

ACSM TPC Part 2
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Examination and Imaging of the Knee and Leg

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Examination and Imaging of the Knee and Leg

Introduction

Meniscus

Ligament

Imaging

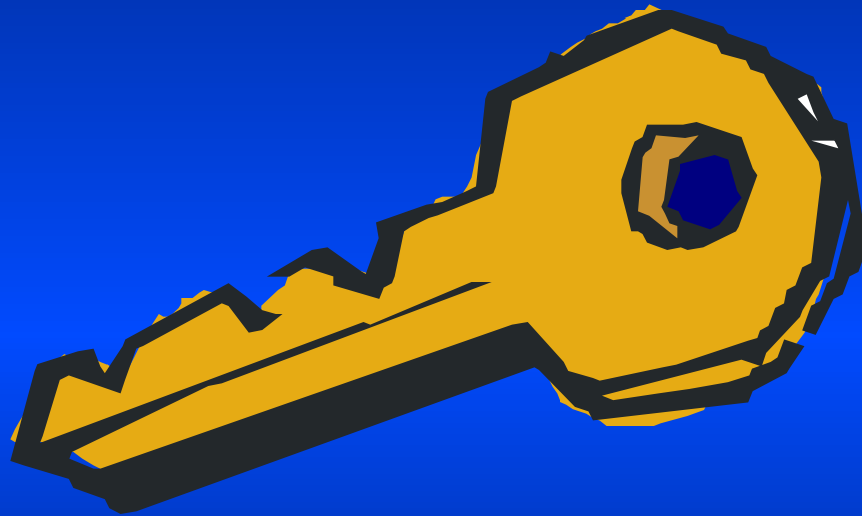
Cases

Conclusions

Quit



**A good History and Physical
is Key**



to a Correct Diagnosis

Grab Sign



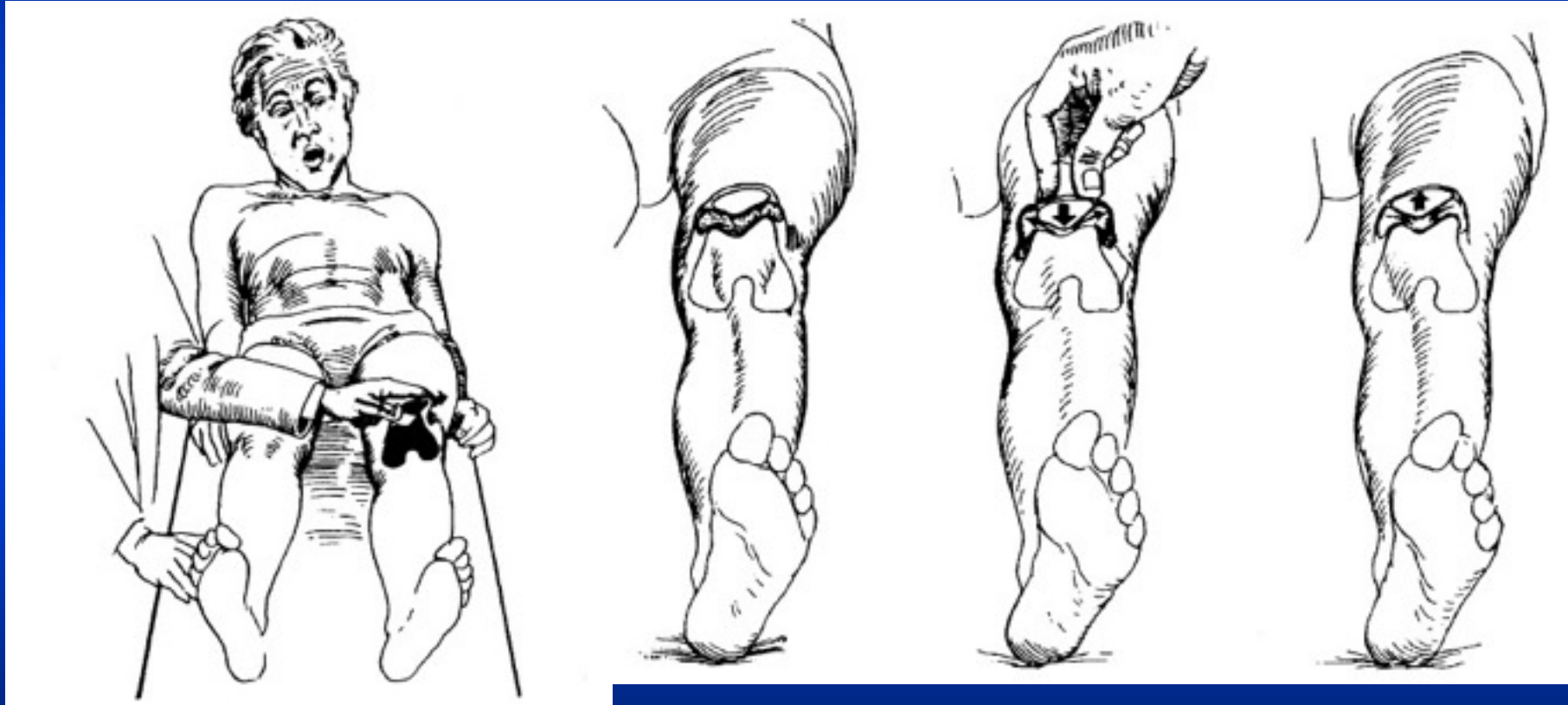
Patellofemoral Disorders

**Fisted
Knuckle
Sign**

= ACL Tear

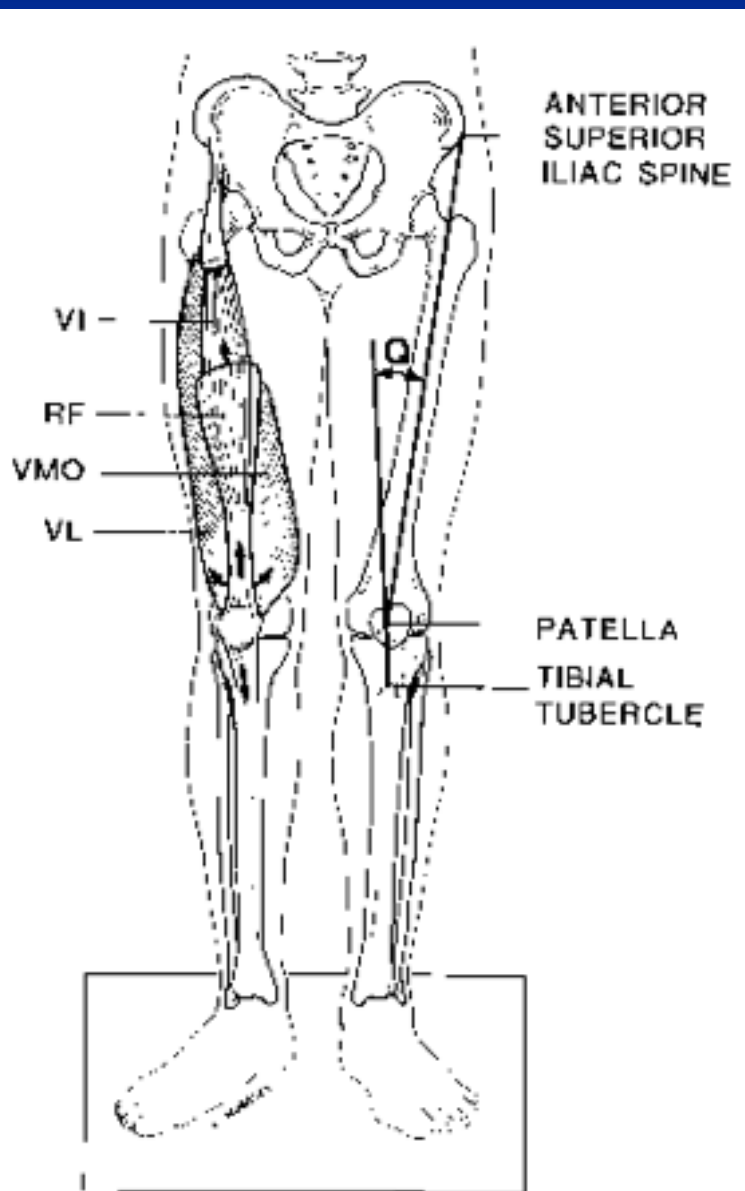


Patient apprehends another lateral patellar dislocation

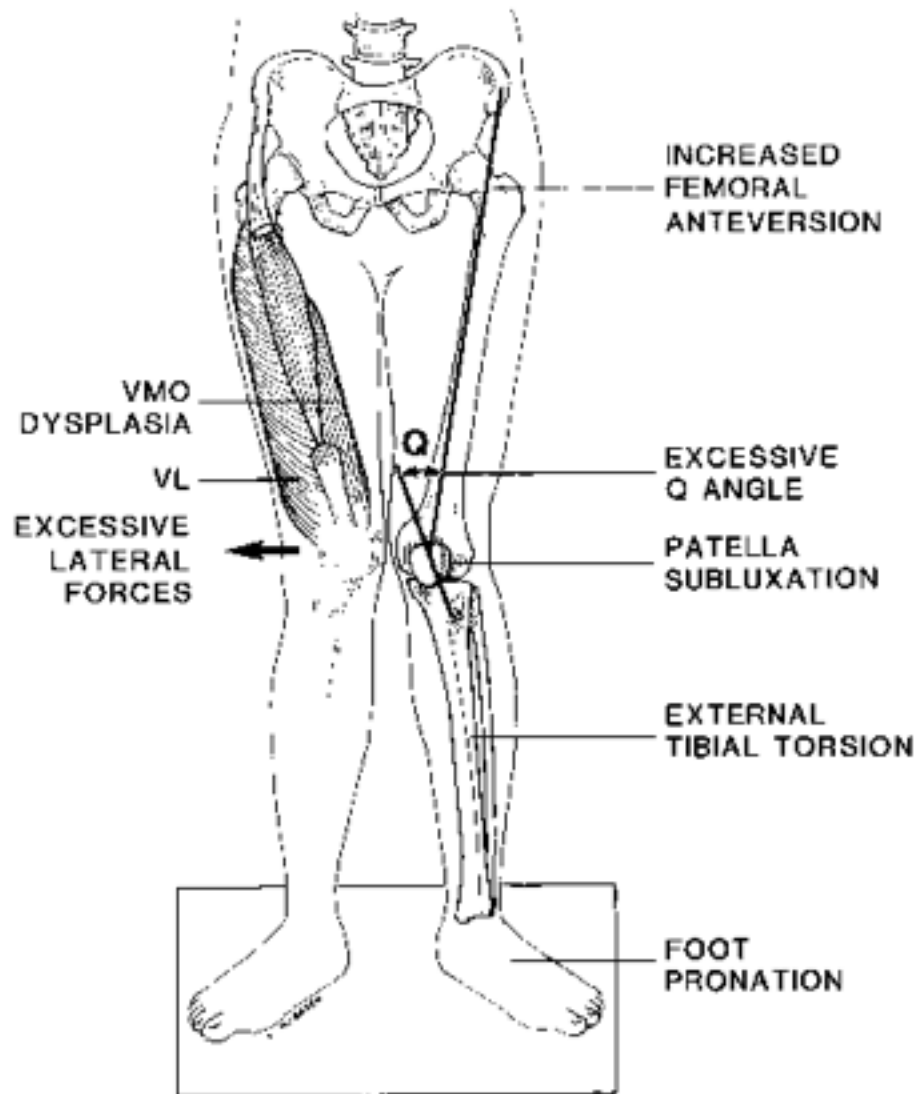


Positive apprehension test
Do the anticipated painful test last

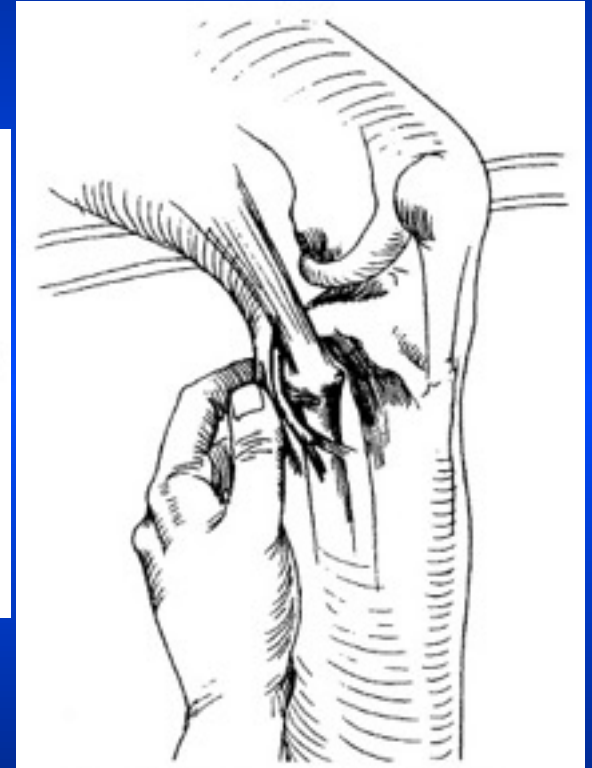
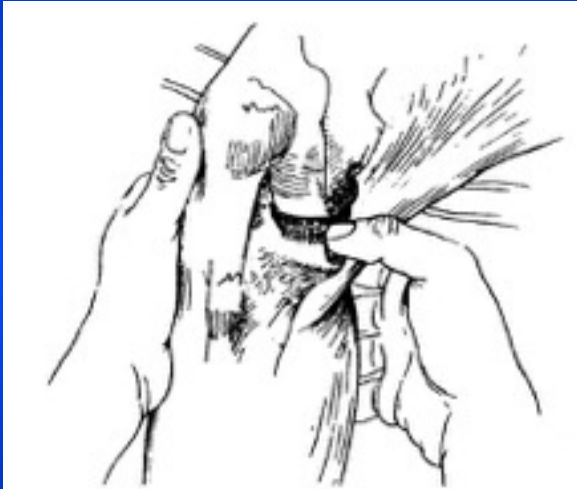
Normal Alignment



Miserable Malalignment Syndrome

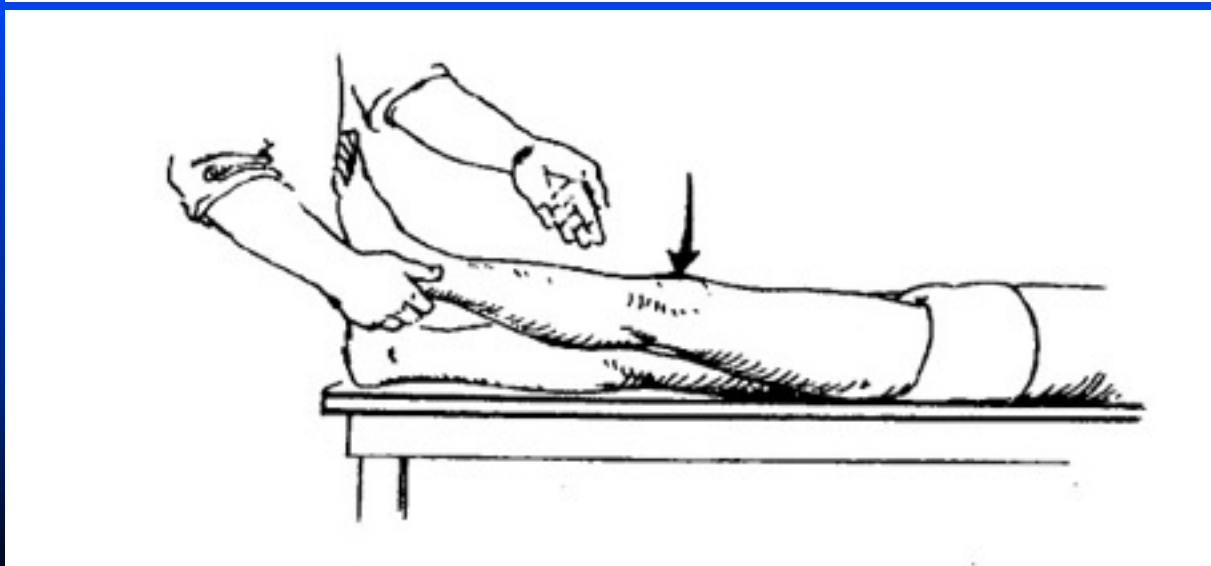
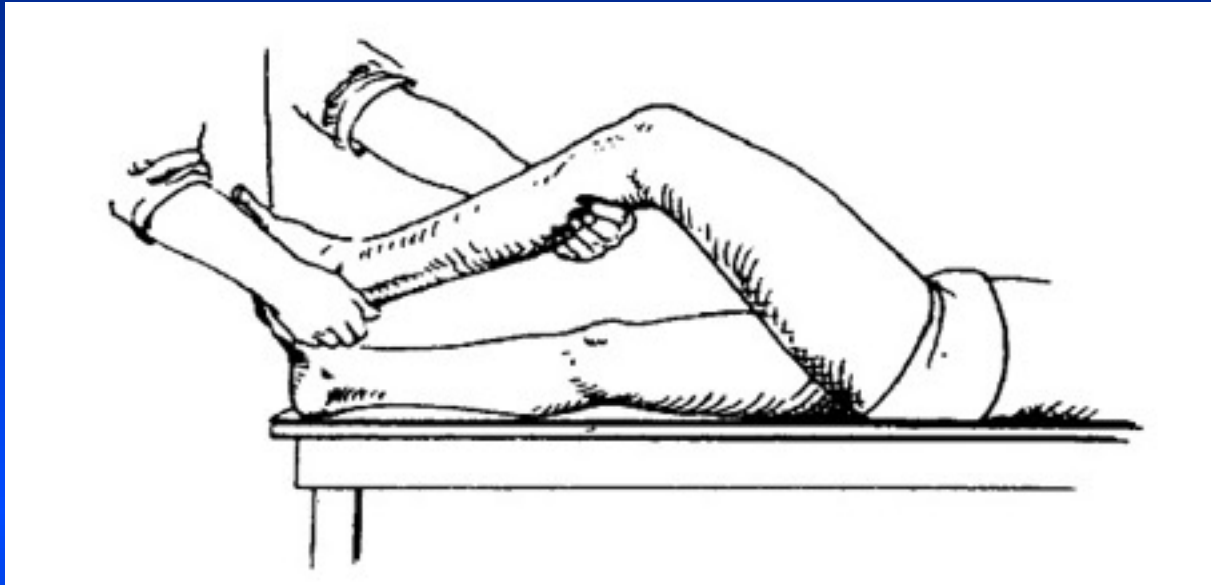


