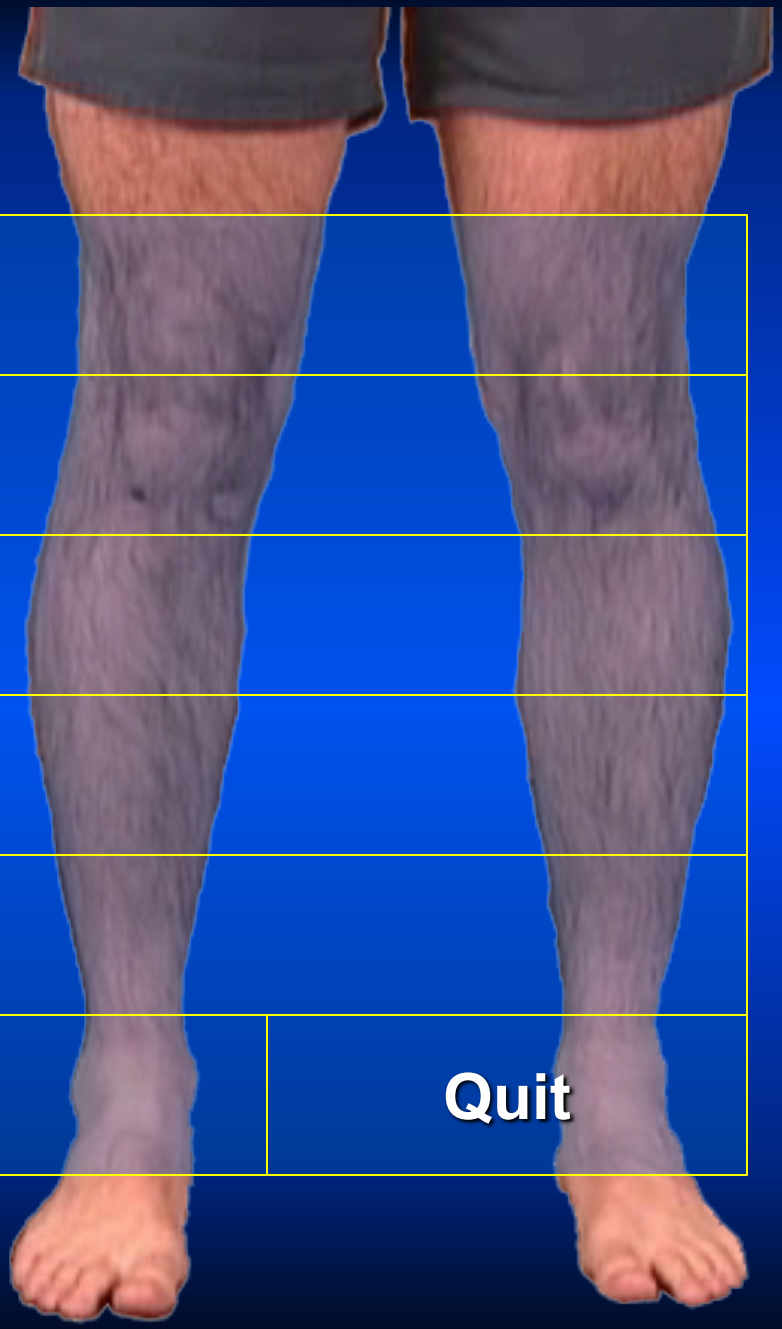
ACSM TPC Part 2
Miami, Florida • February 9, 2013

Examination and Imaging of the Knee and Leg



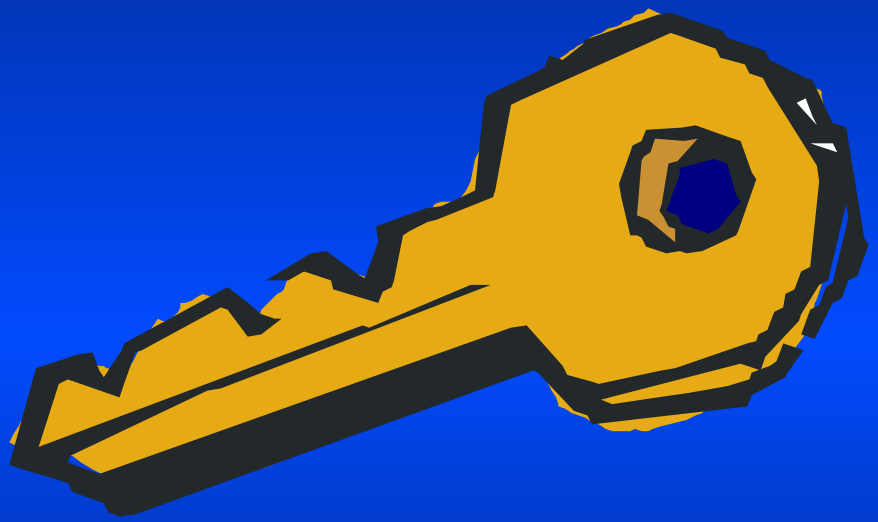
Mary Lloyd Ireland, MD
Associate Professor
Dept. of Orthopaedic Surgery & Sports Medicine
University of Kentucky
Lexington, Kentucky

