tendon sheath.

(normal pop. tendon not to confuse with vertical men. tear.)
Faulty Extensor Mechanisms

Acute trauma, overuse injuries, developmental alterations may lead to dysfunction of the extensor mechanism of the knee, structures involved;

Quadriceps muscle group,

Quadriceps tendon,

Patella,

Patellar tendon,

Patellar retinaculum,

Adjacent soft tissues
Iliotibial Band

Assists lateral collateral ligaments as a lateral stabilizer.

Attachments form the hip/gluteal/ tensor fascia lata to the knee at the Anterolateral tibia

(Gerdy’s tubercle)

and onto the patella.
Iliotibial band syndrome:

- Runners; ITB friction syndrome
- Fluid noted on both sides of ITB, seen as high signal in ITB.

Coronal and axial FSE T2 images
ITB syndrome

IT Band syndrome -
Overuse syndrome

Pain and symptoms can mimic a meniscus condition.

Not a surgical problem
Synovial Plicae;

- Thin fibrous band seen on axial images.
- Extends from medial joint capsule toward the medial facet of the patella.
- Normal structure - remnant of embryologic development of knee.
- Superior, Inferior, and Medial patella plica.
Plica
Synovial Plicae;

- Medial plica only one associated with symptoms, may become thickened and stiff and trapped between patella and the femur.
- Causes pain and clicking and locking, similar to torn meniscus.
- No established measurement for thickness on MRI “just judged” to be thickened from experience.
- Plica syndrome- not common – dx – tx is surgical removal of the medial plica.
Cartilage

FSE T2 or Fast STIR evaluate cartilage surfaces in two or three planes.

Cartilage defects

OCD, Trauma, DJD, CPPD.
Cartilage

Note;
Small area of high signal in patella, subchondral to area of undulation (thinning) of articular cartilage.
Patella

• Lateral dislocation – rapidly reduces on its own.
• ~50% of patients are aware of what really occurred.
• Pts get referred for MRI to r/o internal derangement.
• MRI reveals contusion on anterior lateral portion of lateral femoral condyle.
• Patellar contusion (kiss contusion) at medial facet.
• Medial retinaculum is always injured by frank tear may not be found.
Patella

Position of patella in trochlear notch

cartilage thickness

patellar osseous changes; fx, spur, bruise.
Patella

- If piece of patellar cartilage is missing then arthroscope probably necessary to eval. For joint mouse.
- Shallow/hypoplasatic trochlear notch predisposed to patellar dislocation.
Patellar Dislocation

- Patellar contusion
- Chronic, lateral patellar dislocation
Osteochondral Injury to Patella

Edema in patella and osteochondral defect at medial patellar articular cartilage. 26 yoa man blunt trauma from a fall.
Bipartite Patella

Bipartite patella is a rare cause of anterior knee pain.

In symptomatic bipartite patellae, the pain may result from chronic stress injury.
Patellar Tendon:

- **Jumpers Knee:** Increased signal from myxoid degeneration at the superior margin of the patellar tendon. ? tx surgical resection of myxoid tissue to heal.
  
  - Increased pain at superior patellar tendon on resisted extension from 90 degrees of knee flexion.
  
  - Fat pad syndrome (anterior knee pain) will have decreased pain on resisted extension of knee from 90 degrees of flexion.
Osgood Schlatter

• Osgood-Schlatter condition is osteochondrosis of the tibial tuberosity, which is believed to result from repetitive microtrauma.

• Activity related pain around the tibial tubercle. A high incidence of Osgood-Schlatter condition is seen in patients with patella alta, presumably because of increased tension on the tibial tuberosity as reported by Grelsamer.

• Sinding-Larsen-Johansson syndrome is osteochondrosis involving the distal patellar pole.

• Chronic pain with osseous fragment may need surgically removed.
Patellar Tendon Tear
Bursae: 5 of significance

Popliteal bursa
Pes Anserinus bursa
Prepatellar bursa
Semimembranosus bursa
Tibial Collateral ligament bursa
Posterior bursa;

1. Popliteal (Baker’s cyst) between the medial head of gastroc and the semimembranosus.
   • Should be no more than 5 cc of fluid.
Anterior bursae;

2. Pre-patellar bursa
   – housemaid’s knee
Anterior bursae;

**Pes Anserinus bursa** (pes anserine means goose’s foot)
- Anteromedial tibia just below joint line.
- Pes Tendons – Gracilis, Sartoris, and Semitendinosus
- Bursae lies beneath the tendons – when inflamed, extends proximally towards the joint.
- Pts can have clicking, popping, and painful knee, like a meniscus tear.
Anterior bursae;
Anterior bursae;

4. Semimembranosus/Tibial collateral ligament bursa can mimic meniscal tear
   - fluid signal drapes over semimembranosus tendon on coronal and sag. images.
   - Arises at level of meniscus and extends inferiorly.
   - D.D. with parameniscal cyst. – Bursa has no communication with meniscus.
Anterior bursae;
Anterior bursae;

5. **Tibial collateral ligament bursa**
deep to the medial collateral lig. and
extends vertically above and below the joint line.

*(space between the superficial and deep MCL layers)* sjg opinion.
Bones:

- Patella
- Patella Tendon
- Lat. Tub. of Tibia
- Tibial Tub.
- Lat. Femoral Condyle
- Lat. Femoral Epicondyle
- Lat. Tibial Condyle
- Fibular Head
- Edge of Lat. Femoral Condyle
Contusions:

• Geographic (more well defined margin of contusion) more likely to progress to Osteochondritis Dessicans (OCD).
• Reticular pattern, ill-defined, less likely to progress to OCD.
Contusion Patterns/locations:

- ACL tear: posterior lateral aspect of tibial plateau
- And possible kiss contusion of the anterior lateral femoral condyle (over anterior horn of lateral meniscus).
2\textsuperscript{nd} contusion pattern with ACL tear;

- posterior medial tibial plateau and medial femoral condyle, posterior to MCL. Must have meniscocapsular separation of medial menicus as well.
Soft tissues:
Strains of muscles

• Grade I – microscopic damage, no loss of function.

• Grade II – partial tearing with some loss of function – anything between grade I and grade III.

• Grade III – complete disruption of muscle with loss of function of the unit.
Strains of muscles

• Plantaris tendon; “Tennis Leg” calf pain like medial gastroc injury or d.d. with DVT.
  – Swelling in popliteal fossa,
  – purplish skin discoloration from hemorrhage.

• Hamstring Ruptures;
Figure 15–59. PLANTARIS TENDON TEAR.

A, An axial proton density and B, T2W image through the calf in a patient with sudden calf pain during tennis shows a fluid collection (arrow) between the soleus and the medial head of the gastrocnemius muscle. C, A sagittal T2W image shows a tubular fluid collection (arrows) just deep to the medial head of the gastrocnemius. This is characteristic of a torn plantaris tendon.