Joint line palpation with knee flexed should produce pain if meniscus is torn



**Externally rotate tibia for medial meniscus tears,
Internally rotate for lateral meniscus tears**

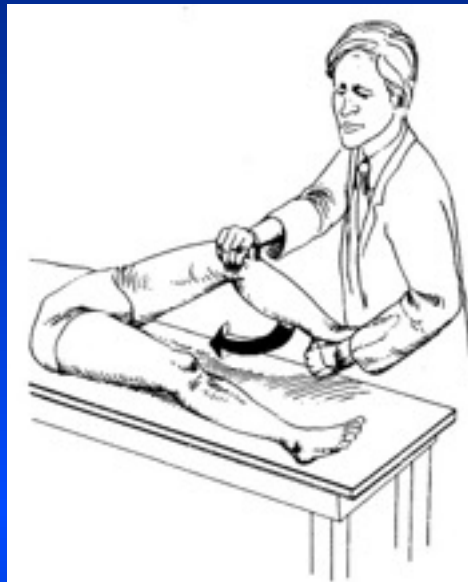
Bounce Home Test



Normal Knee Exam: Bounce Home



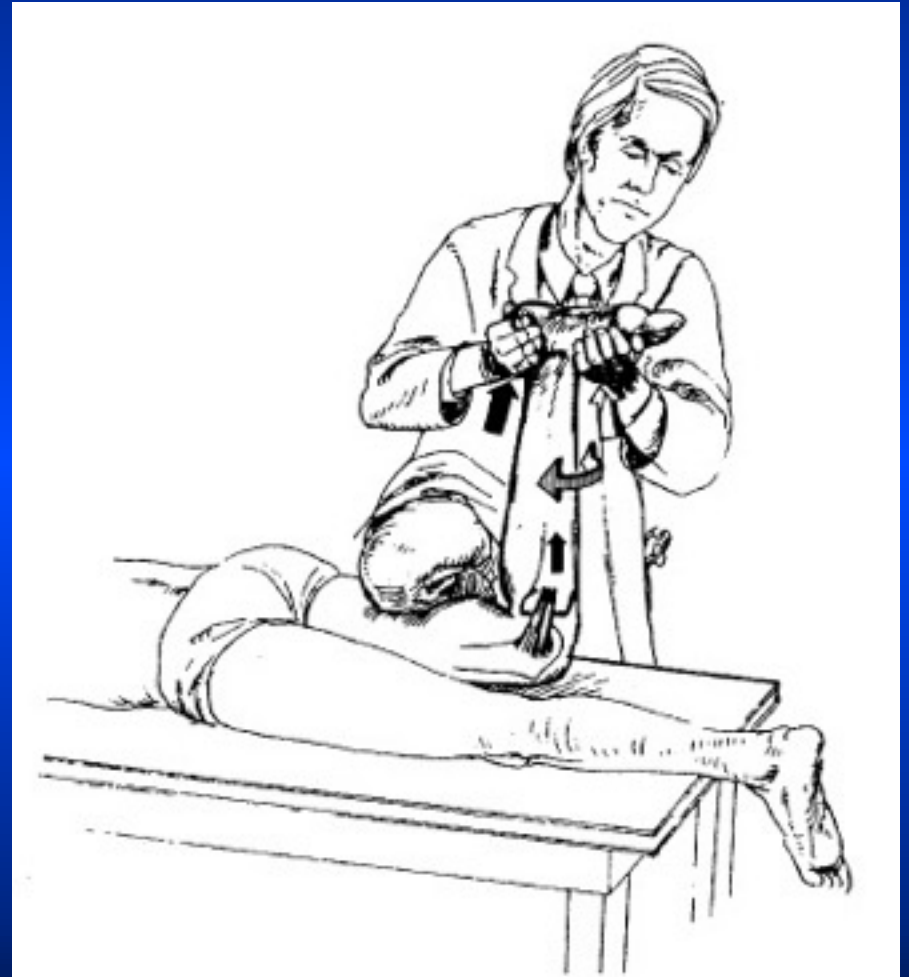
McMurray's Test: Medial Meniscus



Normal Knee Exam: McMurray's Test



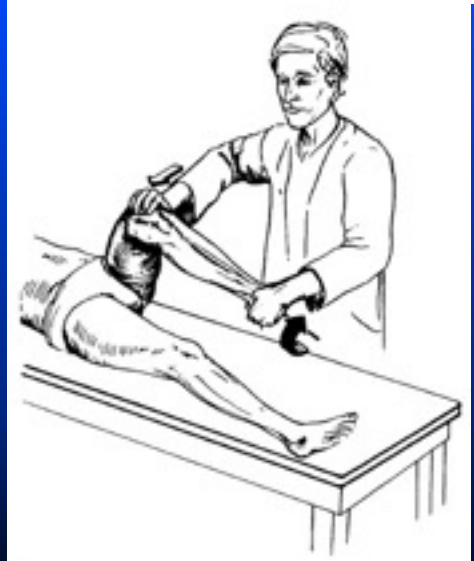
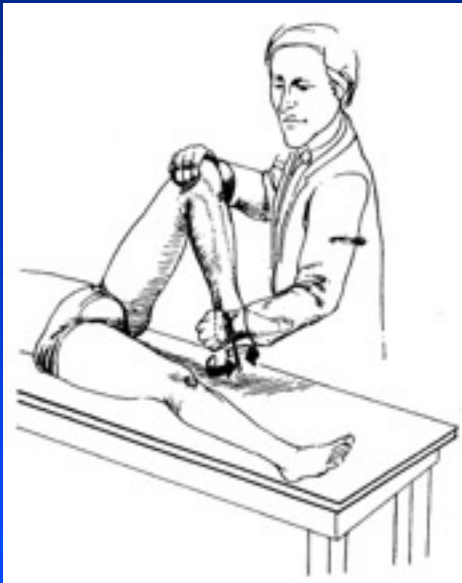
Apley's Compression Test



Normal Knee Exam: Apley's



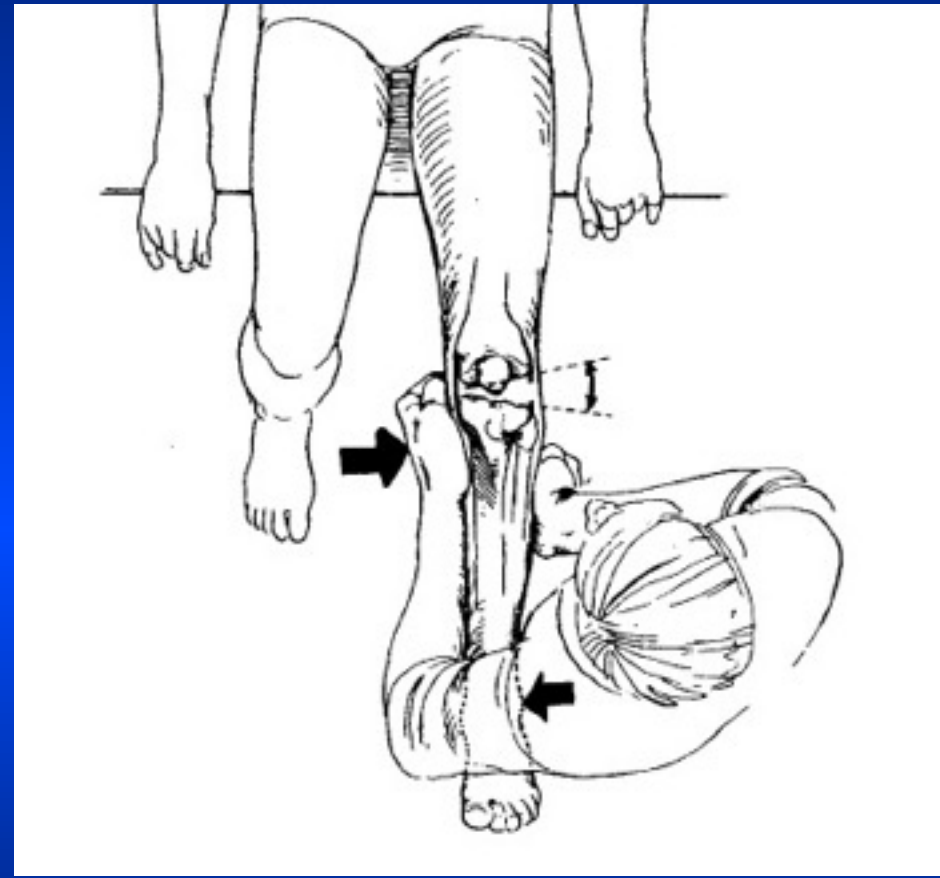
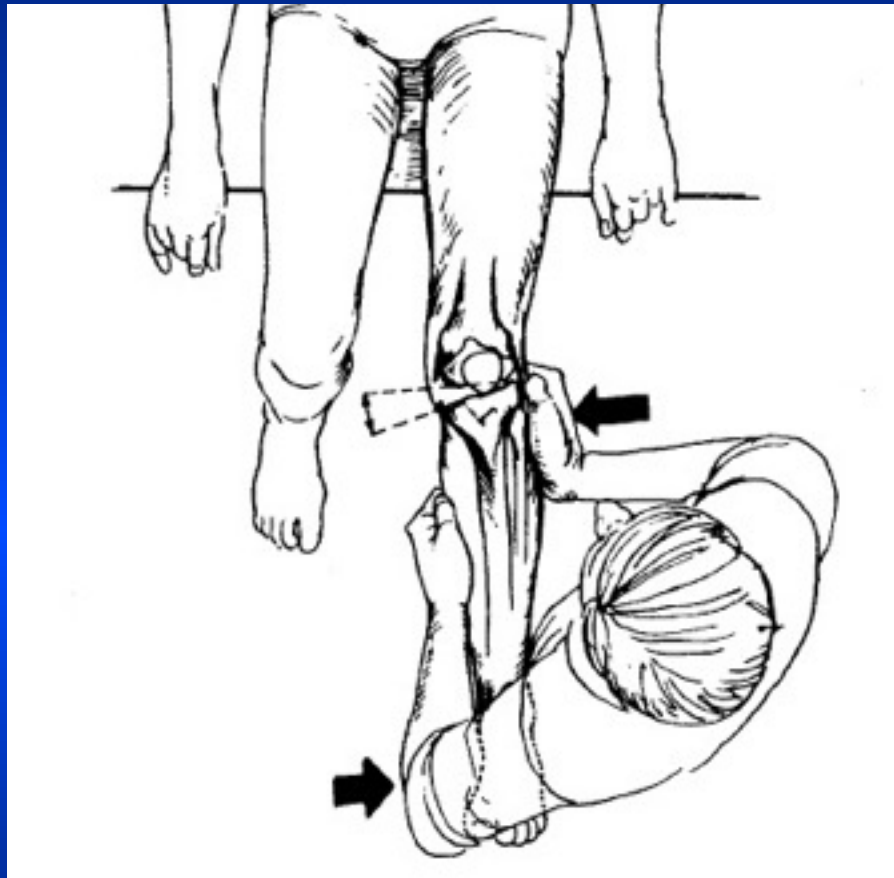
McMurray's Test: Medial Meniscus



Normal Knee Exam: Lateral Aspect



Straight instability vs. Rotatory instability



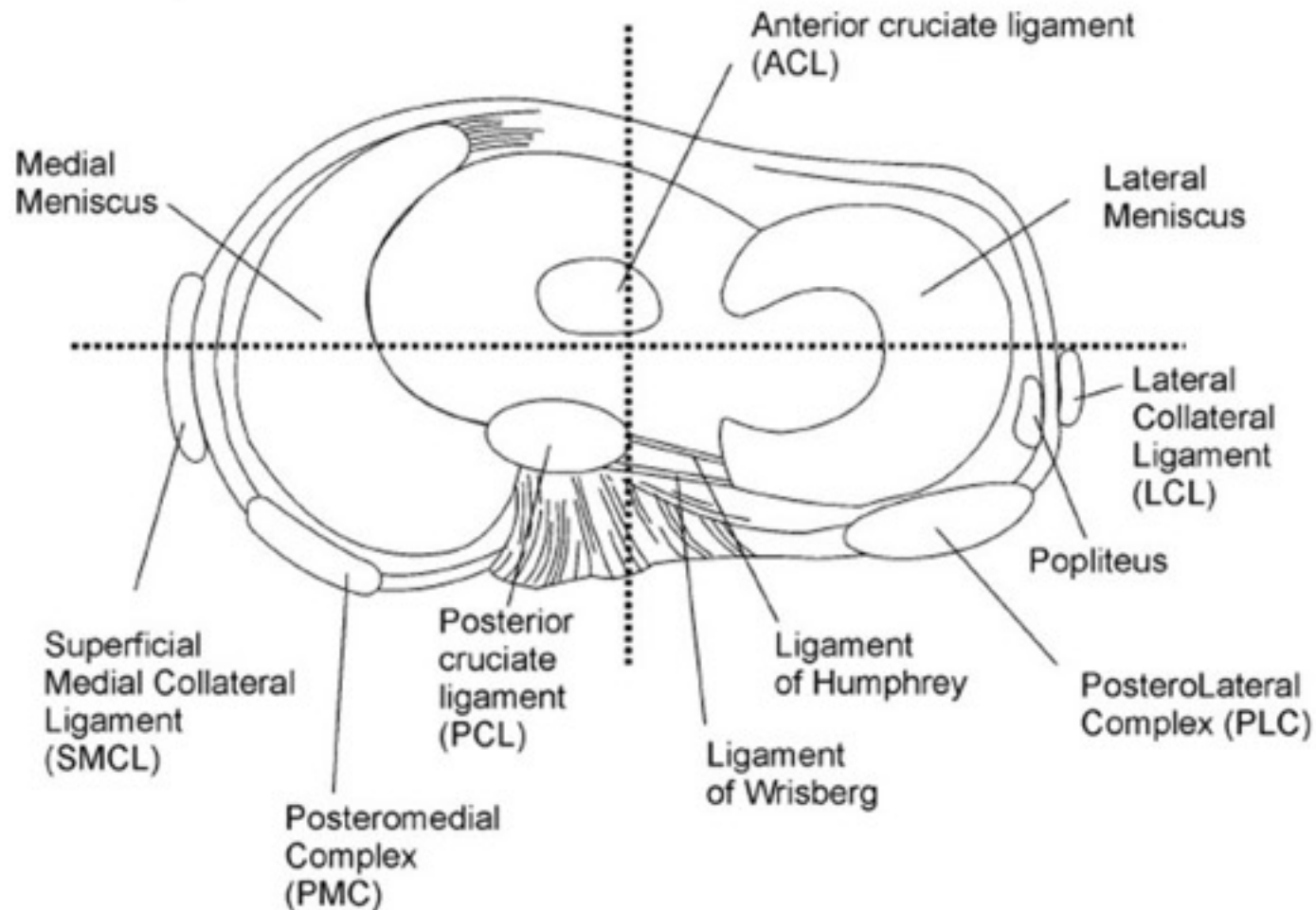
Valgus Stress / Varus Stress

Normal Knee Exam: Ligaments



Knee Instabilities

Bird's-Eye view of Tibia

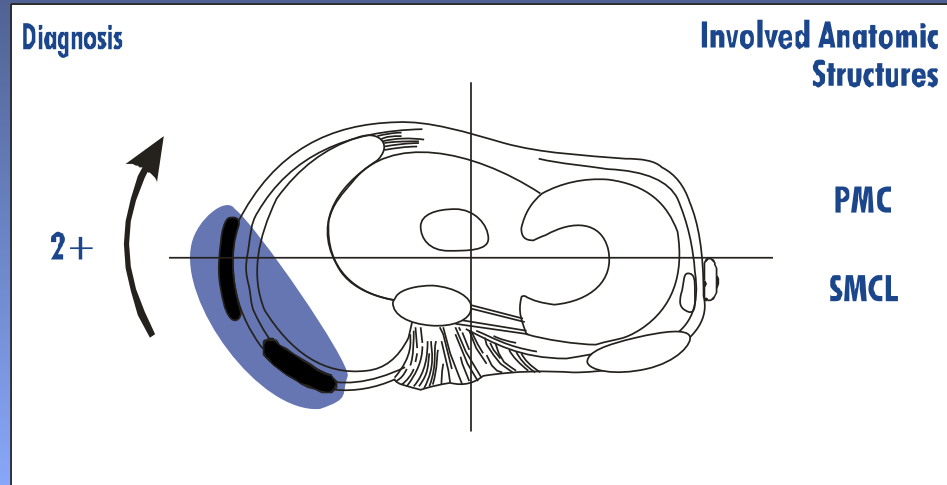
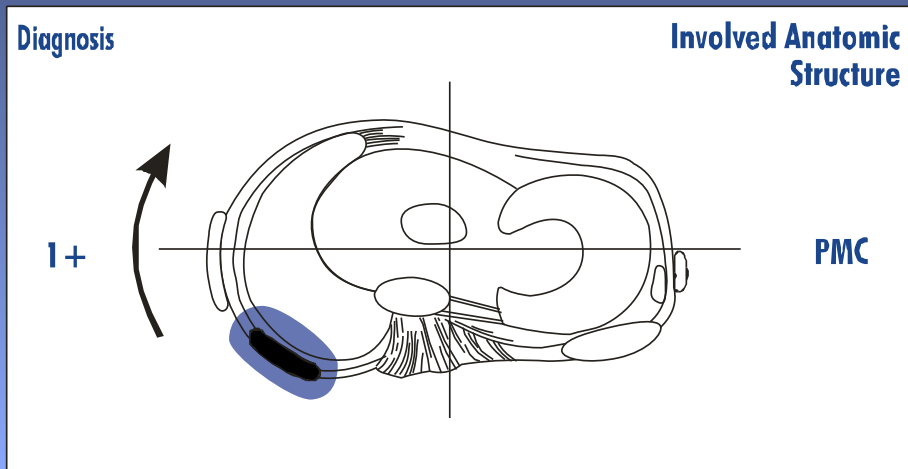