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



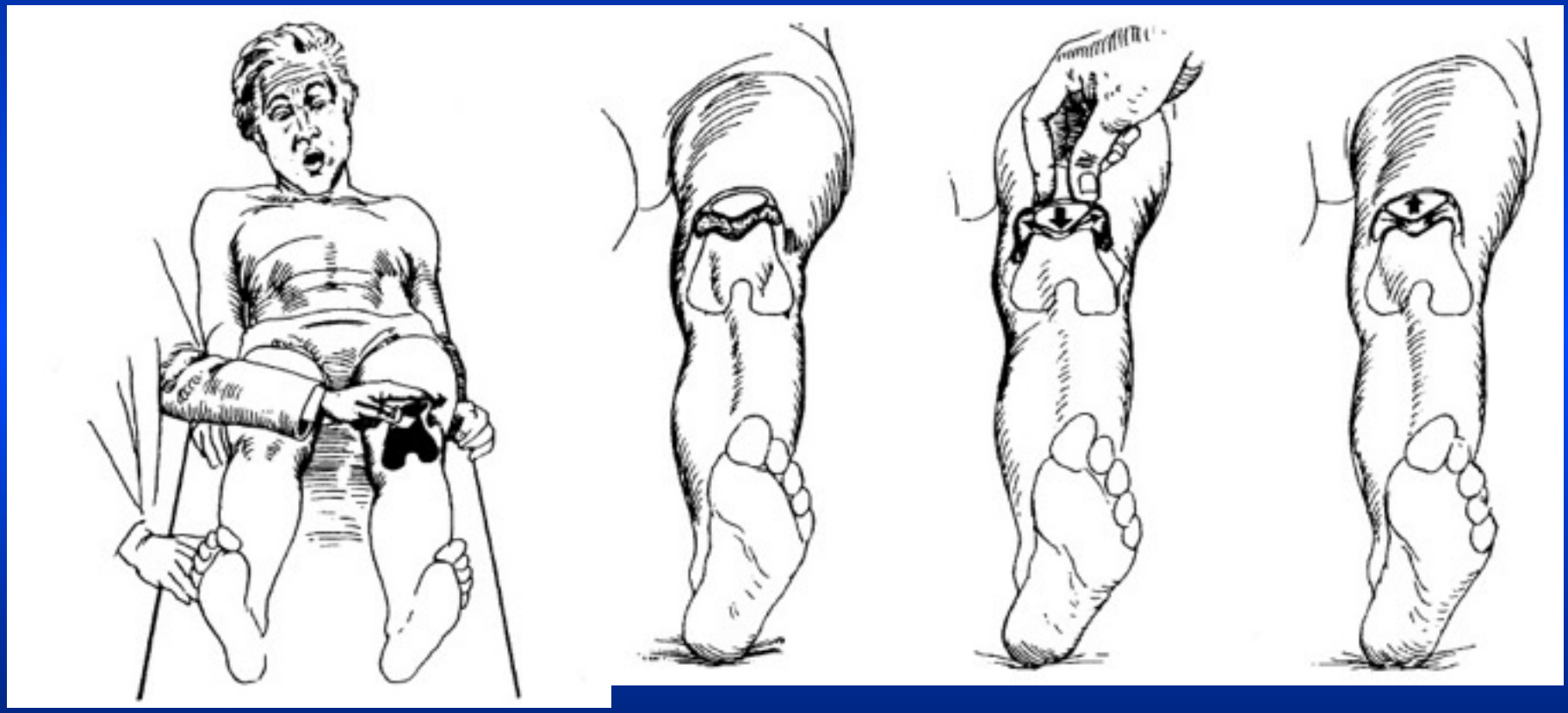
Patellofemoral Disorders

Fisted Knuckle Sign

= ACL Tear

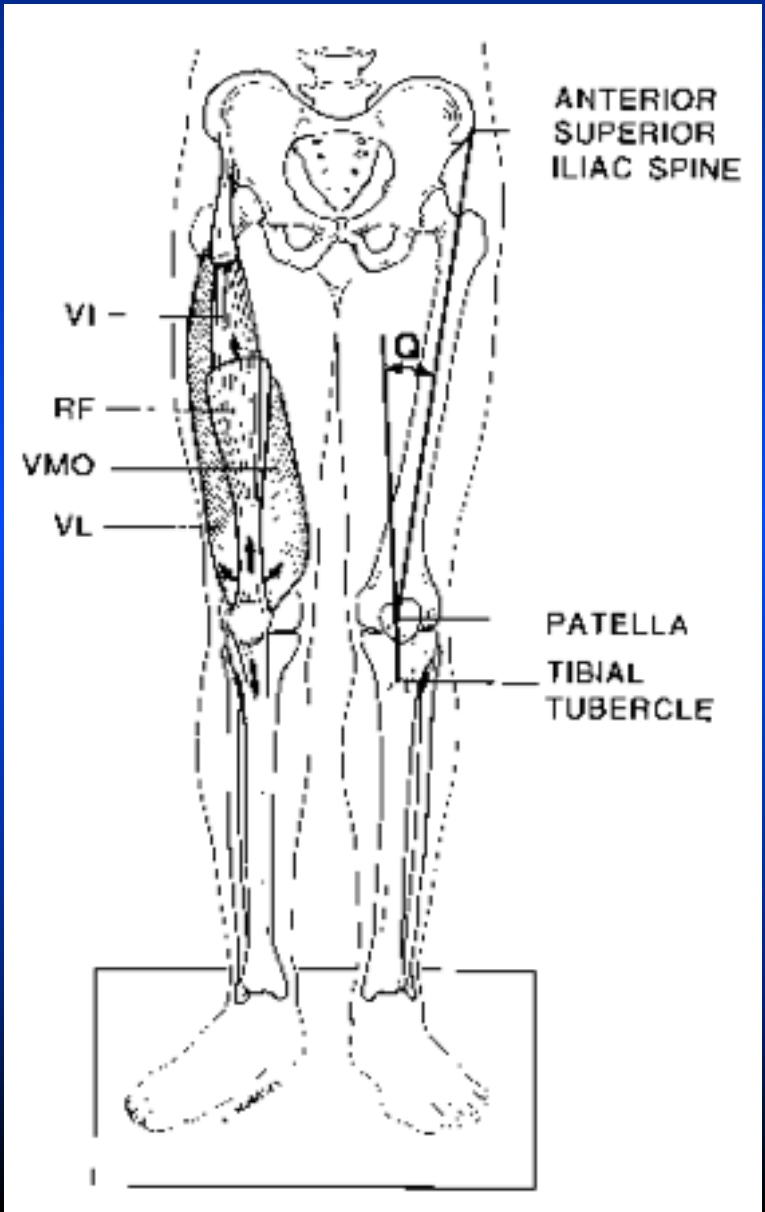


Patient apprehends another lateral patellar dislocation



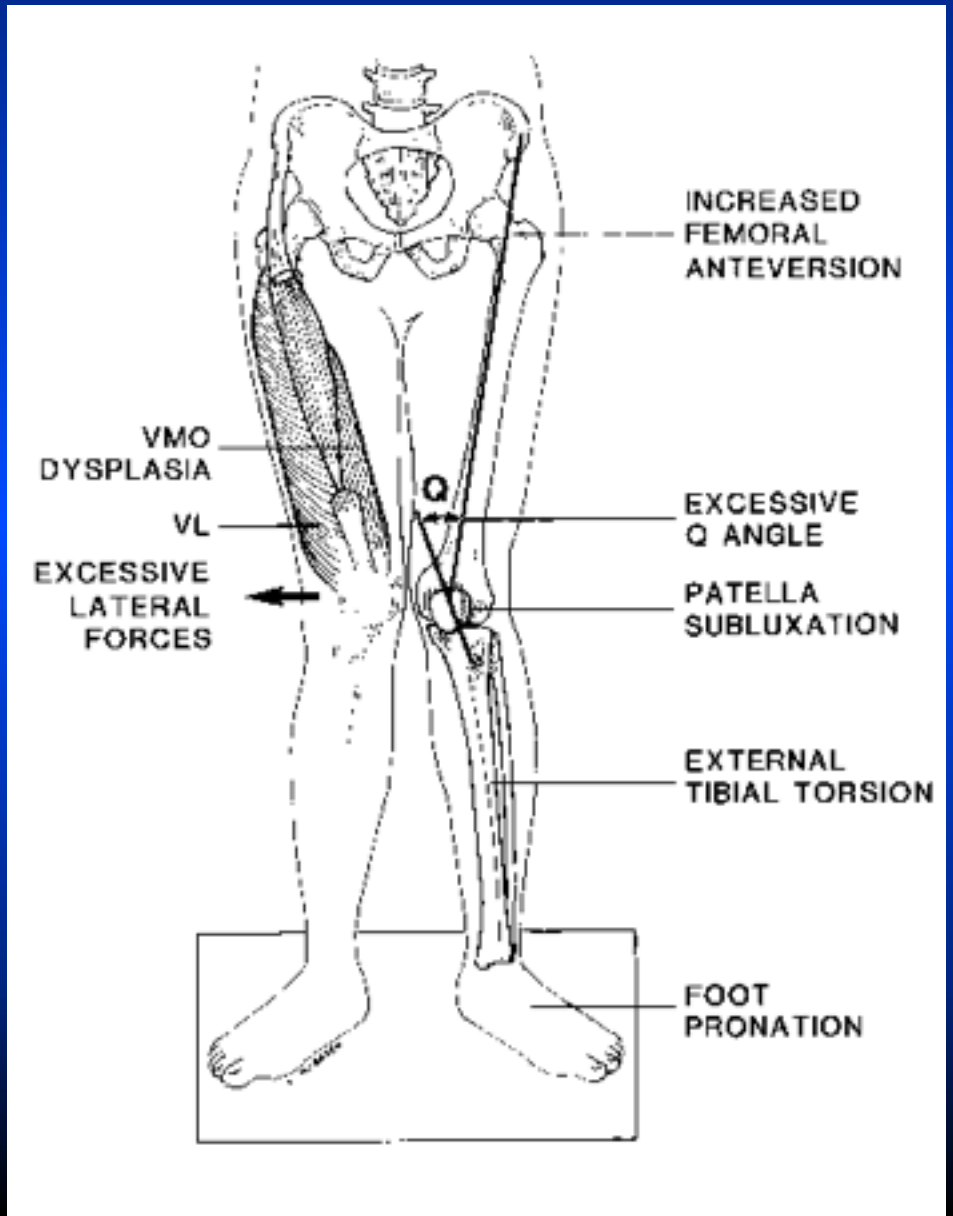
Positive apprehension test
Do the anticipated painful test last

Normal Alignment



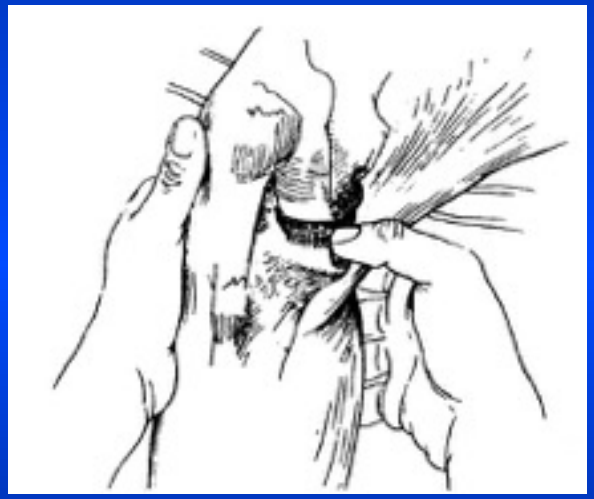


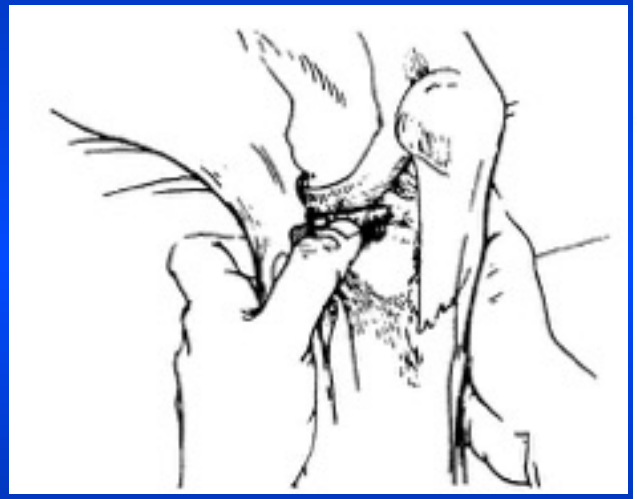
Miserable Malalignment Syndrome





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

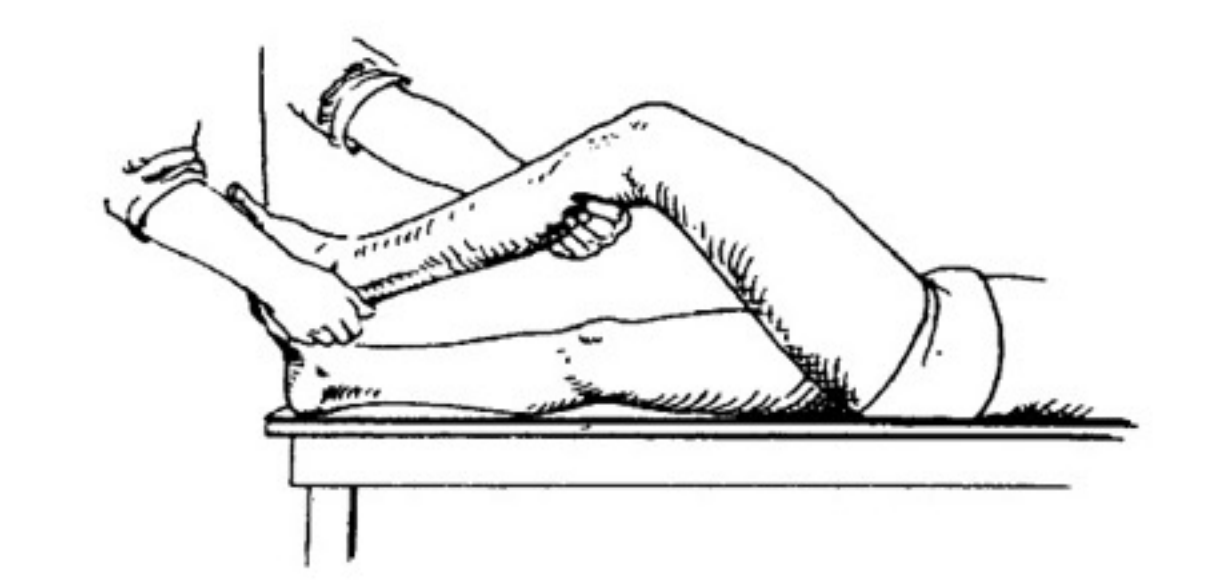


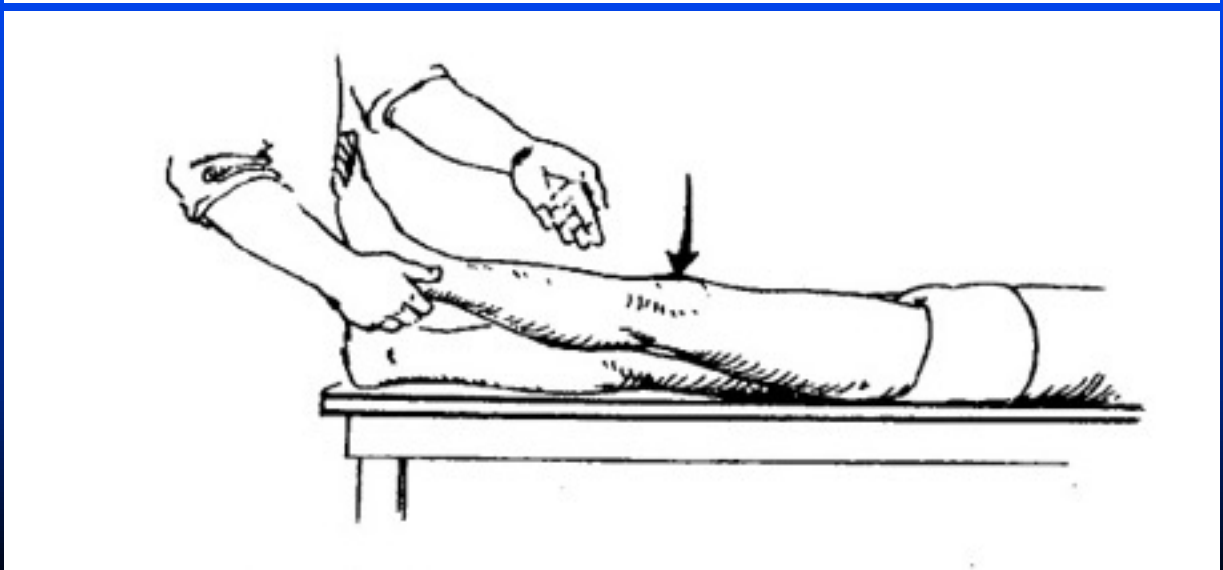




Externally rotate tibia for medial meniscus tears,
Internally rotate for lateral meniscus tears