Classification of Knee Instabilities

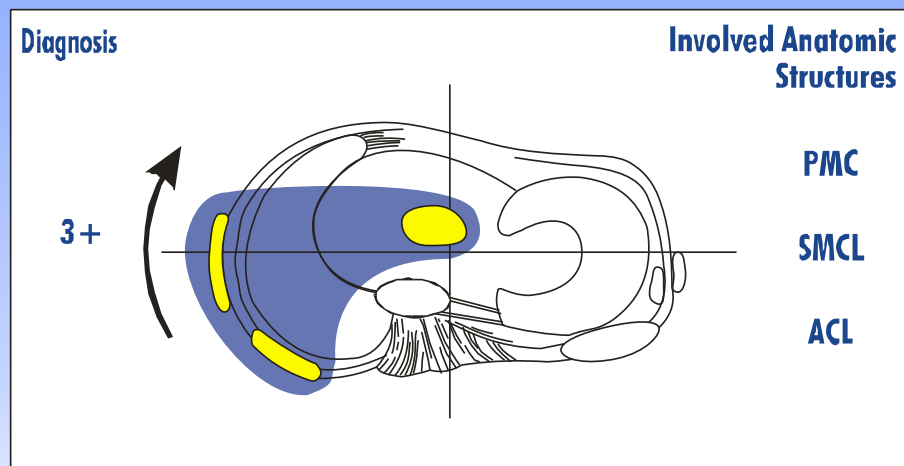
Rotatory, Straight and Combined

- **Diagnosis: +1 to +4 by exam**
Grade I to IV
- **Diagram**
 - Bird's eye view of tibia
- **Involved Anatomic Structure**
- **Physical findings**
- **Mechanism and forces**
 - Contact vs. Noncontact
 - Varus / Valgus, Flexion / Extension
 - Tibial rotation

Anterior Instabilities

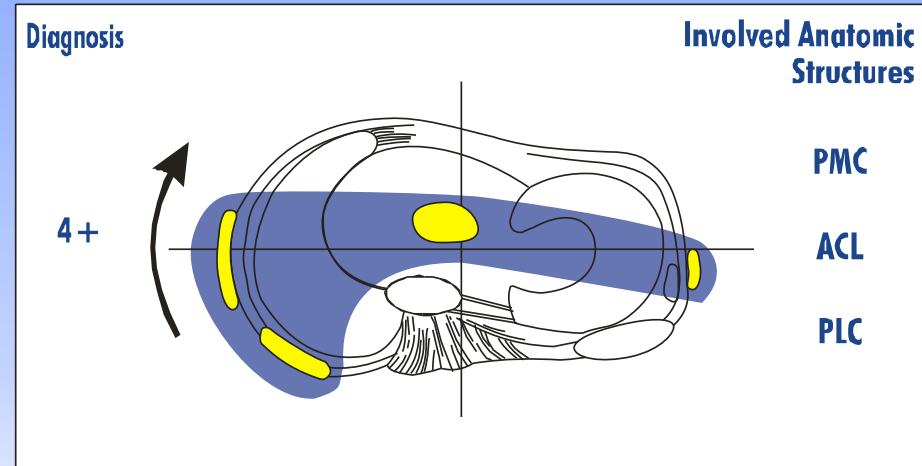


Antero-Medial Rotatory Instabilities (AMRI)



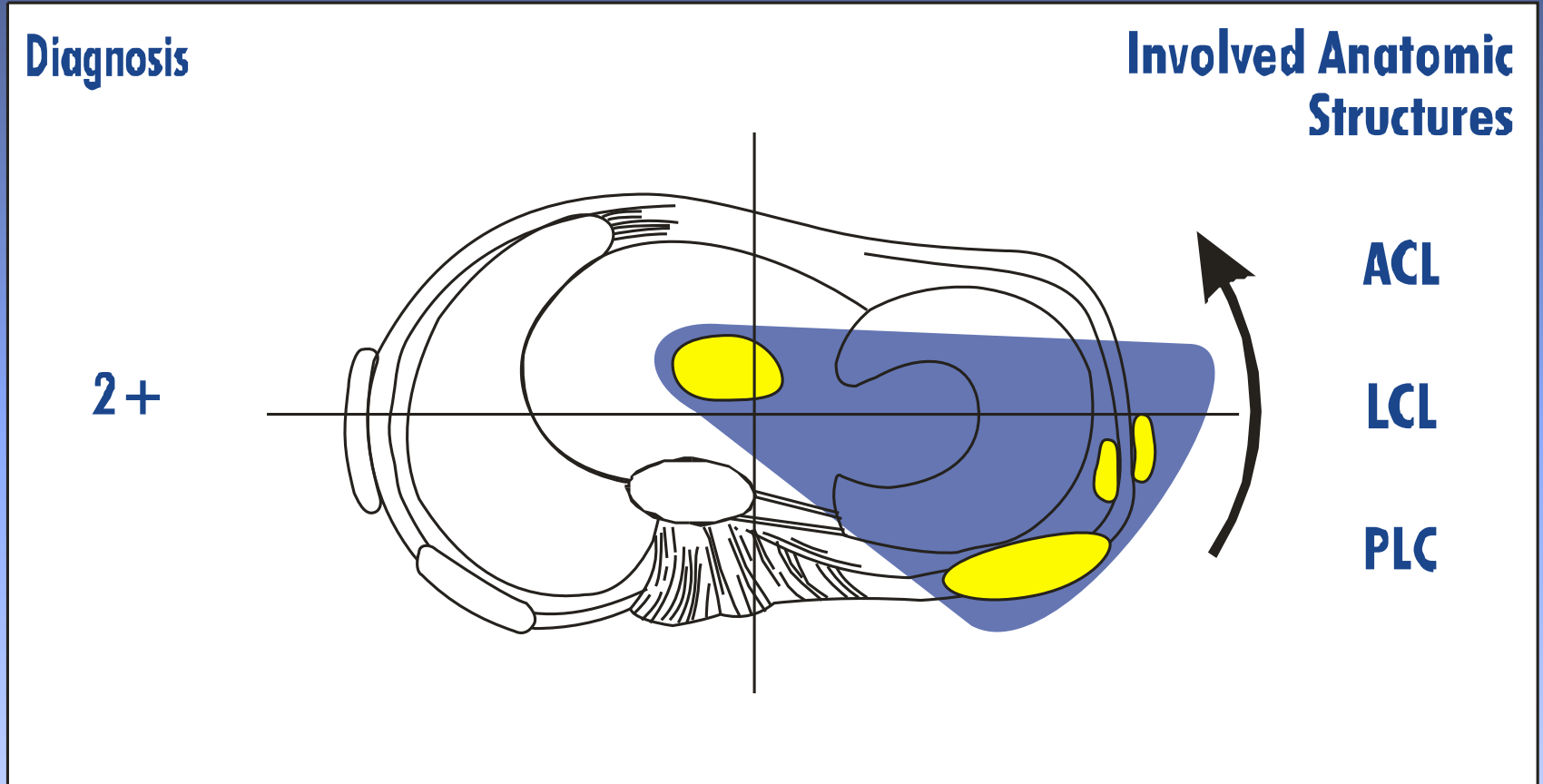
Combined AMRI and ALRI

Antero-Medial Rotatory Instabilities (AMRI)



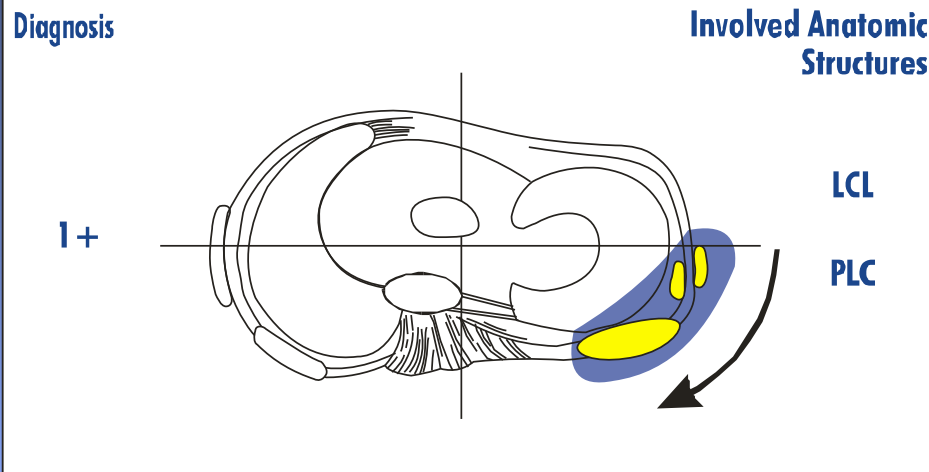
Combined AMRI and ALRI

Knee Instability

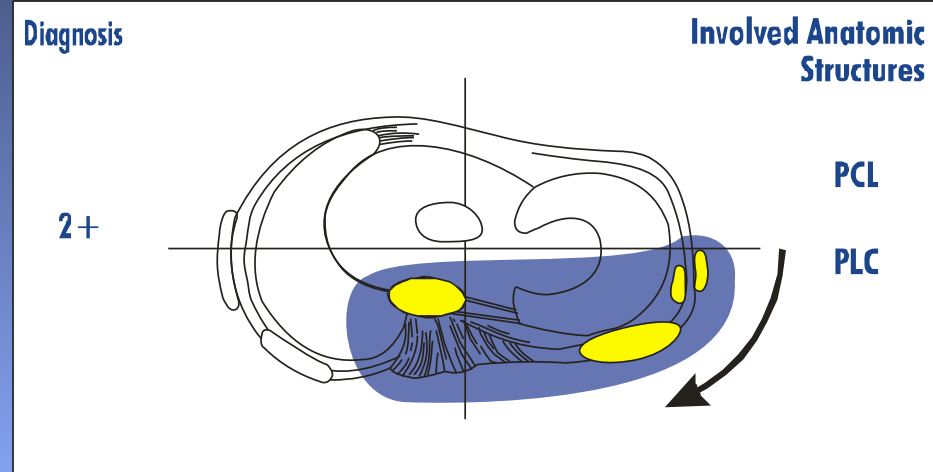


Antero-Lateral Rotatory Instabilities (ALRI)

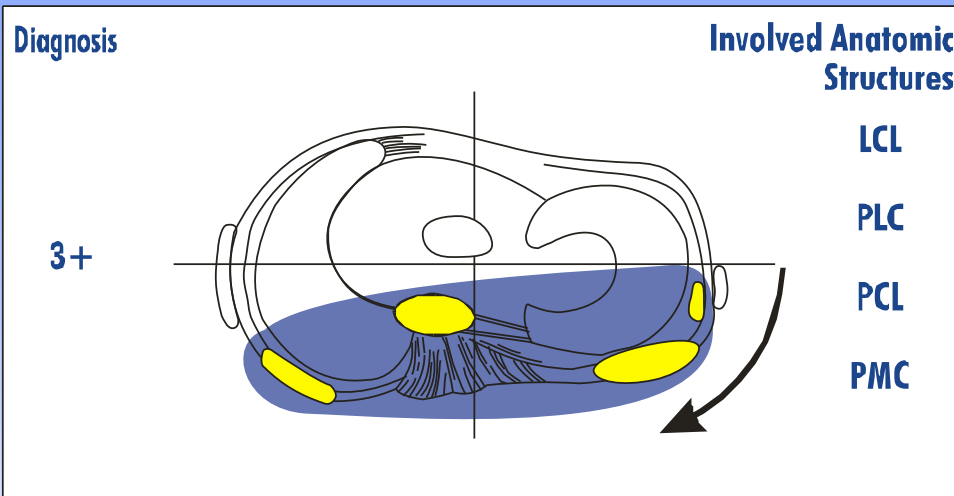
Posterolateral Instabilities



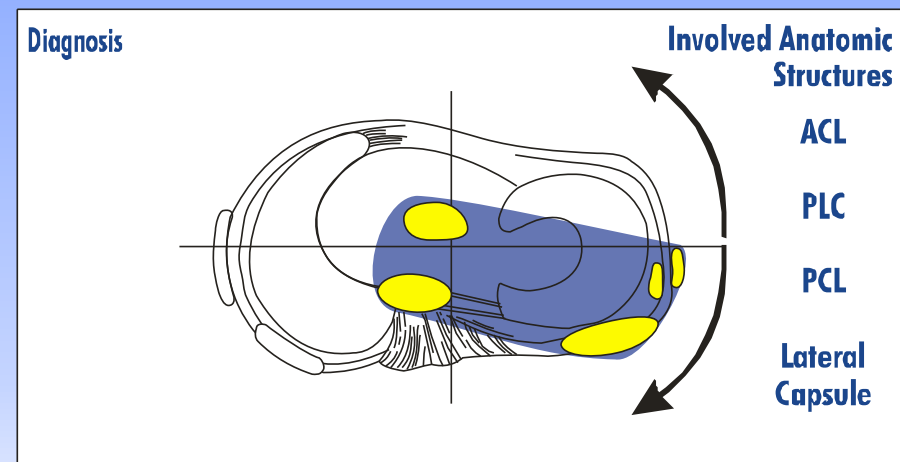
Postero-Lateral Rotatory Instabilities (PLRI)



Postero-Lateral Rotatory Instabilities (PLRI)

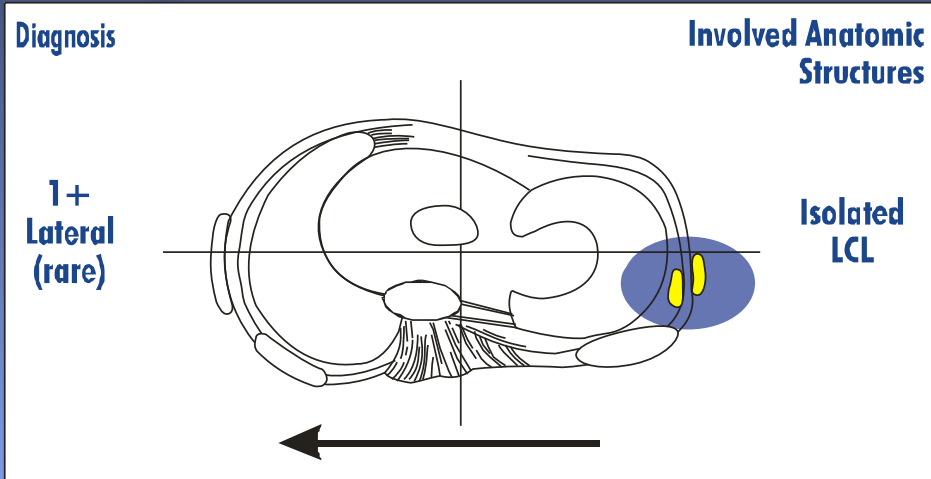


Postero-Lateral Rotatory Instabilities (PLRI)