Bounce Home Test

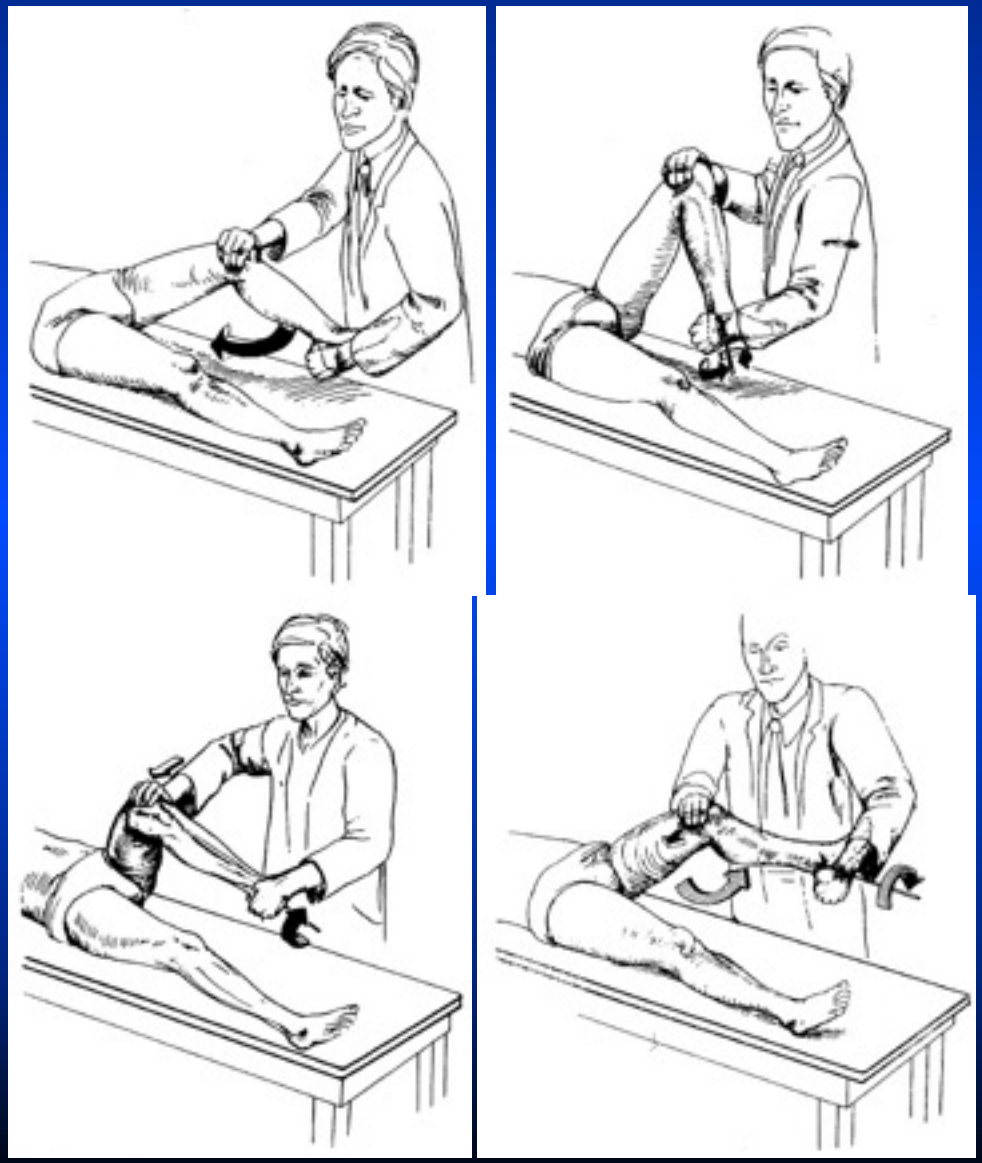




Normal Knee Exam: Bounce Home



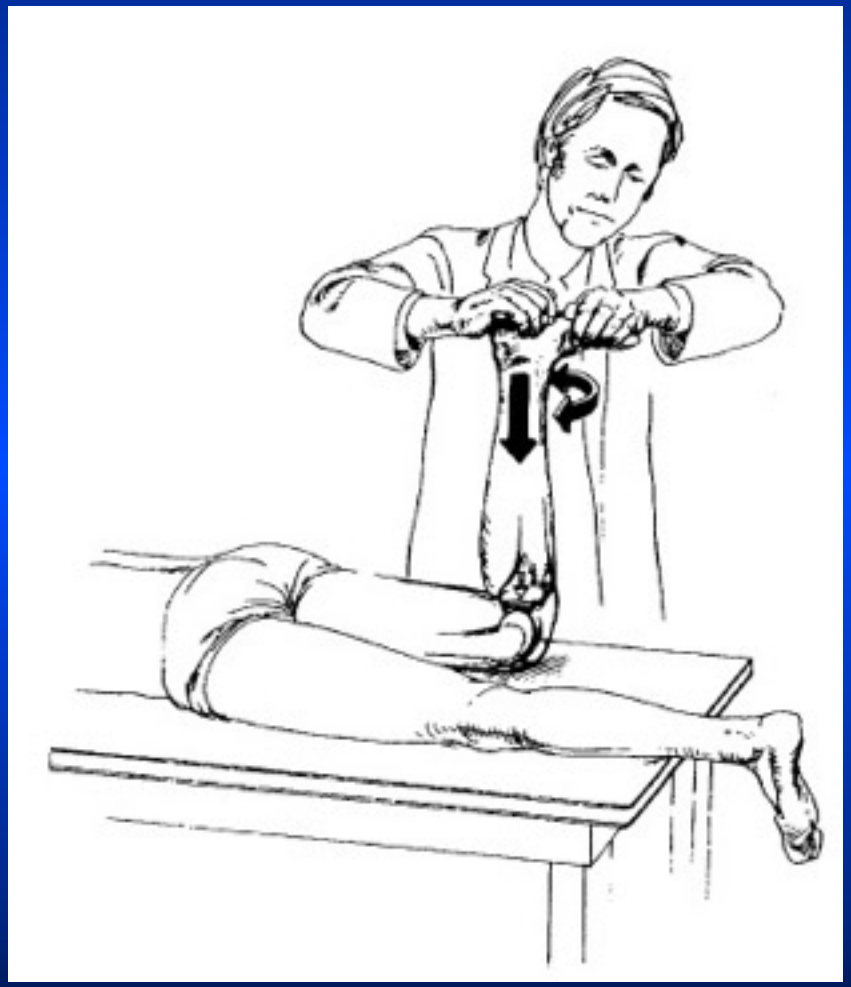
McMurray's Test: Medial Meniscus

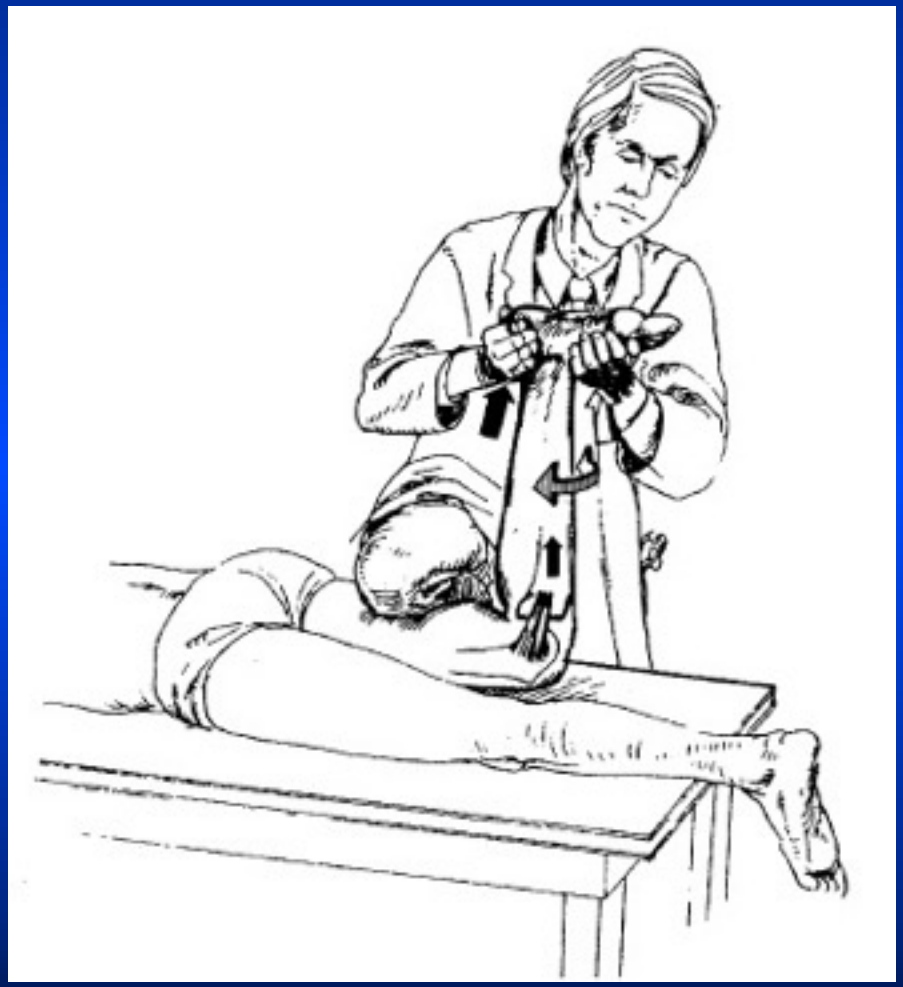


Normal Knee Exam: McMurray's Test



Apley's Compression Test

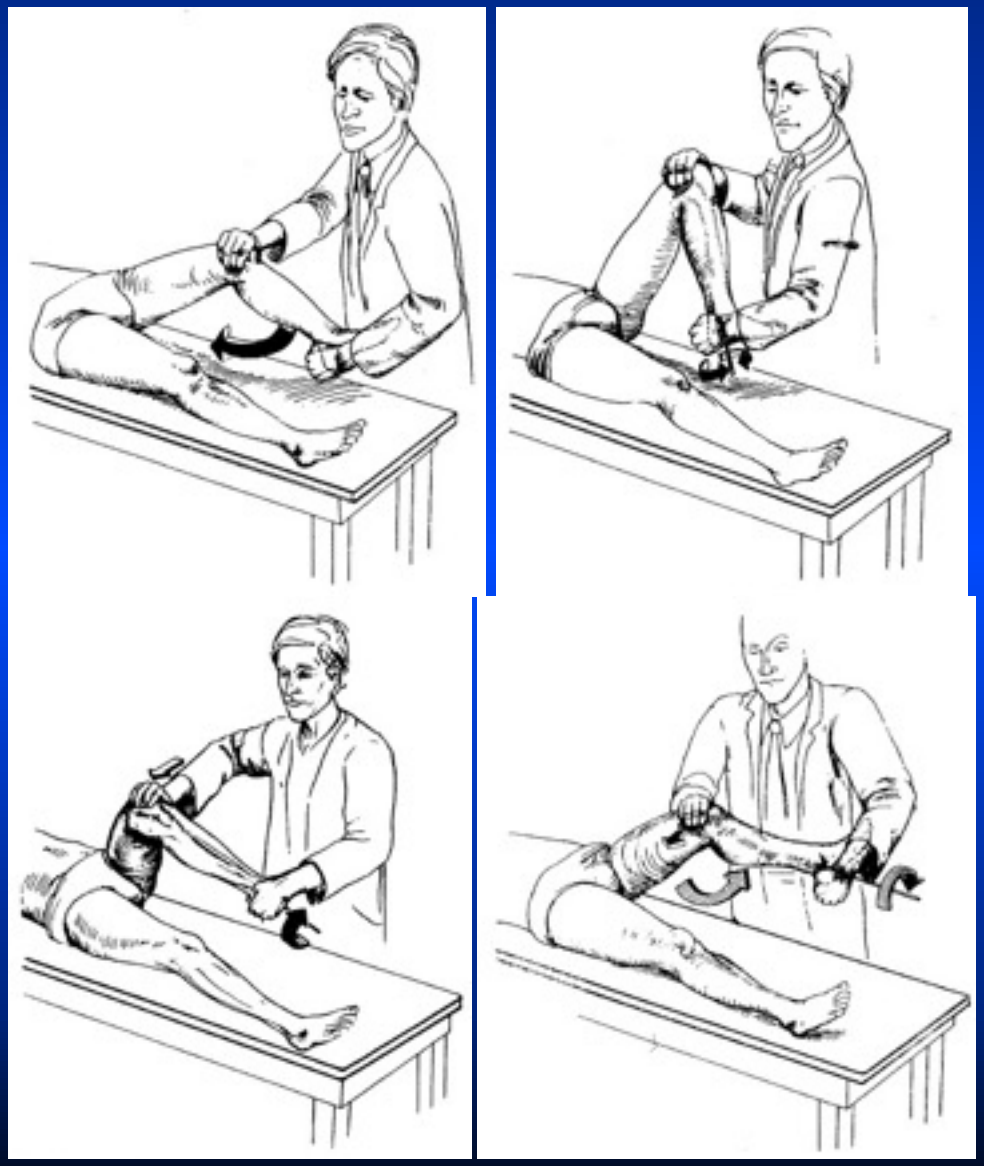




Normal Knee Exam: Apley's



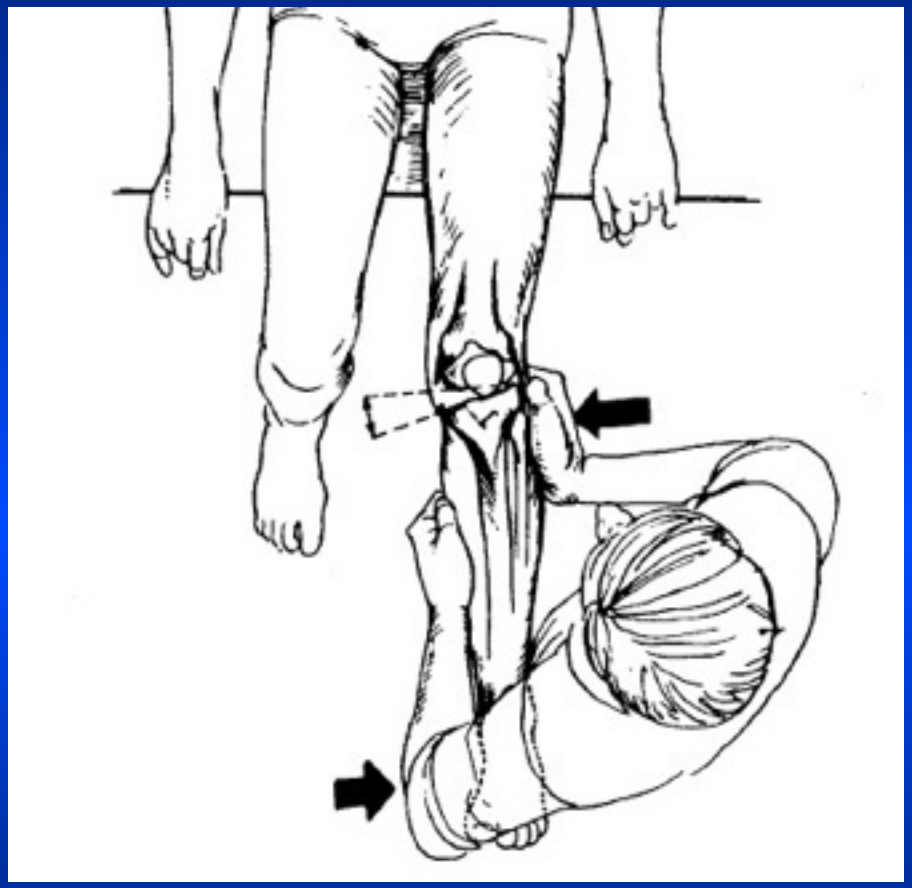
McMurray's Test: Medial Meniscus

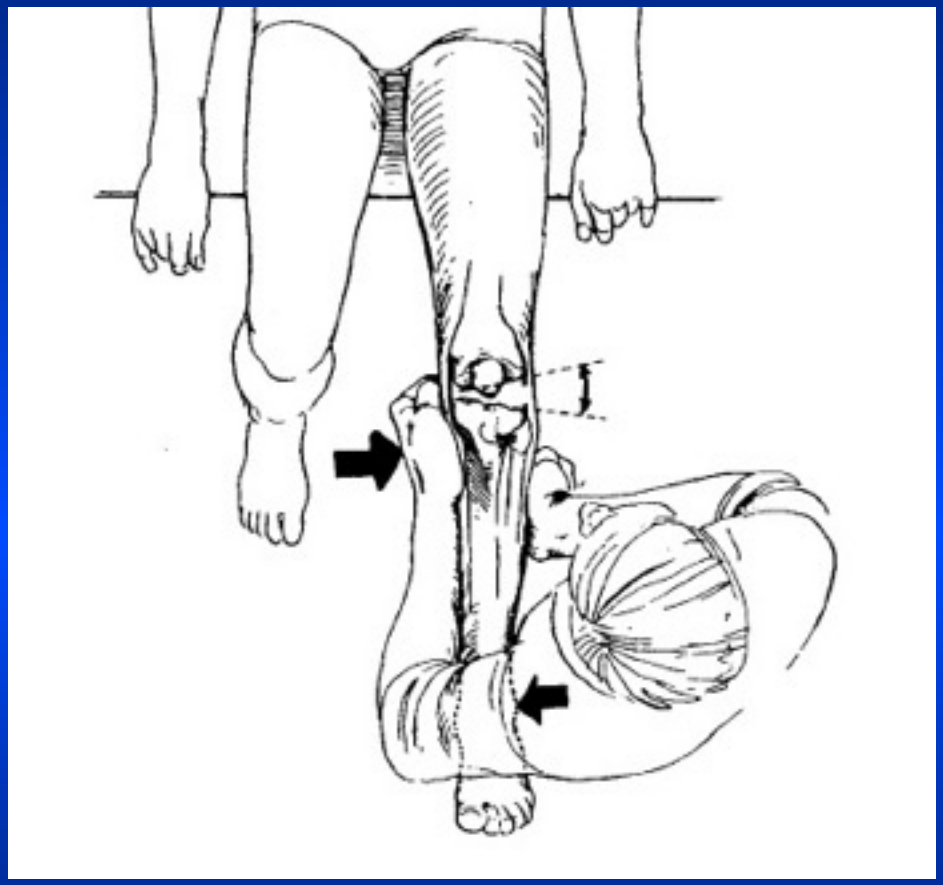


Normal Knee Exam: Lateral Aspect



Straight instability vs. Rotatory instability





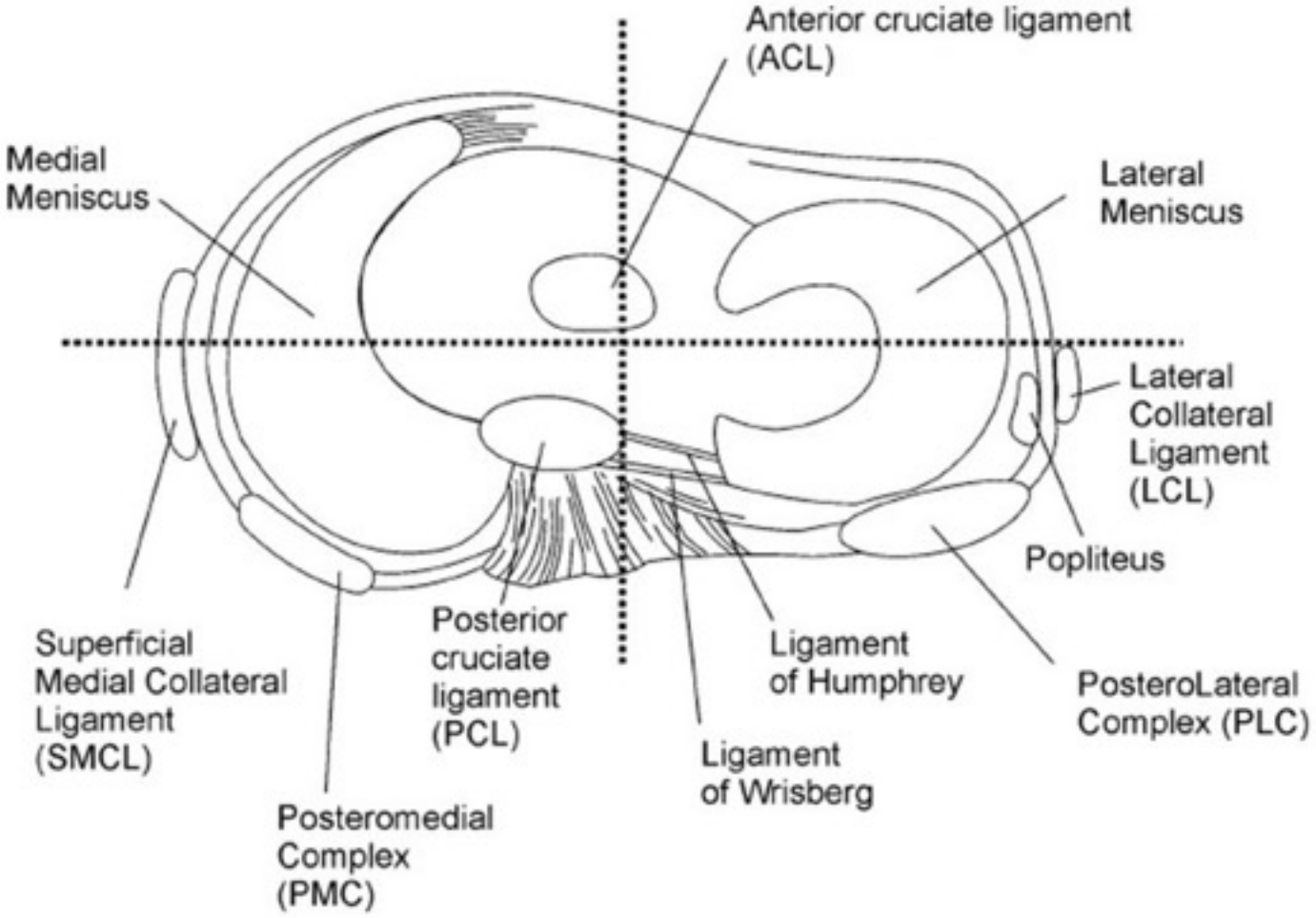
Valgus Stress / Varus Stress

Normal Knee Exam: Ligaments



Knee Instabilities

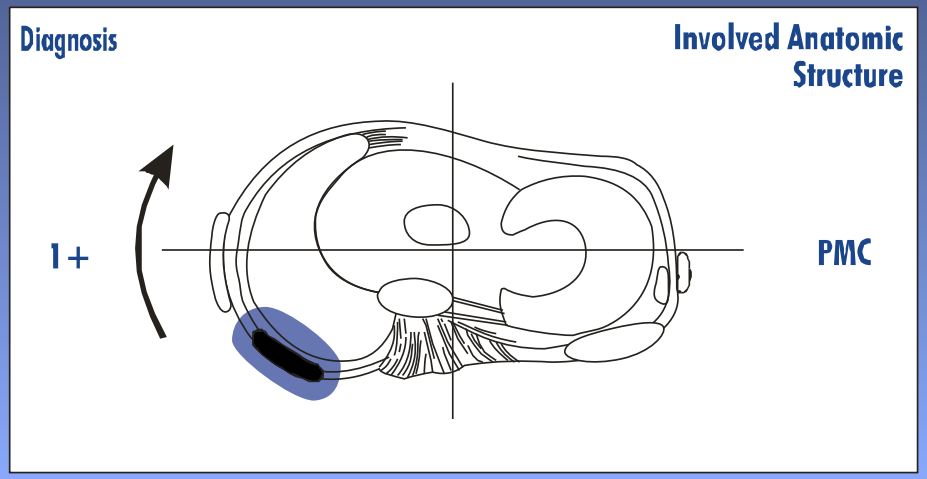
Bird's-Eye view of Tibia



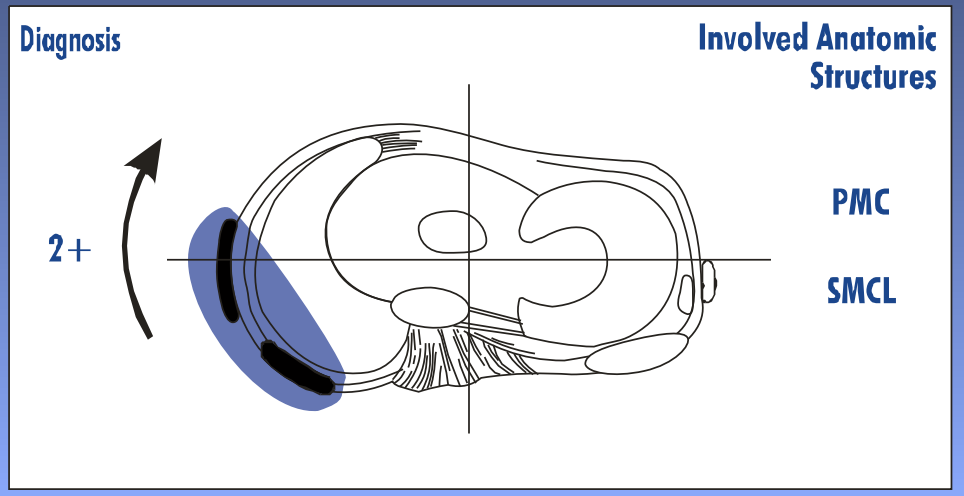
Classification of Knee Instabilities
Rotatory, Straight and Combined