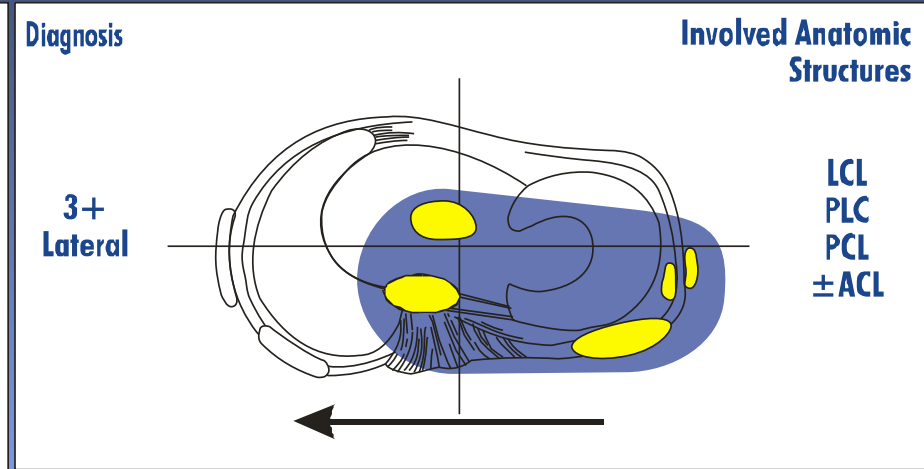


Combined ALRI and PLRI

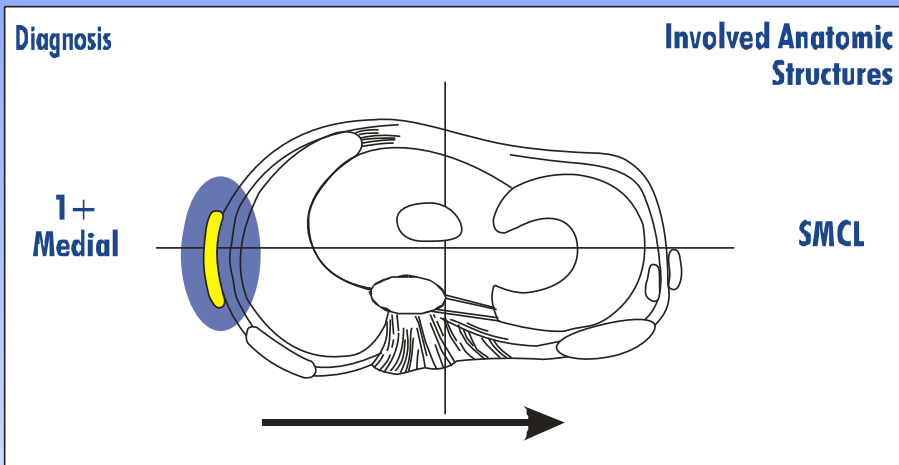
Straight Instabilities



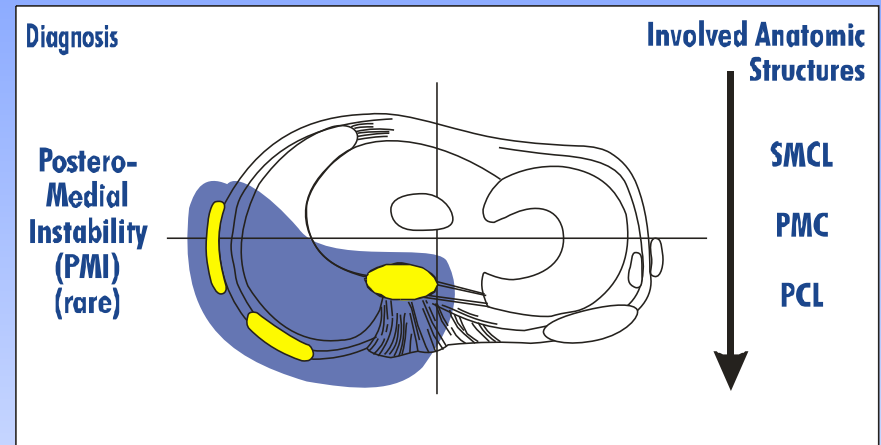
Straight Instabilities



Straight Instabilities

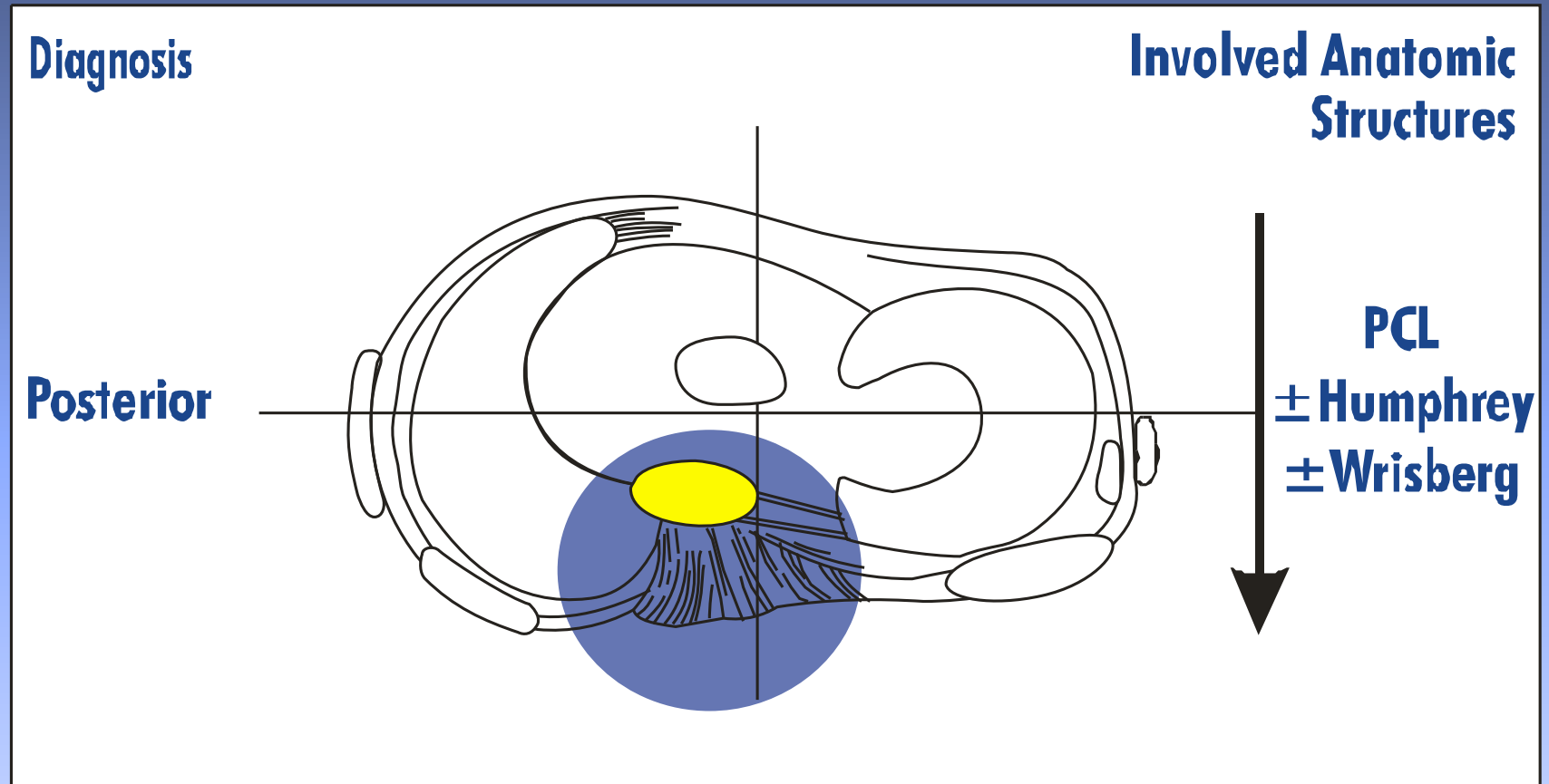


Straight Instabilities



Straight Instabilities

Knee Instability



Straight Posterior

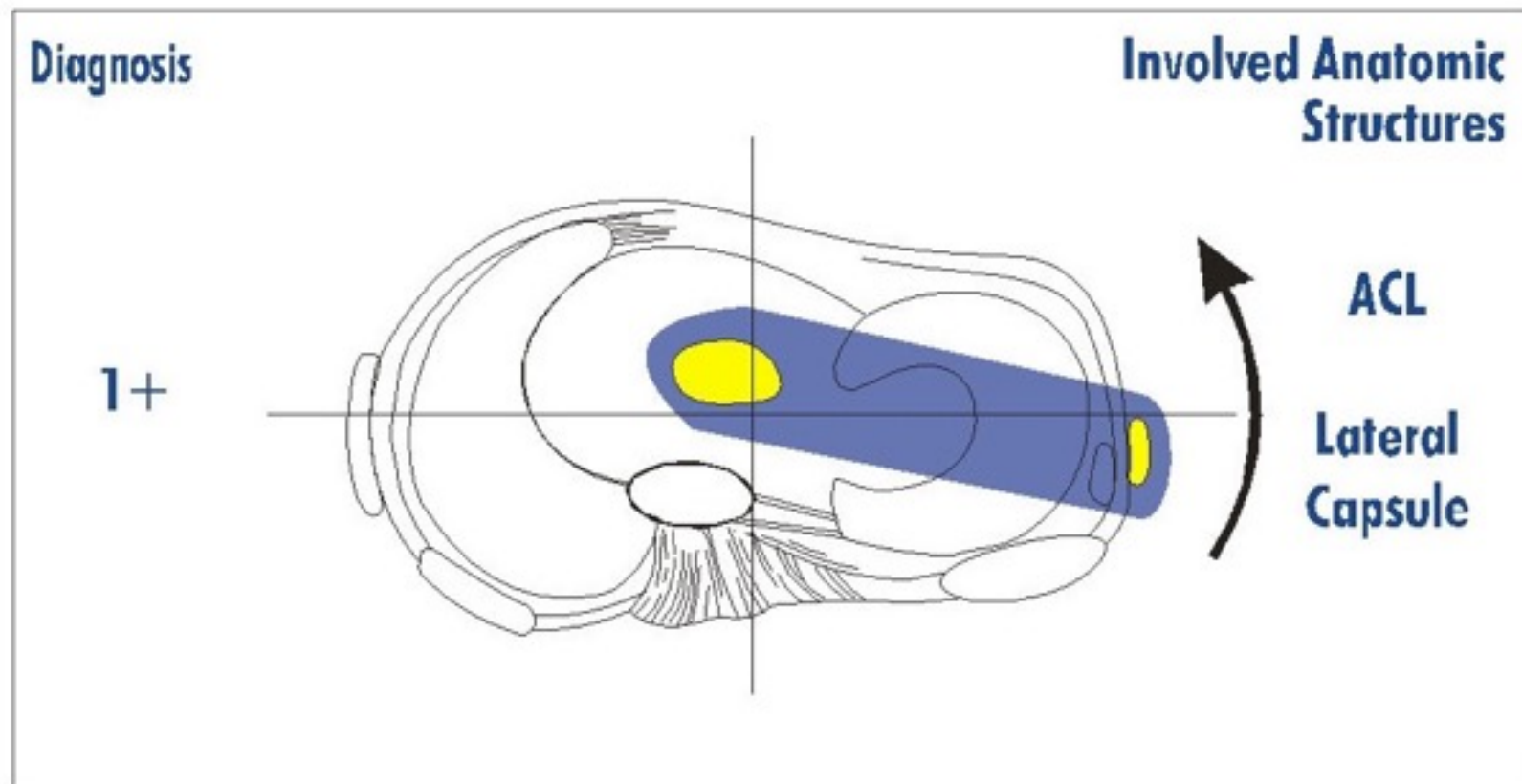
Anterior Drawer



Normal Knee Exam: Ligaments

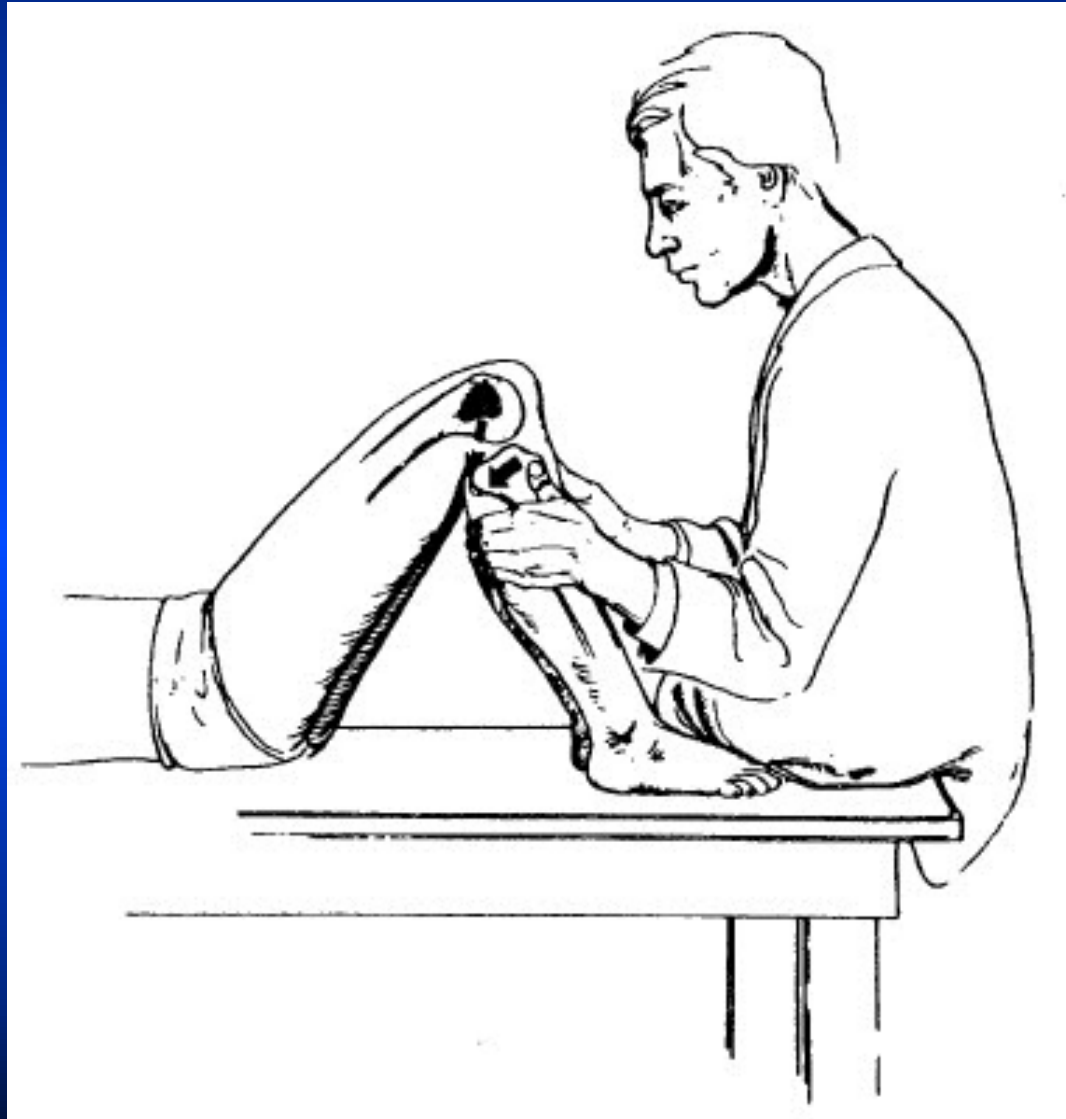


Knee Instability



Antero-Lateral Rotatory Instabilities (ALRI)

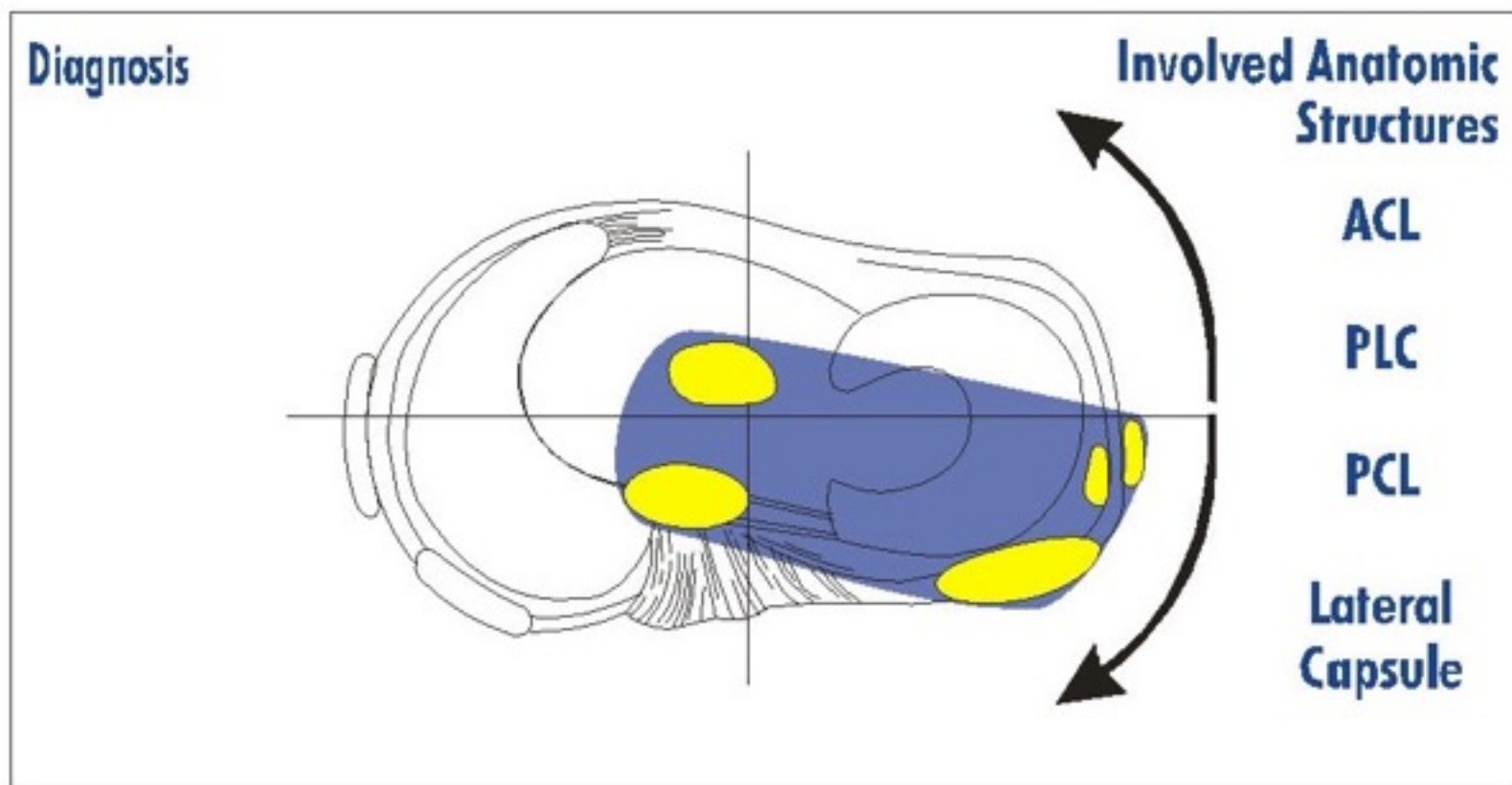
Posterior Drawer



Normal Knee Exam: PCL Exam



Knee Instability



Normal Knee Exam: Reverse Pivot Shift, ER Recurvatum



Radiographs

- Standing 45° PA, bilateral
 - Patellar Views: Merchant or Sunrise Bilateral
 - Lateral 45° Flexion
 - Notch for Osteophytes
-
- Standardize Your Views for All Physicians
 - Use Goniometer
 - Know Your XRay Technicians

Osteoarthritis grading systems:

- **Kellgren and Lawrence**
- **Fairbanks**
- **Joint space narrowing JSM –standing radiographs**
- **Ahlback classification**

- **Numerous studies comparing different classifications—there is disagreement on the definition and grading of osteoarthritis, as well as poor correlation with patient symptoms and progression of osteoarthritis.**

References

Mazzuca SA, Brandt KD, Schauwecker DS, Buckwalter KA, Katz BP, Meyer JM, et al. **Bone scintigraphy is not a better predictor of progression of knee osteoarthritis than Kellgren and Lawrence grade.** J Rheumatol 2004;31:329-332.

Oiestad BE, Holm I, Engebretsen L, Risberg MA. **The association between radiographic knee osteoarthritis and knee symptoms, function and quality of life 10-15 years after anterior cruciate ligament reconstruction.** Br J Sports Med 2011;45:583-588.

Tapper EM, Hoover NW. **Late results after meniscectomy.** J Bone Joint Surg [Am] 1969;51-A:517-26.

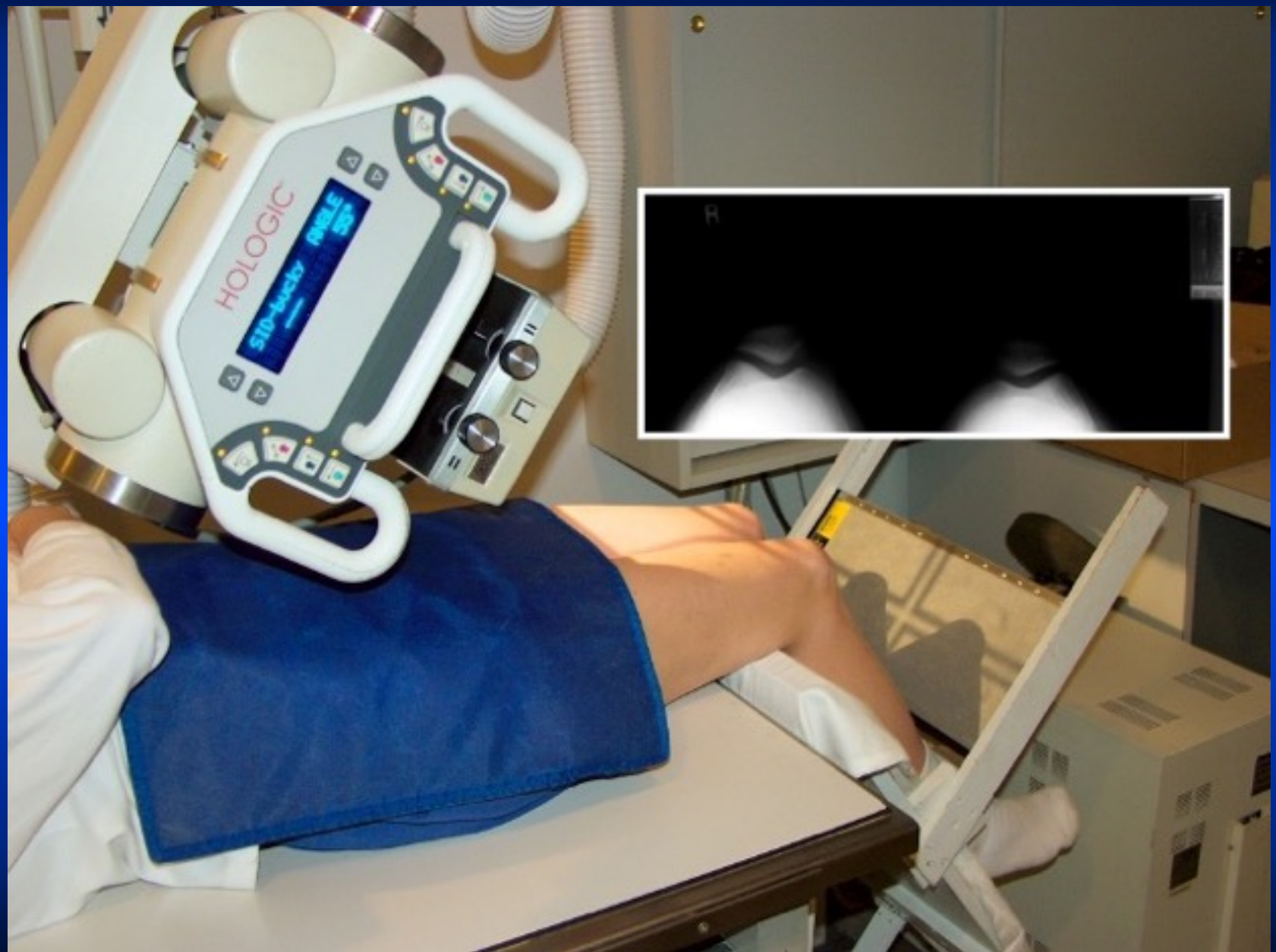
45 Degree Flexed Weight-Bearing PA View is most sensitive for detecting joint space loss

Cole BJ, Harner CD, Degenerative arthritis of the knee in active patients: evaluation and treatment. JAAOS 1999, Nov.-Dec. 7(6):389-402.

Dervin GF, Feibel RJ, Rody K, Grabowski J., 3-Foot standing AP versus 45 degrees PA radiograph for osteoarthritis of the knee. Clin J Sports Med. 2001 Jan;11(1):10-6.



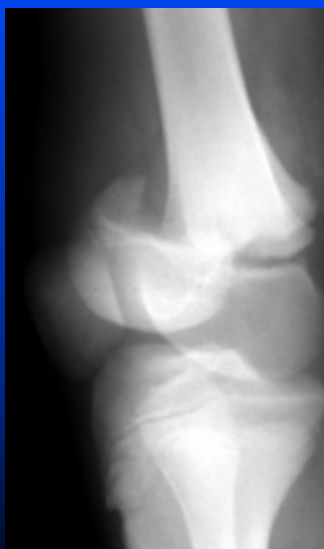


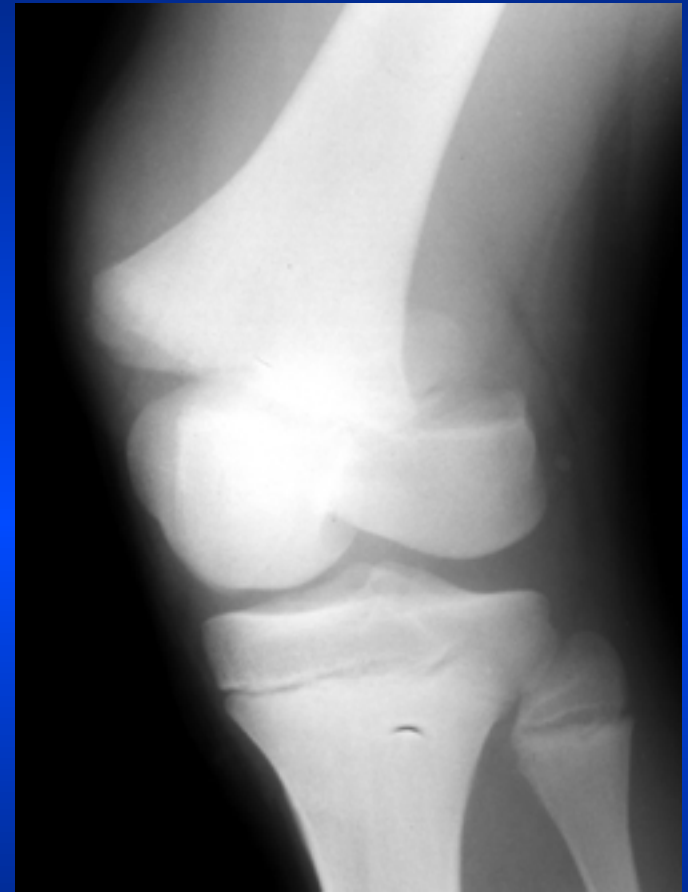


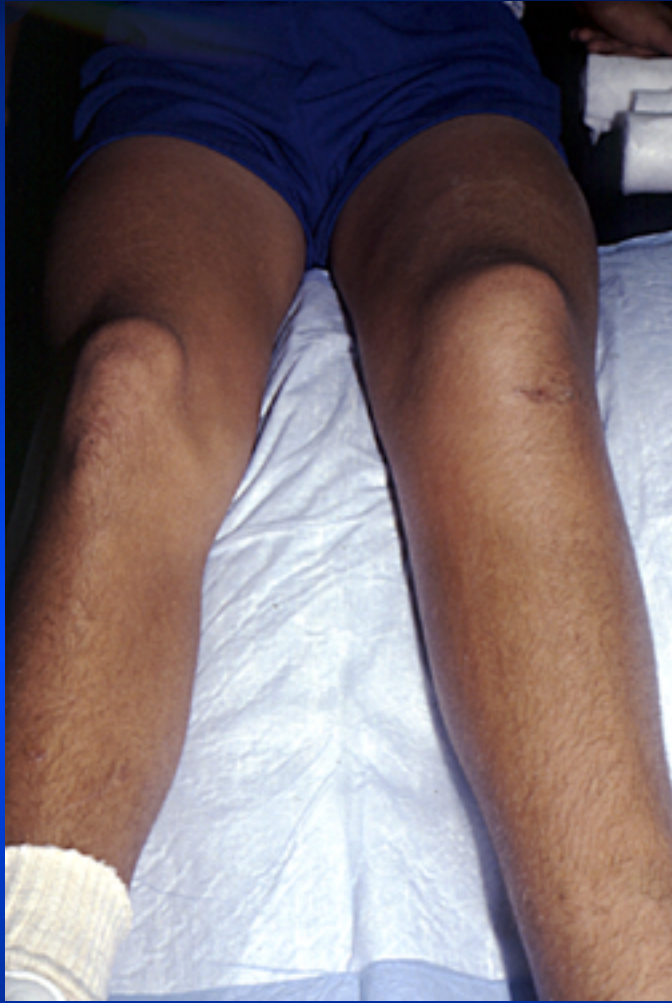




14 YO punter was crushed by defensive line







**16 YO WM Football Athlete
Struck from Lateral Side of Knee**

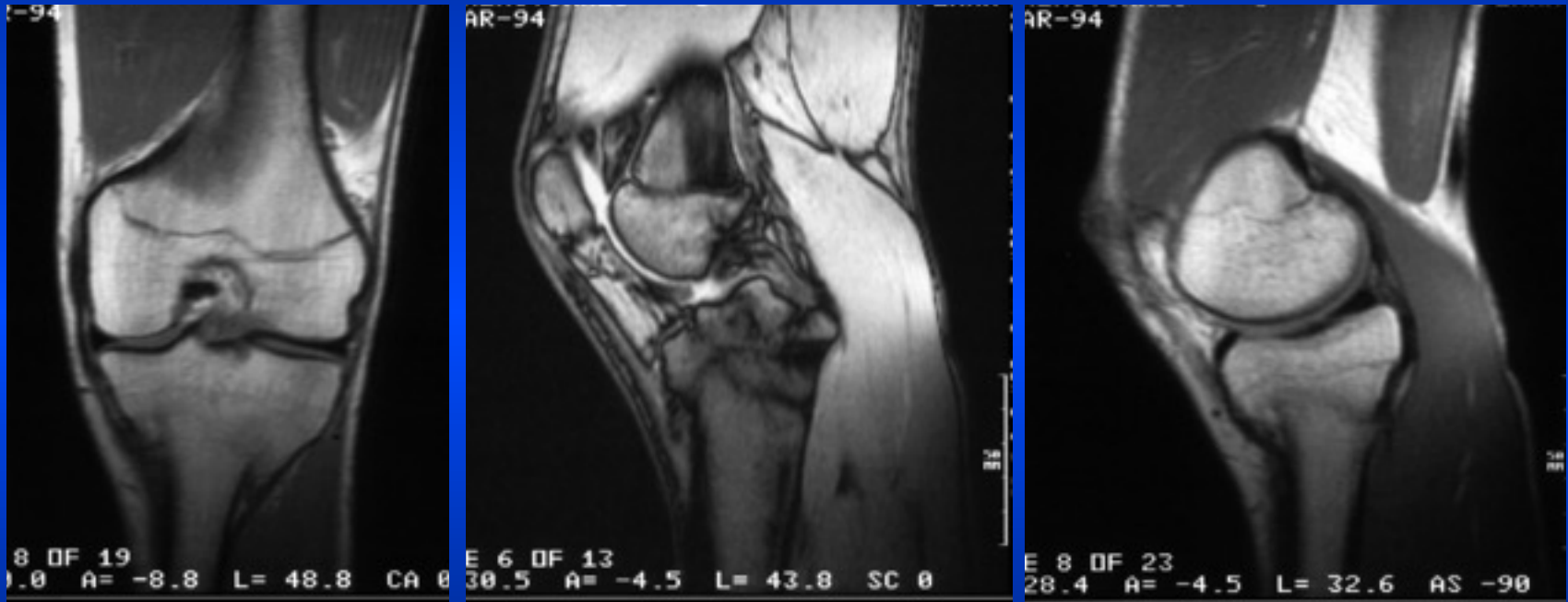




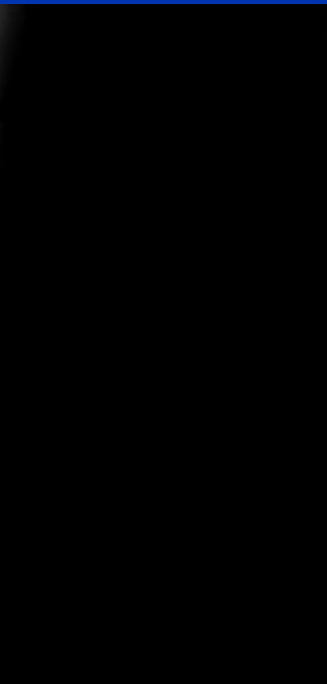
Angular Deformity from 20° Malunion from Proximal tibial growth arrest