- 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

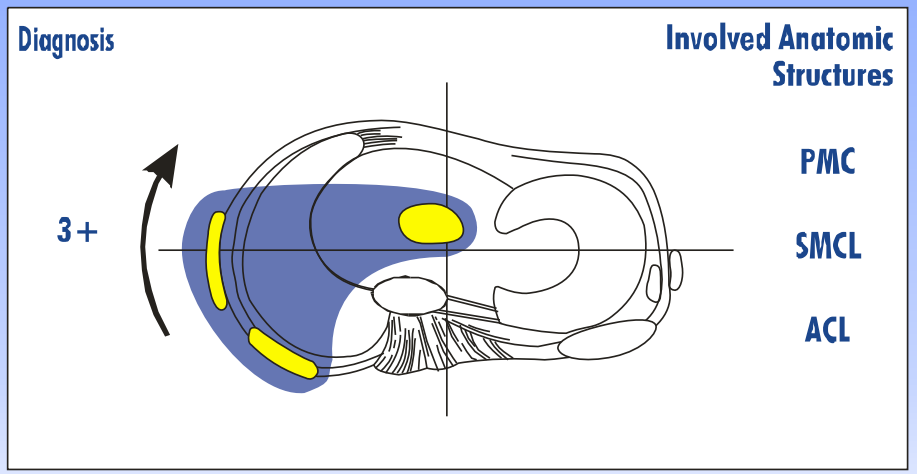
Anterior Instabilities



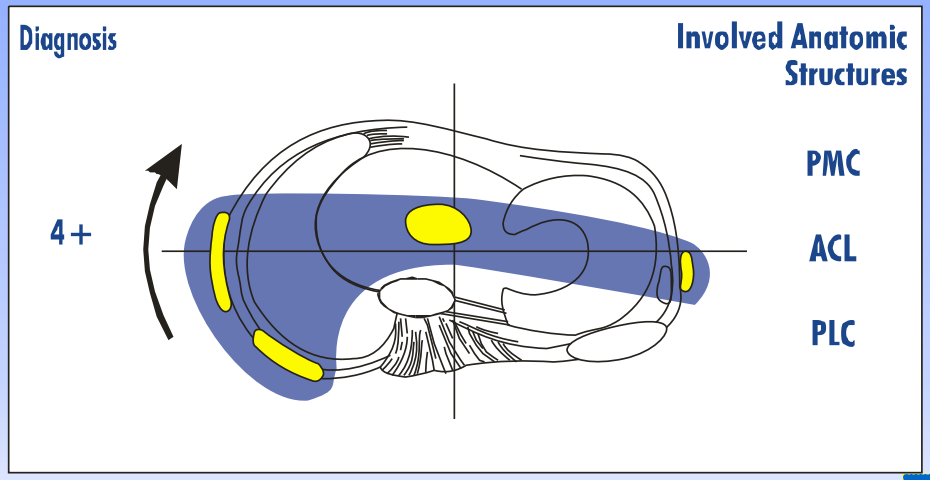
Antero-Medial Rotatory Instabilities (AMRI)



Antero-Medial Rotatory Instabilities (AMRI)



Combined AMRI and ALRI

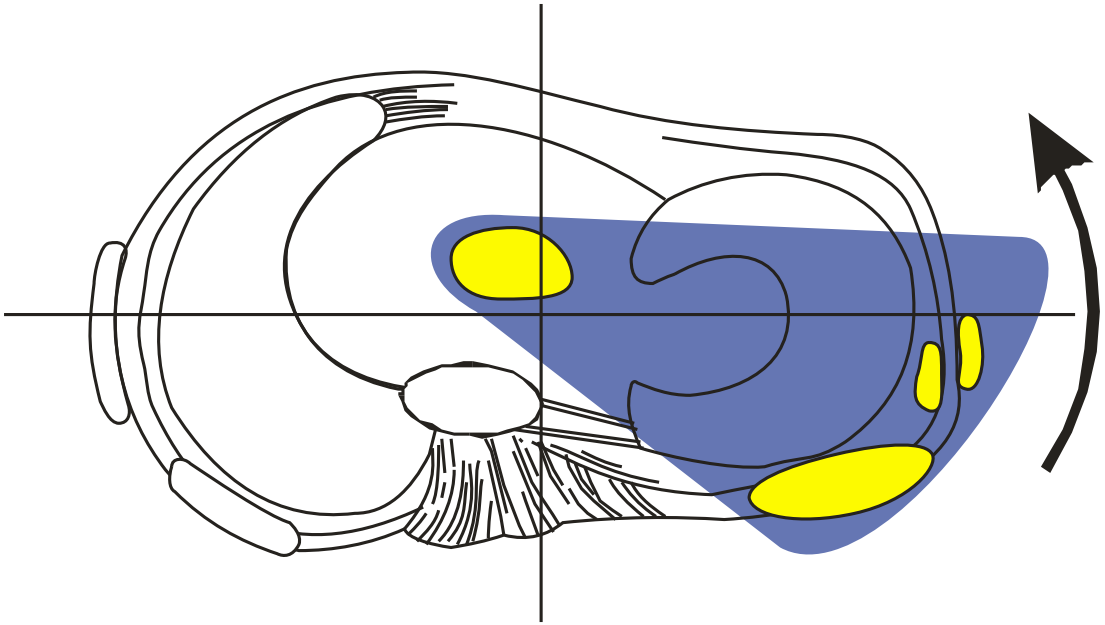


Combined AMRI and ALRI

Diagnosis

Involved Anatomic Structures

2+



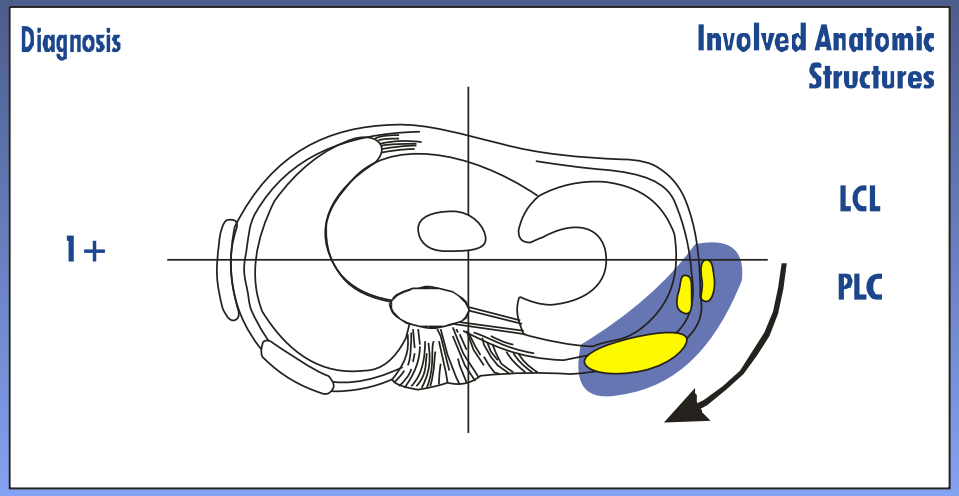
ACL

LCL

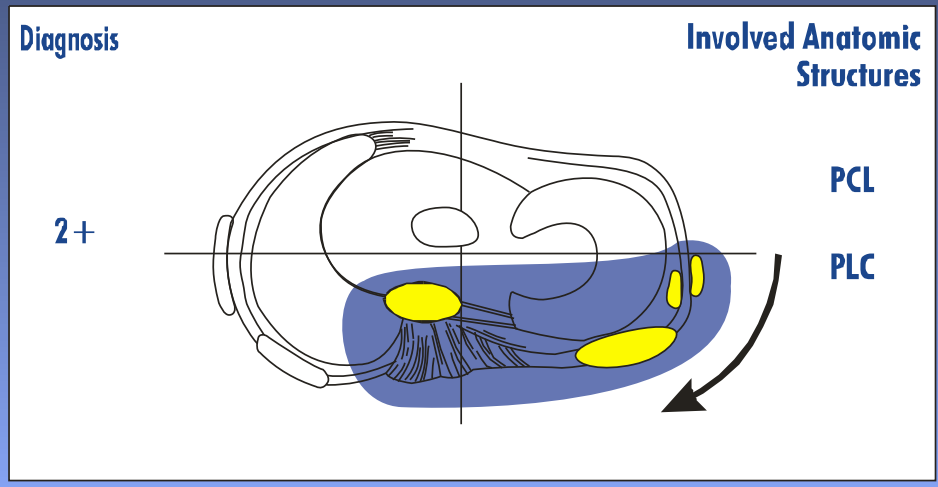
PLC

Antero-Lateral Rotatory Instabilities (ALRI)

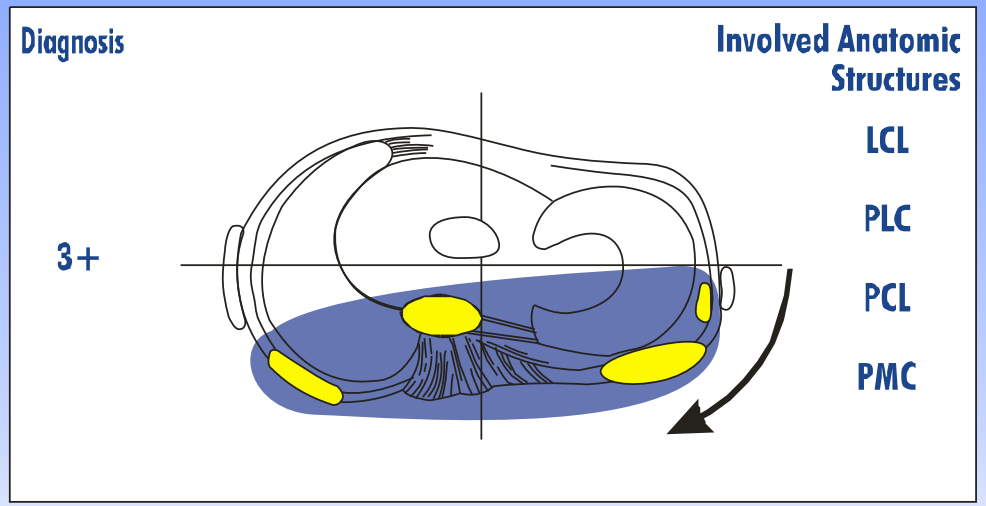
Posterolateral Instabilities



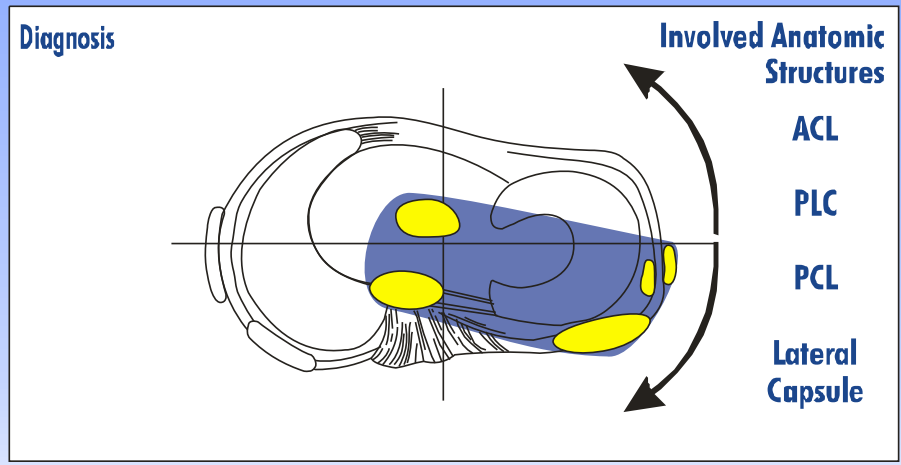
Postero-Lateral Rotatory Instabilities (PLRI)



Postero-Lateral Rotatory Instabilities (PLRI)

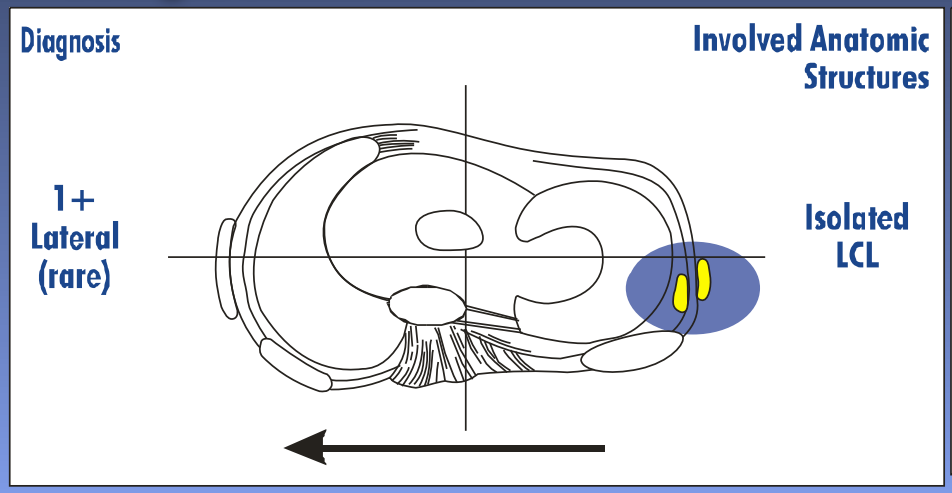


Postero-Lateral Rotatory Instabilities (PLRI)