MRI scan at time of initial injury

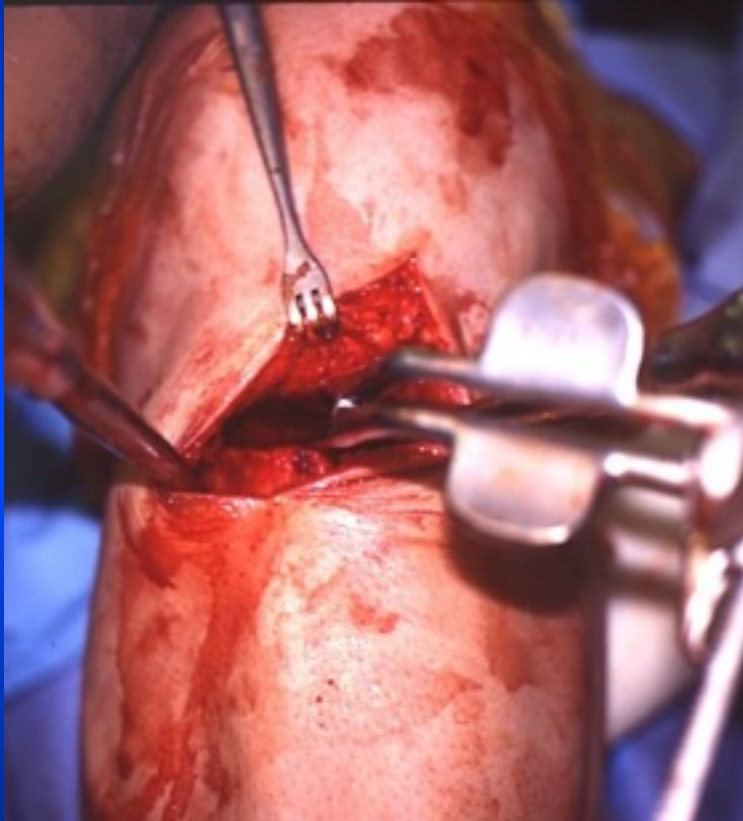








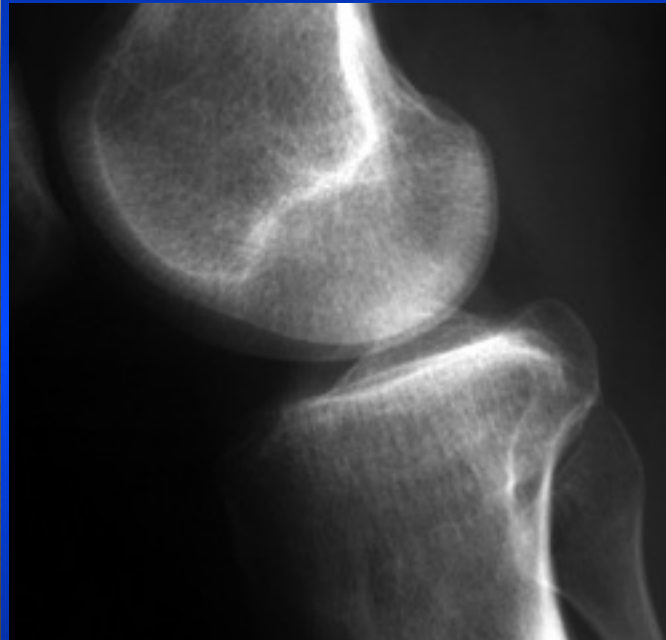
Anterior opening wedge osteotomy



**Post op:
~ 1 week**

22 weeks

28 weeks

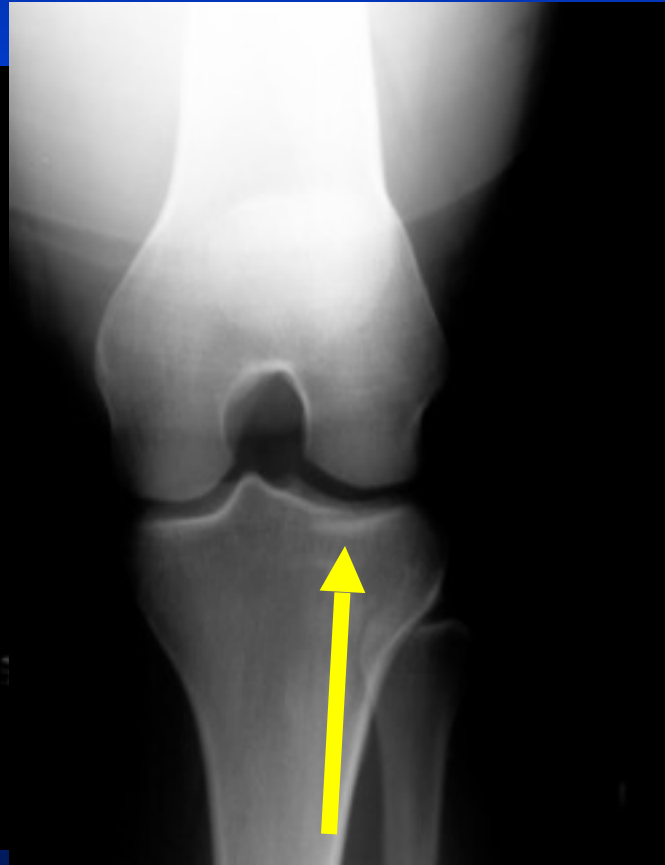


19 YO Female

- Collegiate basketball athlete
- Landed awkwardly in a game
- PE: ACL Tear, Left knee

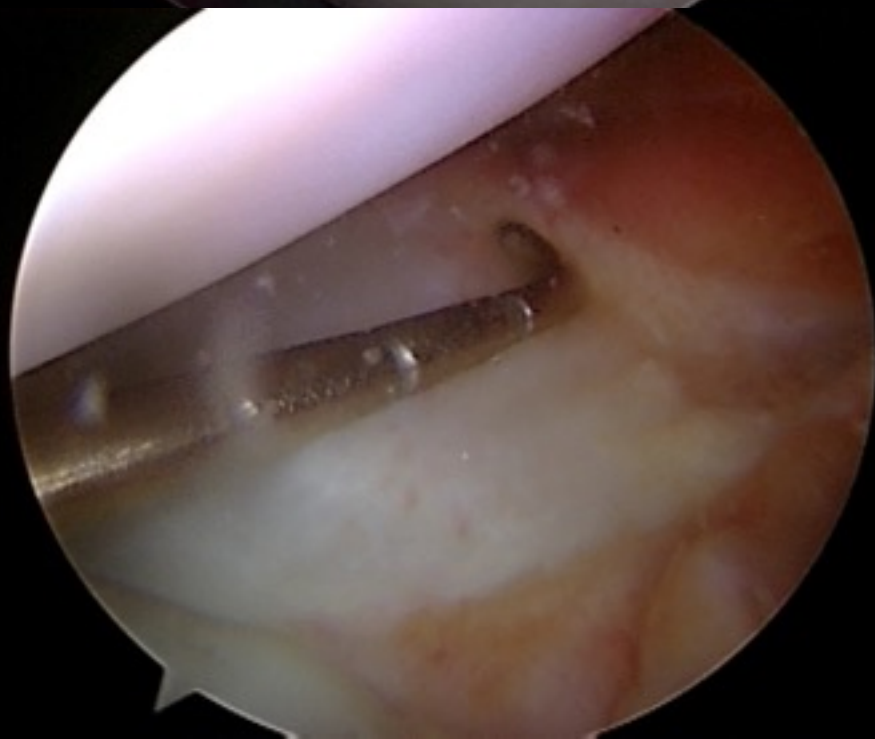
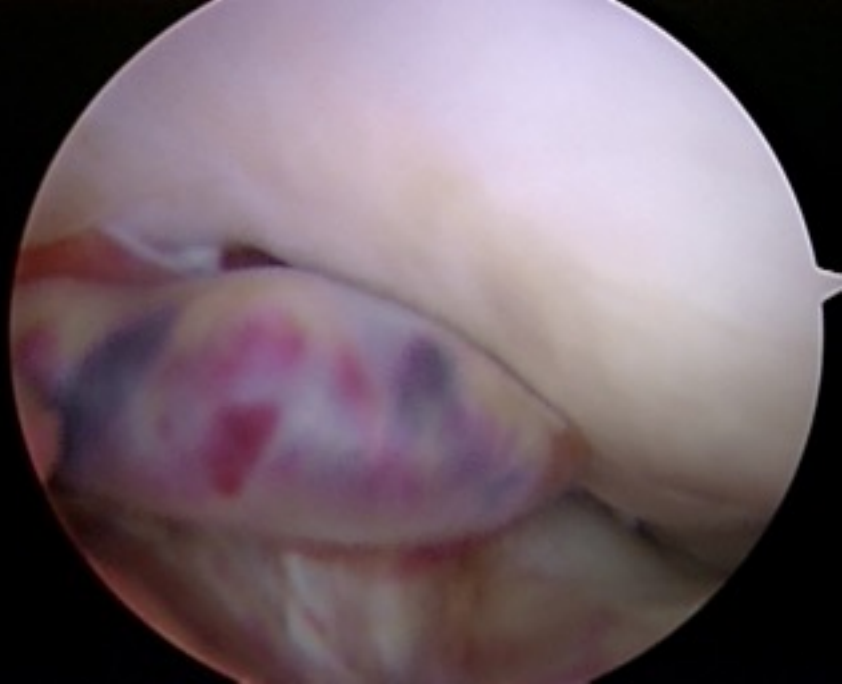


Suspected osteochondral fracture LFC, possible anterior aspect LTP fracture







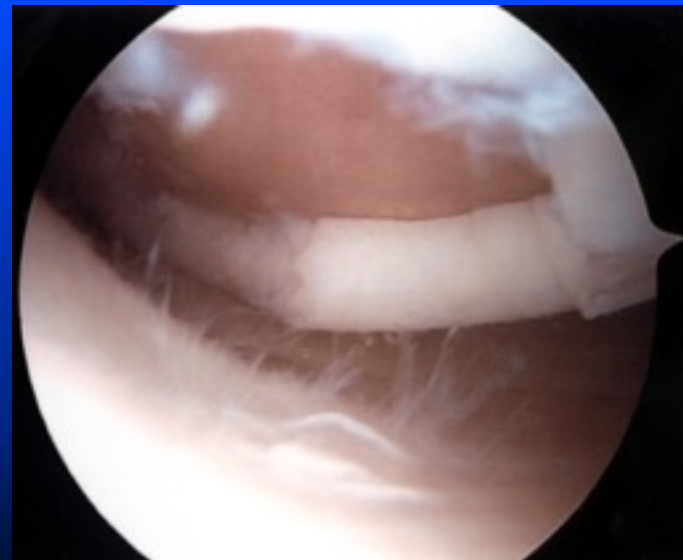
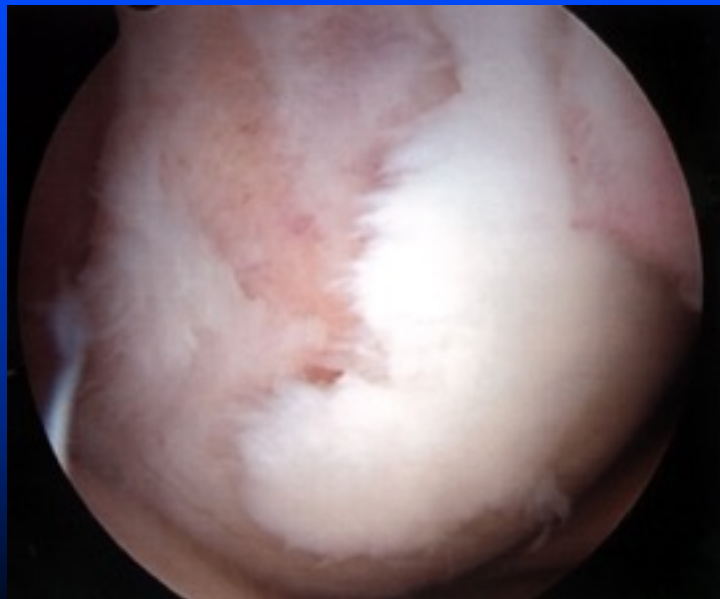


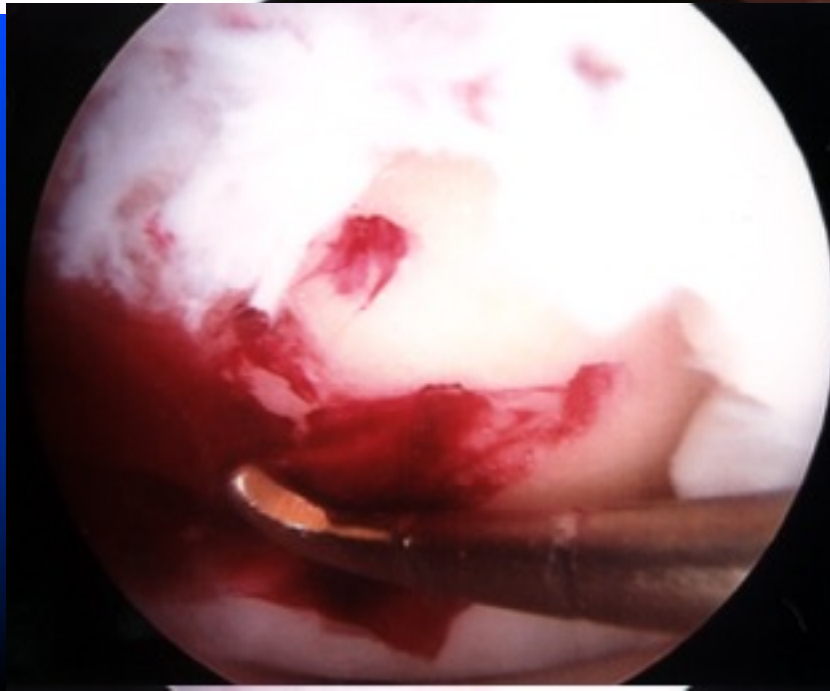
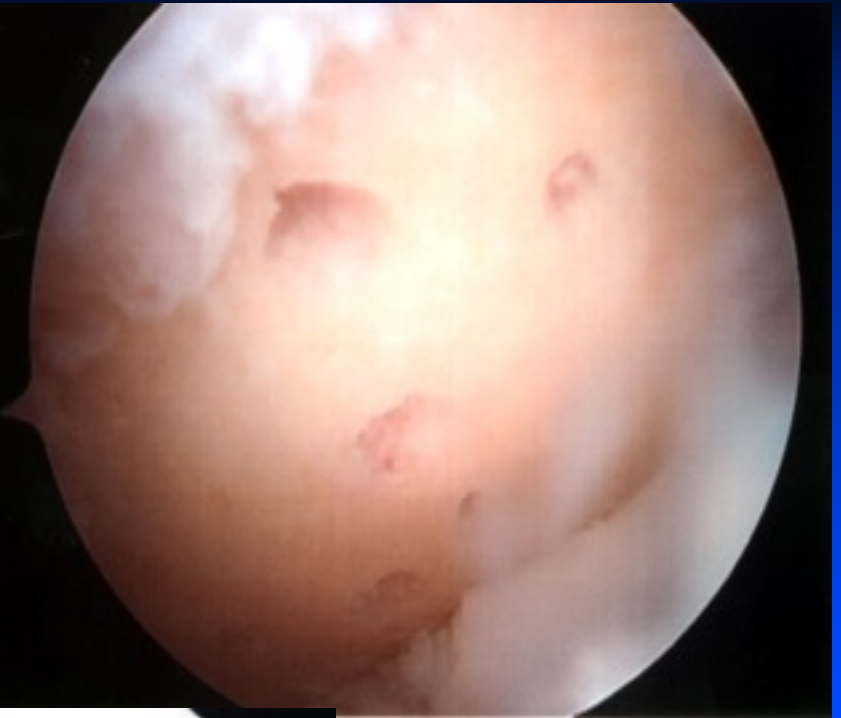
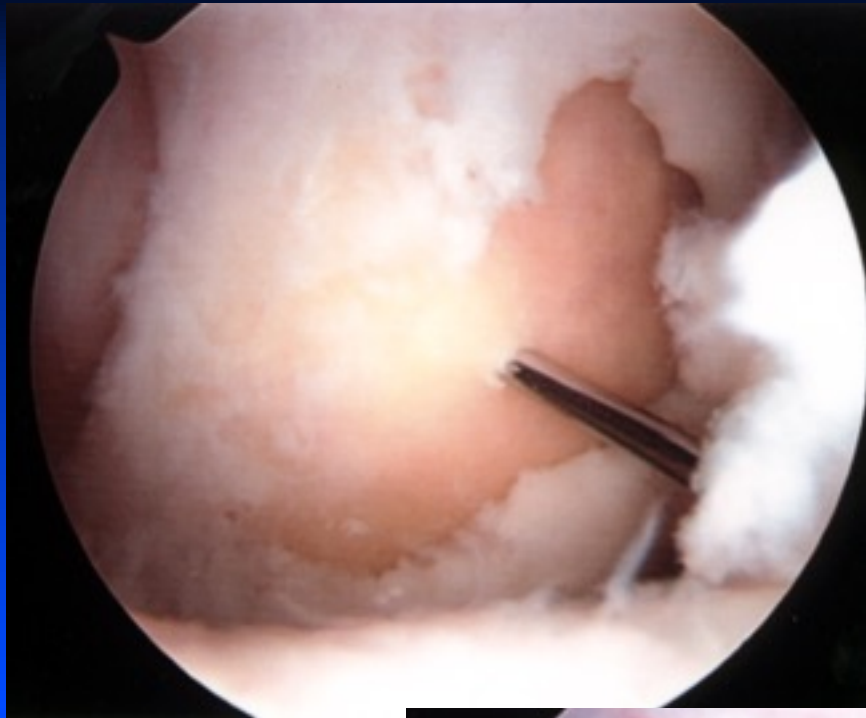
42 YO Male: ACL Tear

- Injured playing soccer
- Beware articular surface injuries



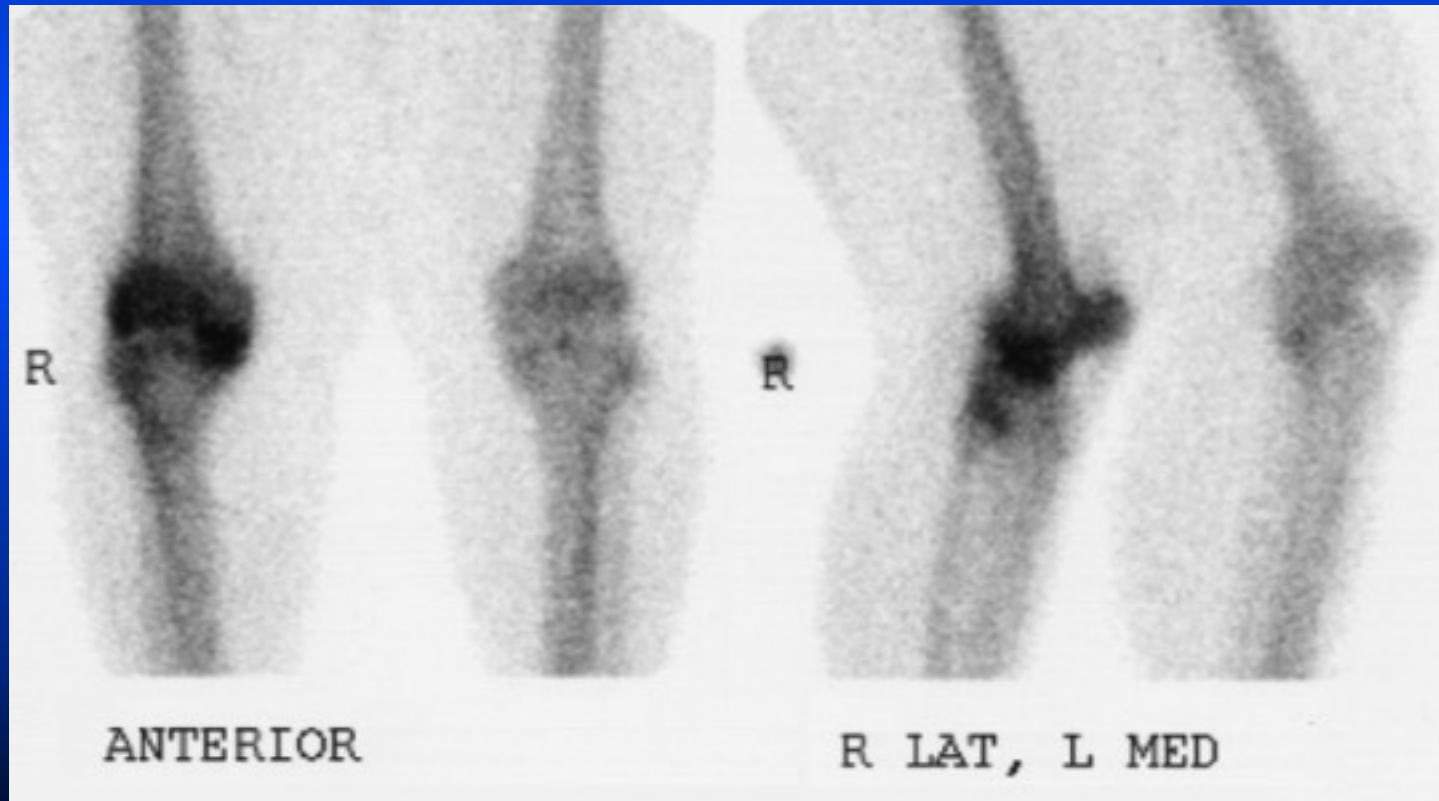




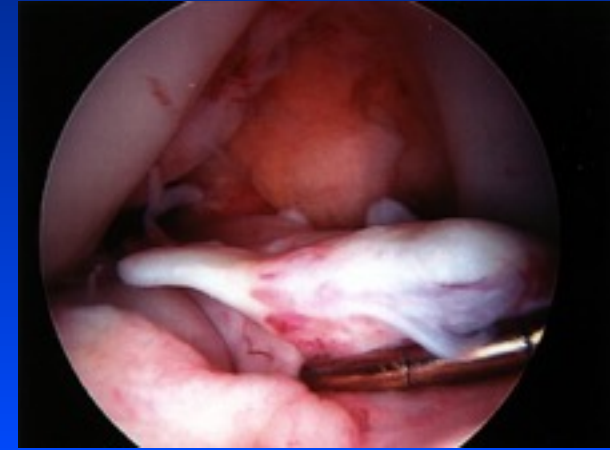
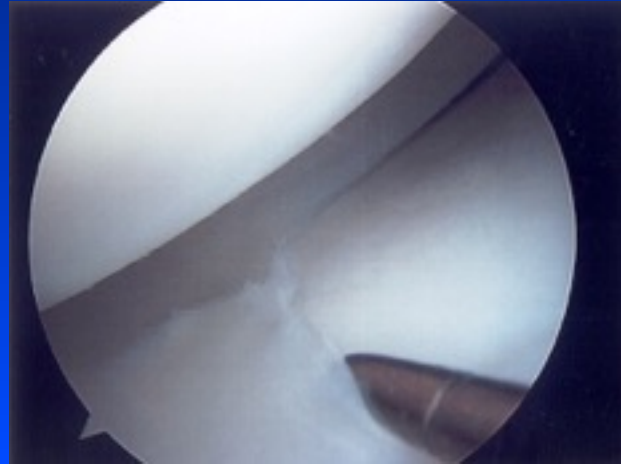


Technetium Bone Scan LE

- Informative for MD + Patient



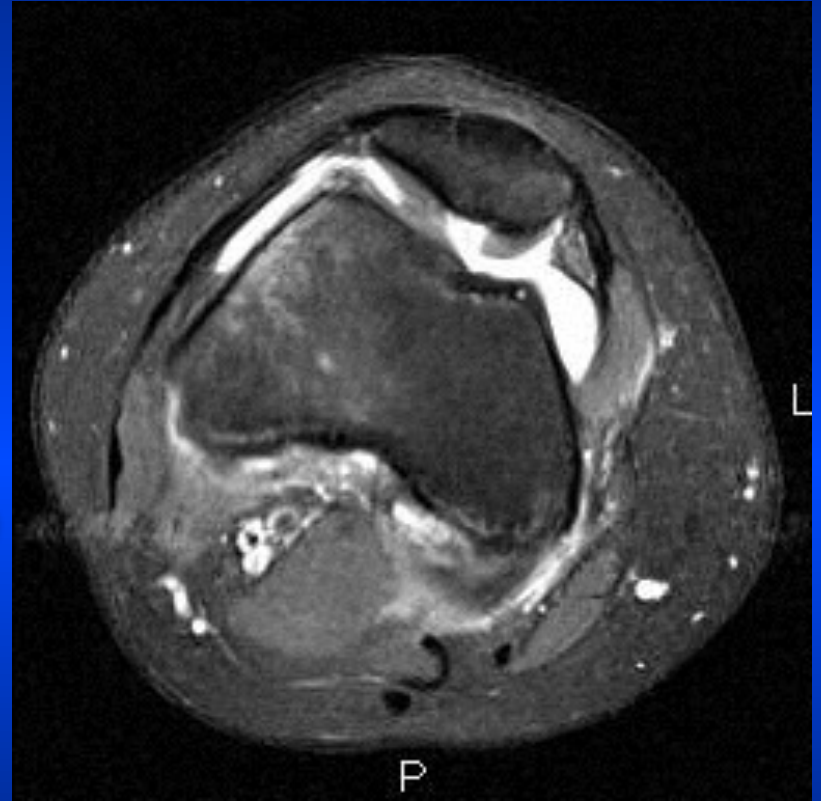
Bone Bruise



Does That Predict Development of OA?

Bone Bruise Patterns

- Acute patellar dislocation
- Medial patella anterolateral femoral condyle
- No OA from bone bruise, but from articular cartilage injury and mal-tracking



Bone Bruise Patterns

- In soccer, medial tibial plateau bone bruise no long term risk of OA
- In degenerative posterior horn root avulsions, medial tibial bone bruise often seen

? Long-term follow-up for bone bruises needed to determine significance for development of OA

What is the significance of Bone Bruises?

Unknown. . .

- Long term Bone Bruise \neq OA
- In ACL injuries noncontact compartments:
 - Lateral / acute
 - Medial / chronic OA
- Classification systems for bone bruises need further development

Late Results After Meniscectomy

Tapper EM, Hoover NW, “Late Results after Meniscectomy,” *J Bone Joint Surg Am*, 1969 Apr 01;51(3):517-603.

Mayo clinic retrospective review

- 1005 patients undergoing meniscectomy
- 1936-1956
- 113 examined, 100 questionnaires
 - Males did better
 - Best results in bucket-handle resection leaving peripheral rim
 - Do not leave posterior horn if torn

Tapper EM, Hoover NW, “Late Results after Meniscectomy,” *J Bone Joint Surg Am*, 1969 Apr 01;51(3):517-603.

- **Discussion by Dr. Don H. O'Donoghue,**
Oklahoma City, Oklahoma
 - I would therefore not accept the conclusion that:
 - Delay in operation does not affect the ultimate result
 - Patients under twenty years of age have fewer satisfactory results
 - Leaving the peripheral ring will give the best results in bucket-handle fractures
 - Conclusions are not valid based on evidence presented

Tapper EM, Hoover NW, “Late Results after Meniscectomy,” *J Bone Joint Surg Am*, 1969 Apr 01;51(3):517-603.

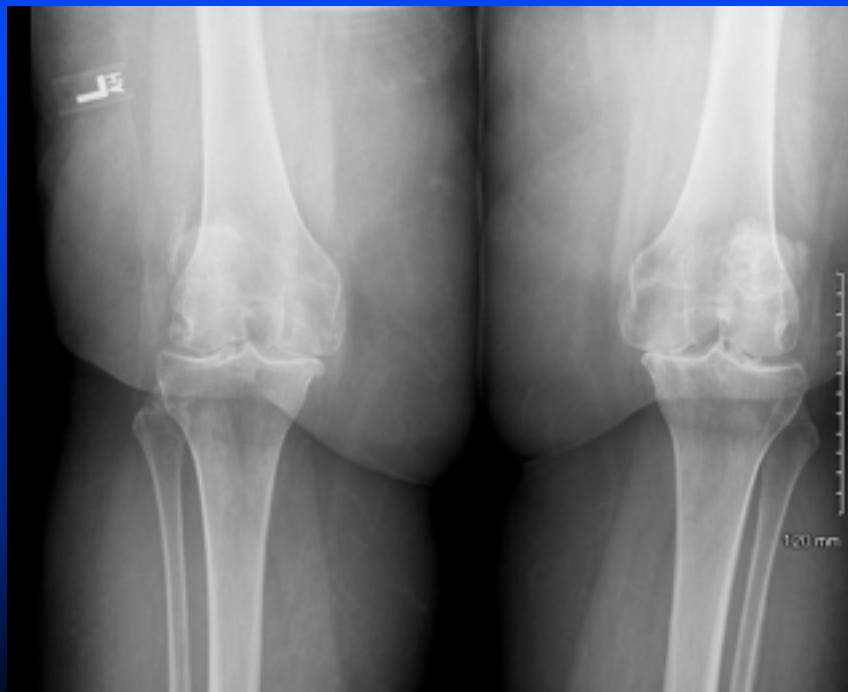
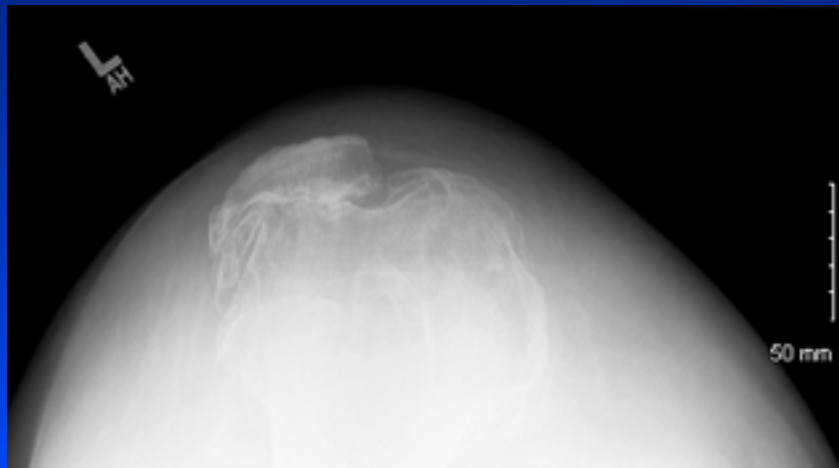
- Discussion by **Dr. Don H. O'Donoghue**,
Oklahoma City, Oklahoma
 - I think the authors are to be congratulated on their efforts to obtain a valid series. As I have indicated, it is extremely difficult to get an uncontaminated series. Probably a study should be initiated, not after operation but before operation, on patients whose surgery would qualify as relatively uncomplicated meniscectomy.

History & PE

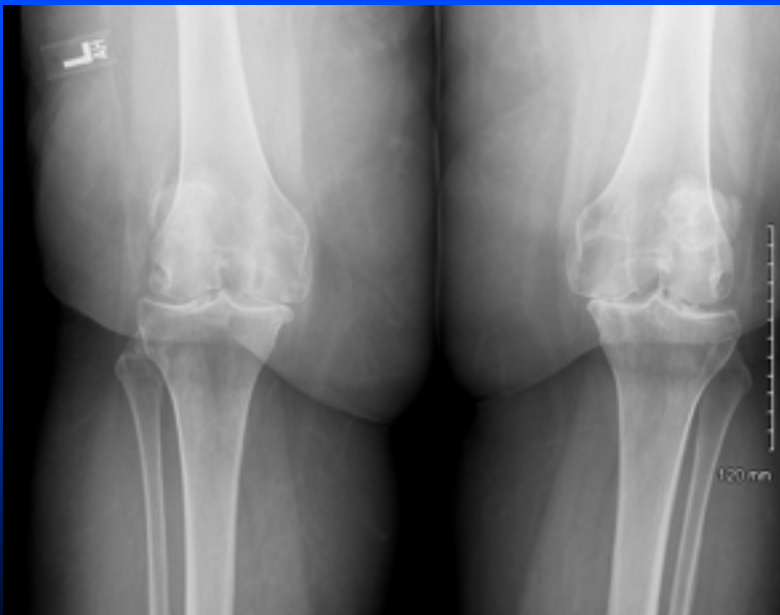
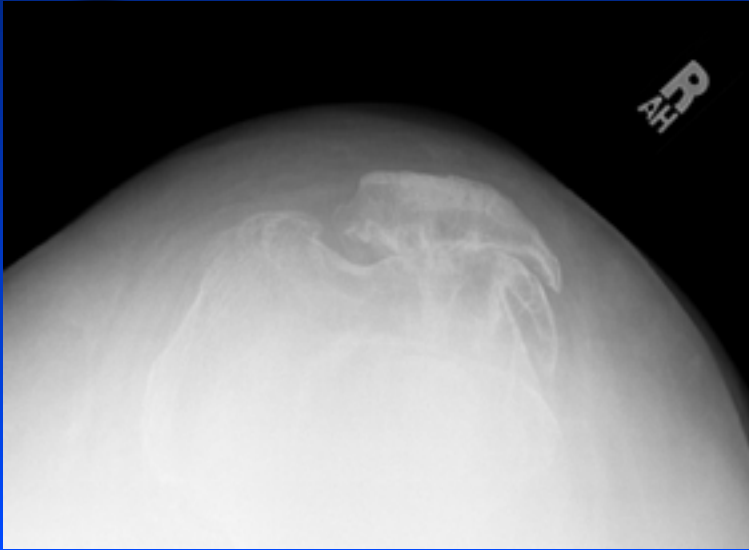
- 55 YO Female
- Difficulty walking due to left knee out of alignment
- Fell 10 years ago and was told she had meniscal tears
- PE: Height 5' 5½", weight 303: BMI 43
- Bilateral Knees:
 - Diffuse crepitus and pain
 - Mild effusion
 - No calf tenderness



Left Knee

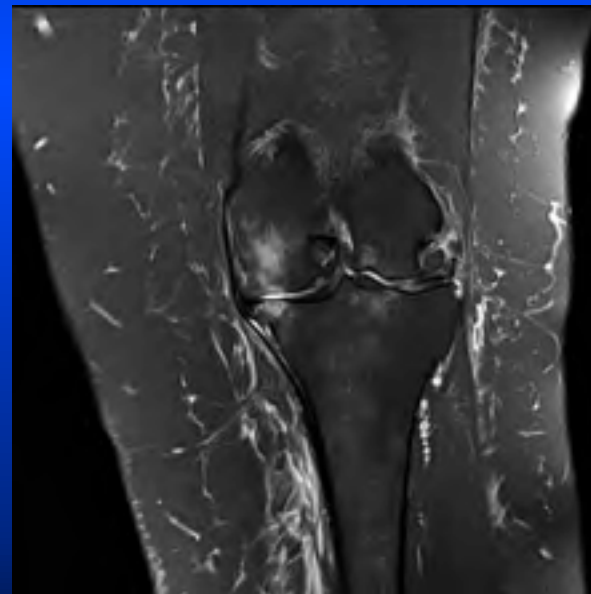
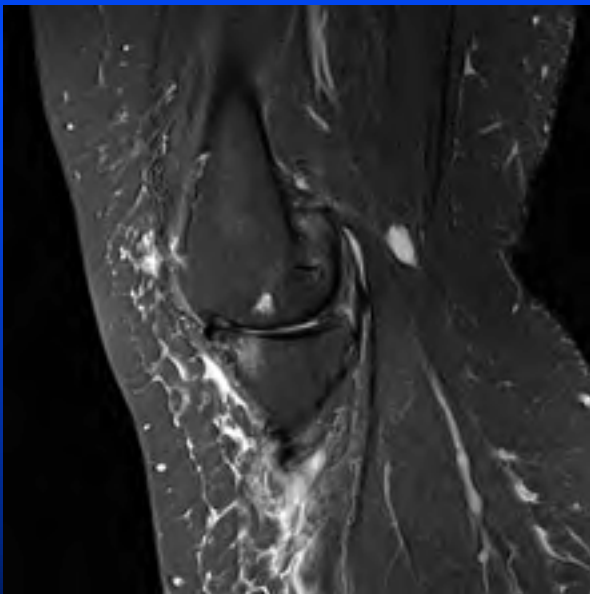
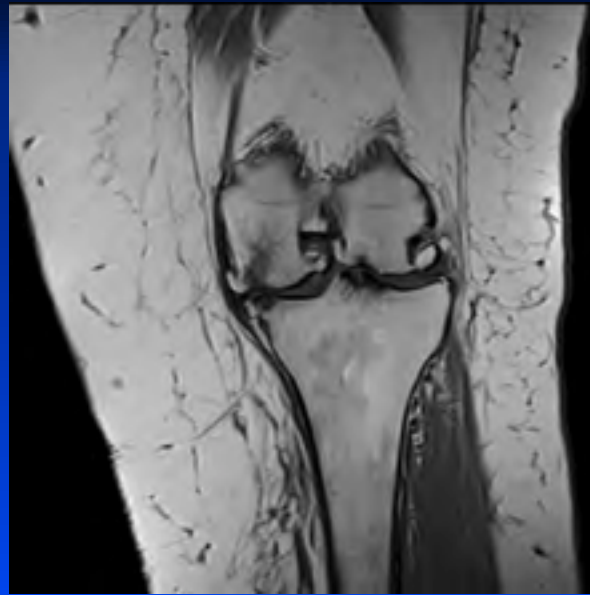
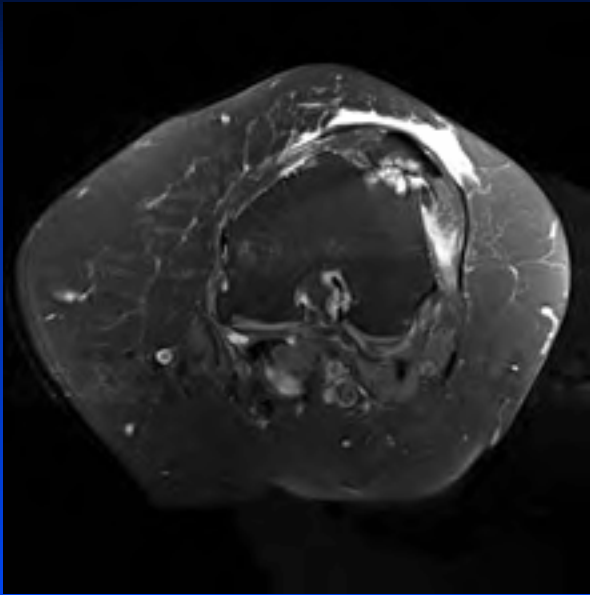


Right Knee



What test would you do next?

MRI



Are more tests needed?

MRI Scan in the Arthritic Knee After 50 years

- **Not Helpful for Articular Cartilage**
- **Meniscal Signal Will Usually Be Abnormal and come to the tibial surface.**

MRI Scan in the Arthritic Knee After 50 years

- Is the root of the Medial Meniscus Avulsed?
- What about my Baker's Cyst?
- Think tree - MRI Scan
 - In a Big Forest – Arthritis
—The Plain Xrays
show us the reason
for stiffness & pain:
Arthritis



IMAGING THE ARTHRITIC KNEE

- Use goniometer to assure comparable Xrays year to year and for outcome studies
- Let the Orthopaedist Order the MRI Scan in the Arthritic Knee Patient.
 - May want DESS or special articular cartilage sequences.
 - In most cases MRI scans in patients over age 50 would not change treatment plan.
 - I don't need an MRI scan to know what to do arthroscopically! I was scoping knees prior to MRI scans!

Conclusions

- **Make the connection between:**
 - Anatomy
 - Function
 - History and Physical Exam
- **In relation to:**
 - Functional disability
 - Specific diagnosis

“The Knee as a Biologic Transmission with an Envelope of Function”

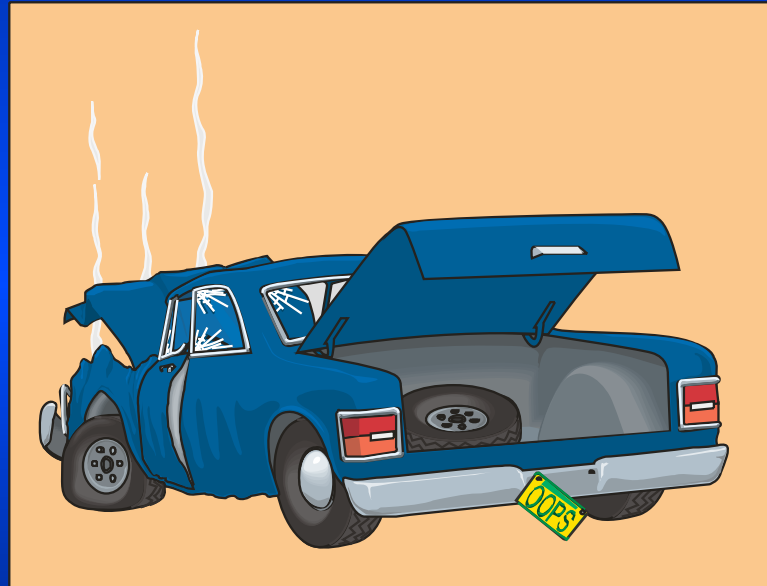
Scott Dye. **The Knee as a Biologic Transmission with an Envelope of Function.** *Clin Orthop Rel Res* 1996;325:(April): 10-18.

Envelope of Knee Function

- **Factors:**

- Anatomy
- Kinetics
- Physiology
- Treatment

The Knee as a Biologic Transmission with an Envelope of Function

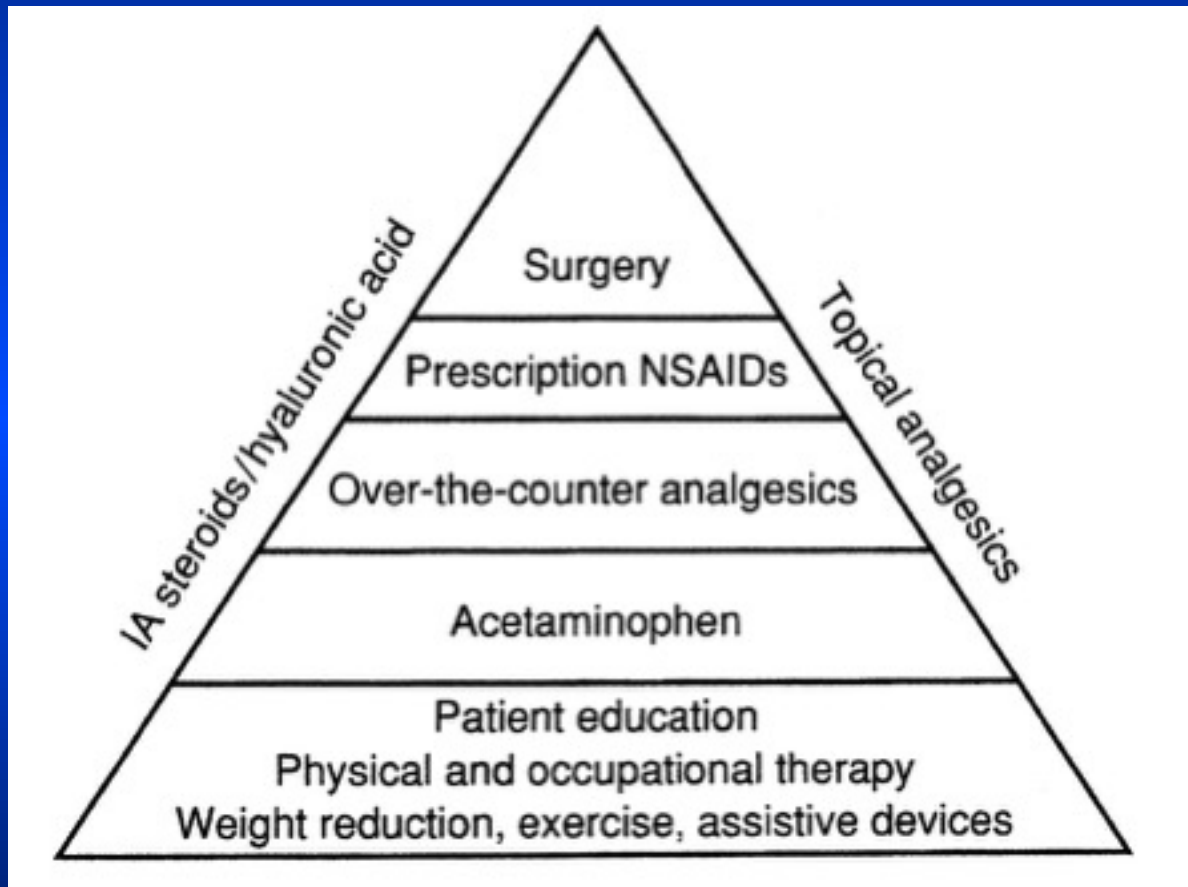


A Knee Injury is like a car wreck

Goal of Treatment of Knee Disorders

- Broaden envelope of function
- Resume activity safely
- Inform patients of “lowered threshold” of function

Pyramid Approach to the Management of Osteoarthritis



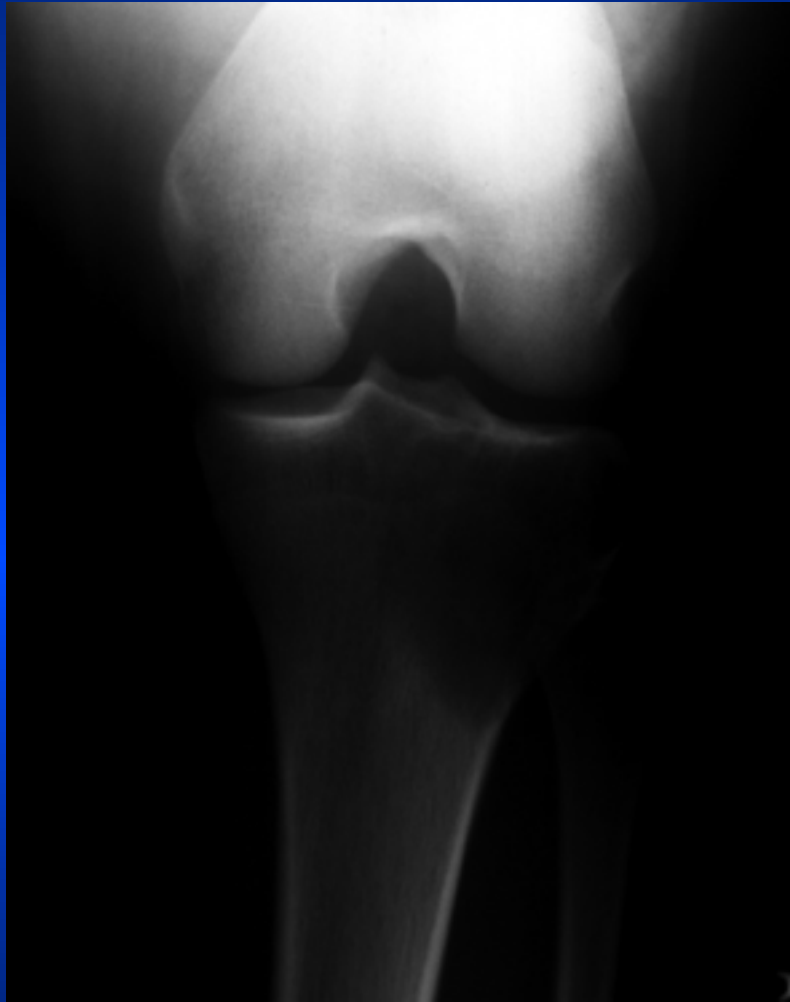
**You May Not Have Seen It, But It Has
Seen You**

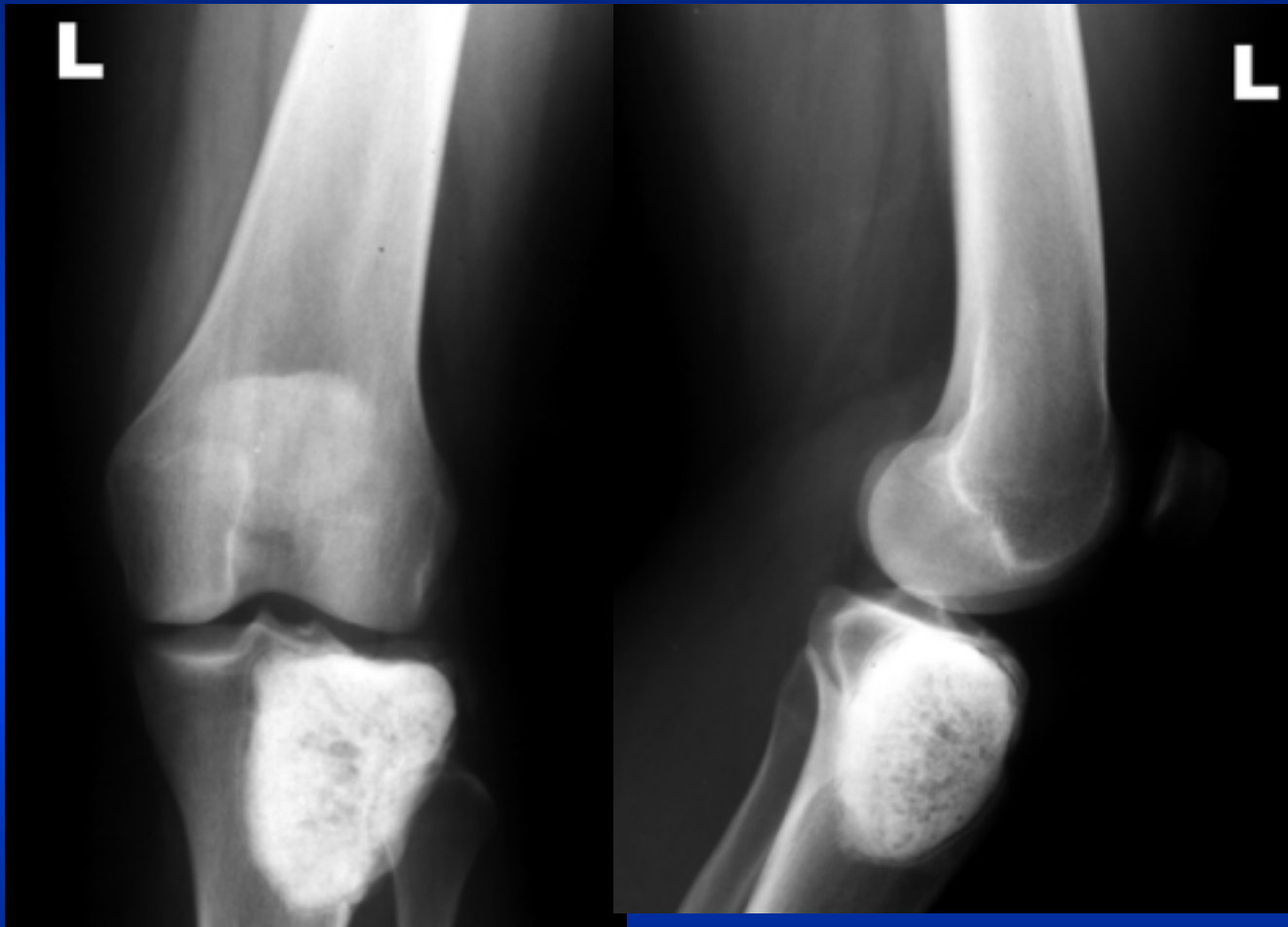




Right distal femur osteosarcoma







S/P Excision Curettage Cementation

**You Look for What You Know
and You Find What You Look For**



The End . . .

Thank You!

Examination and Imaging of the Knee and Leg



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Lexington, Kentucky

ACSM TPC Part 2

Miami, Florida

February 9, 2013