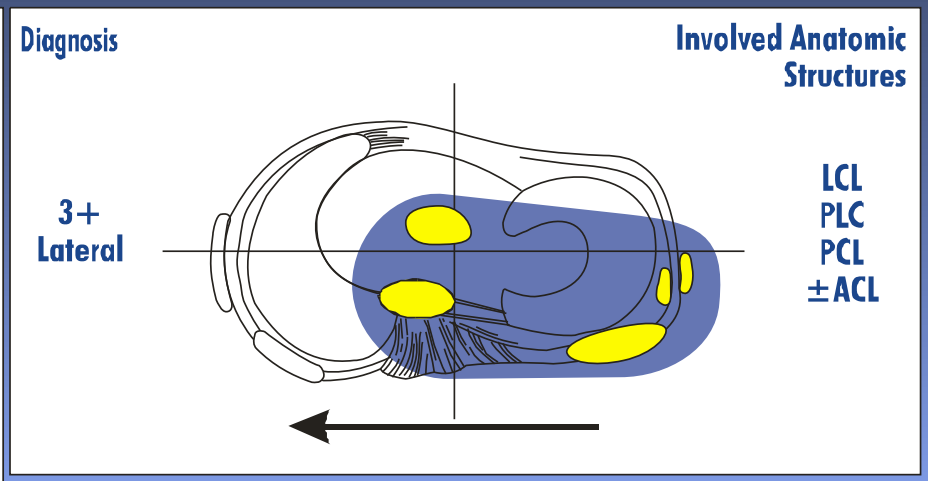


Combined ALRI and PLRI

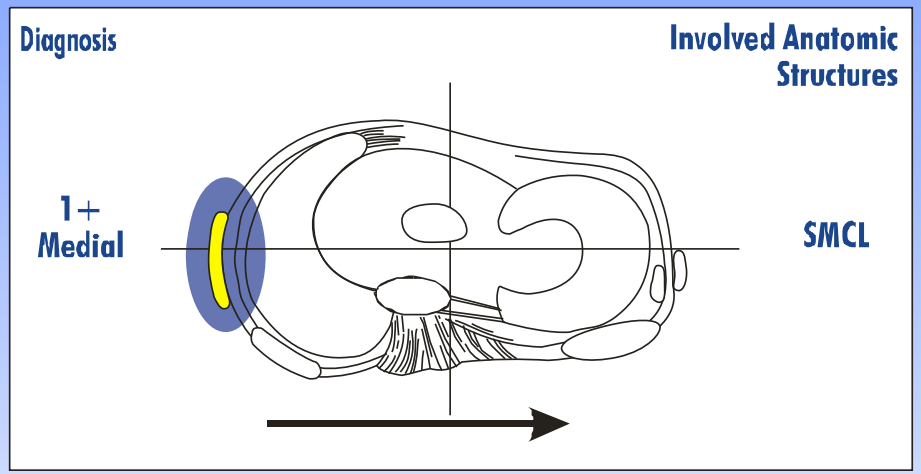
Straight Instabilities



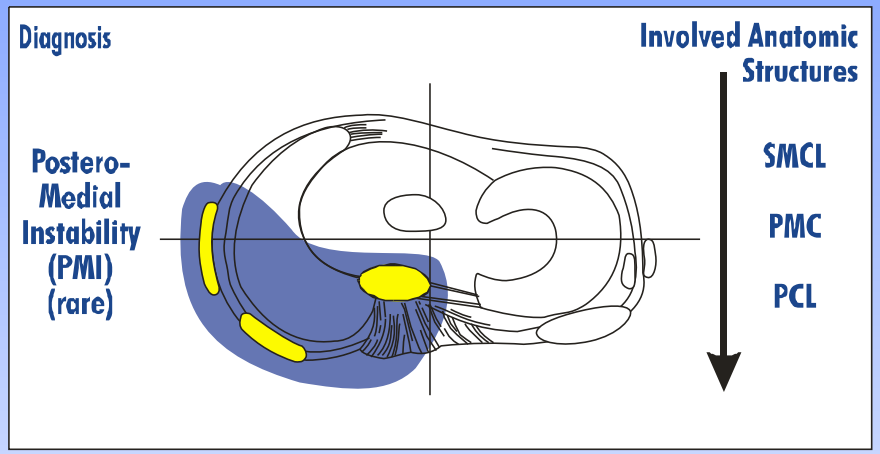
Straight Instabilities



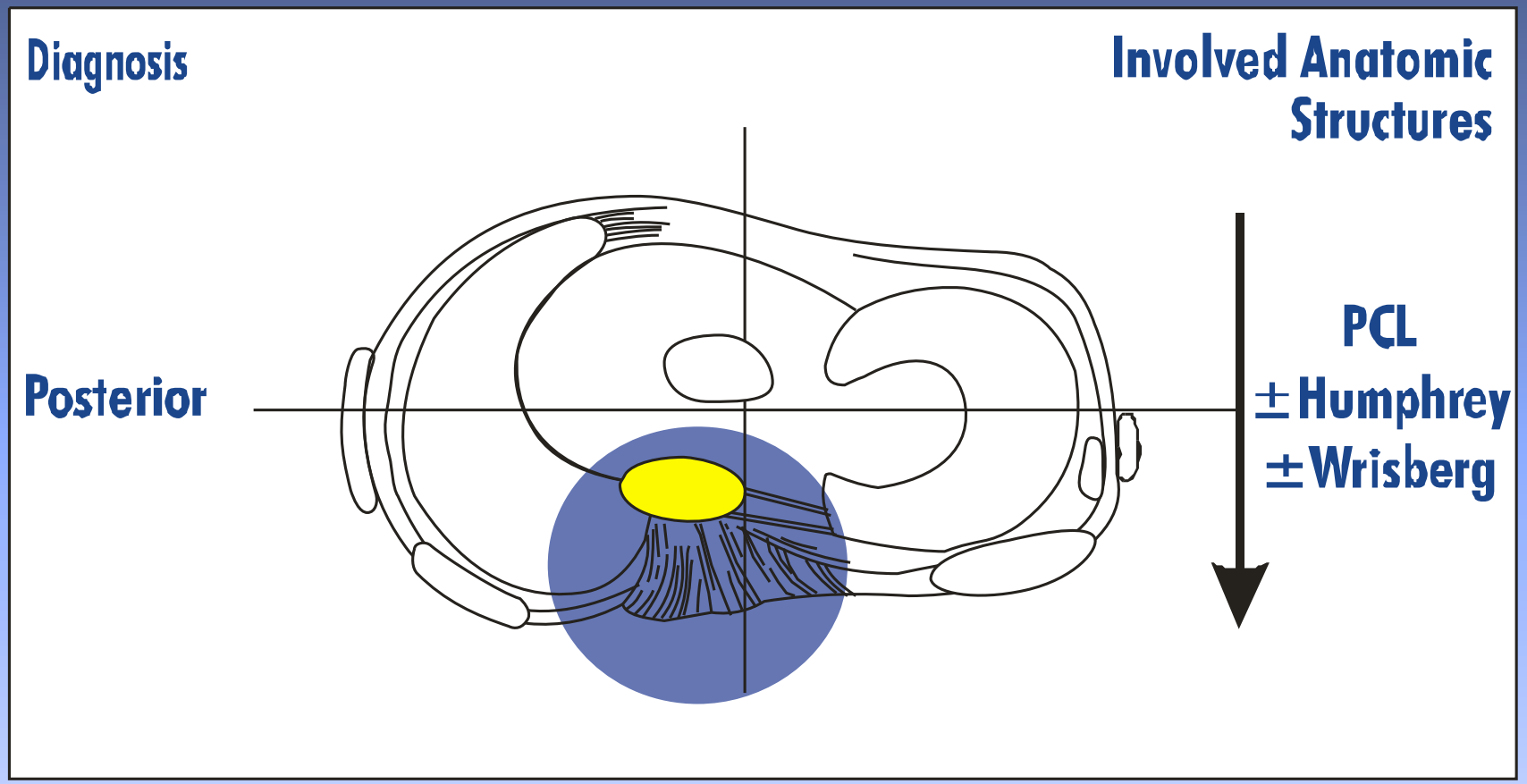
Straight Instabilities



Straight Instabilities



Straight Instabilities



Straight Posterior

Anterior Drawer

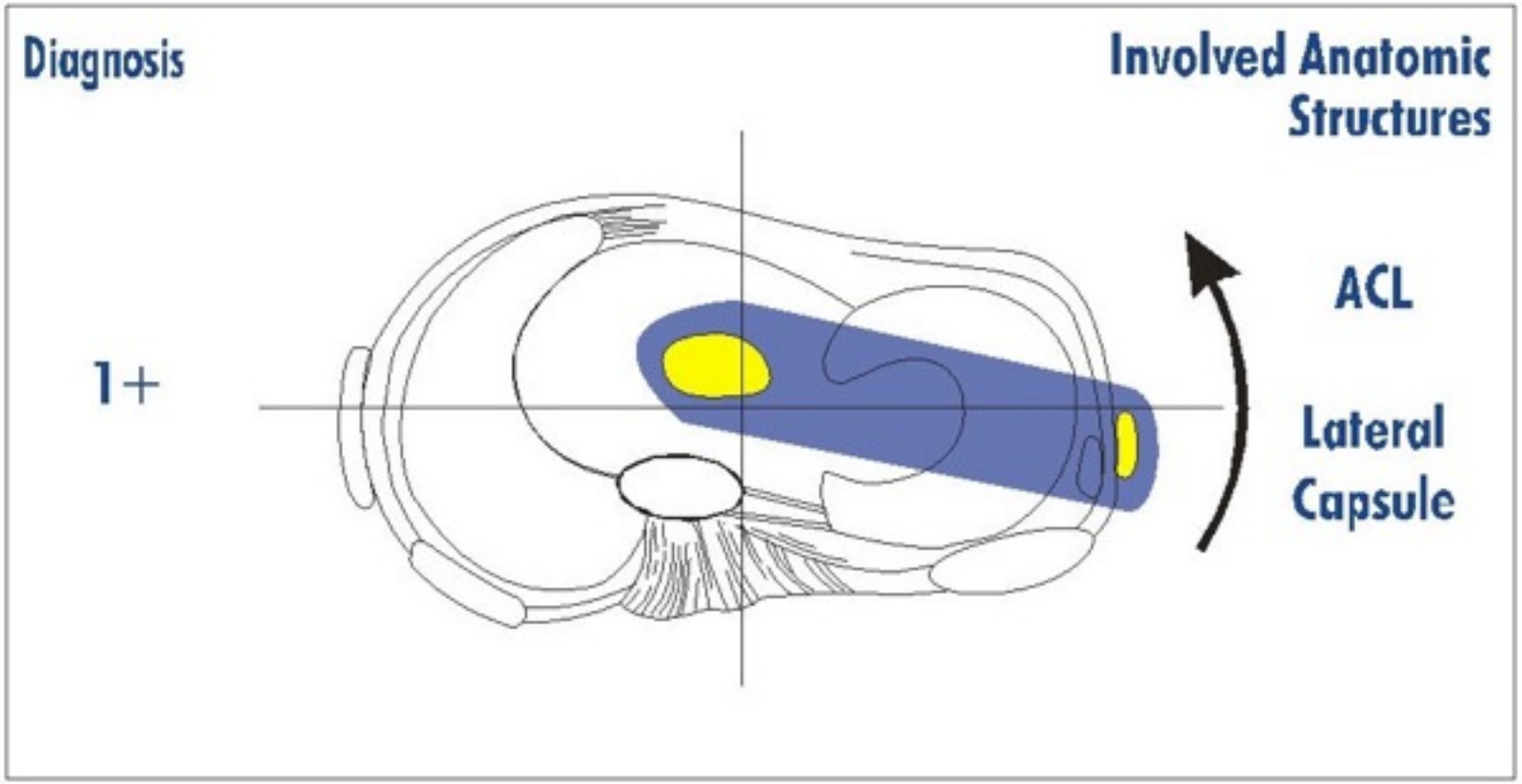




Normal Knee Exam: Ligaments

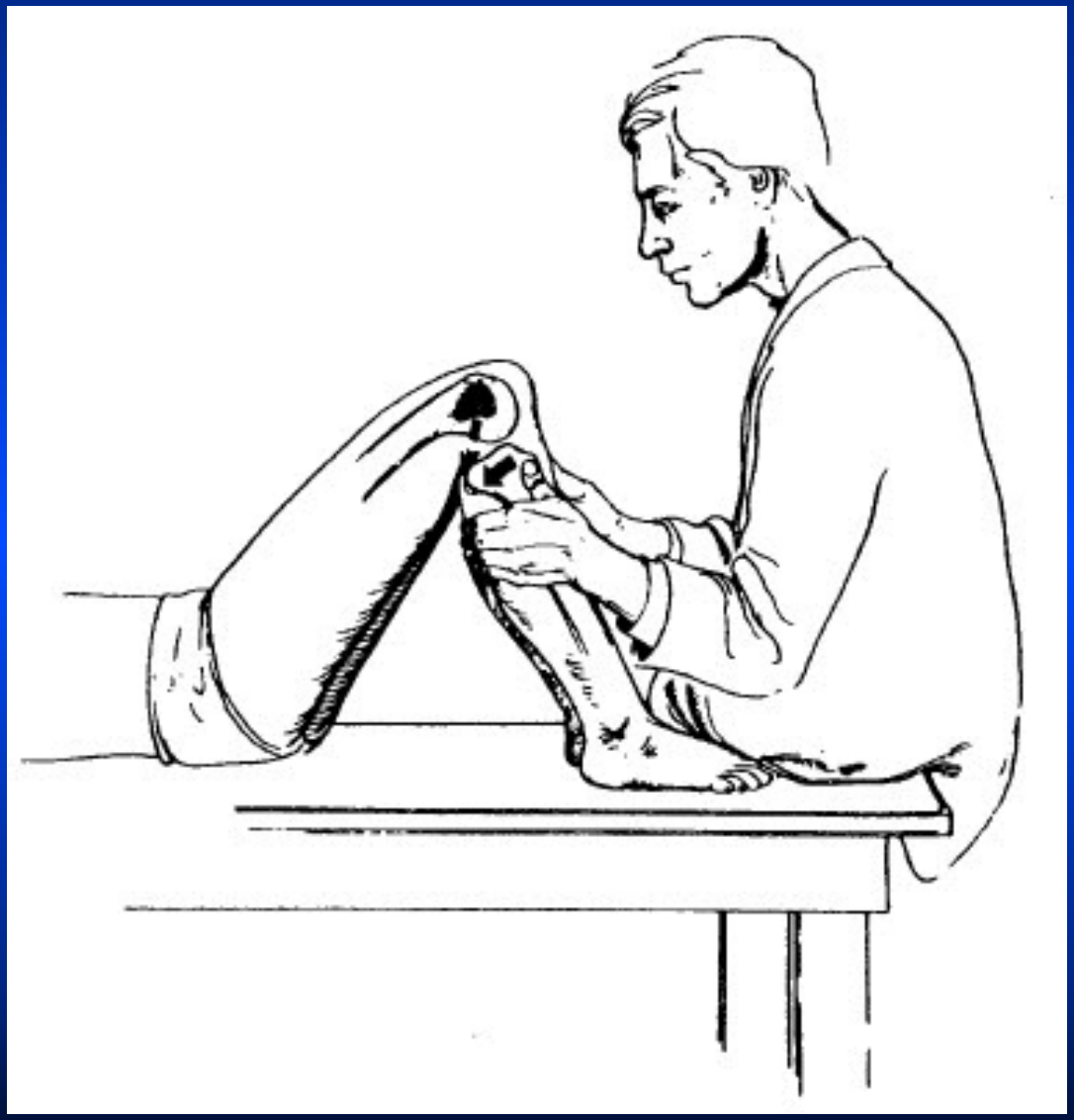


Knee Instability



Antero-Lateral Rotatory Instabilities (ALRI)

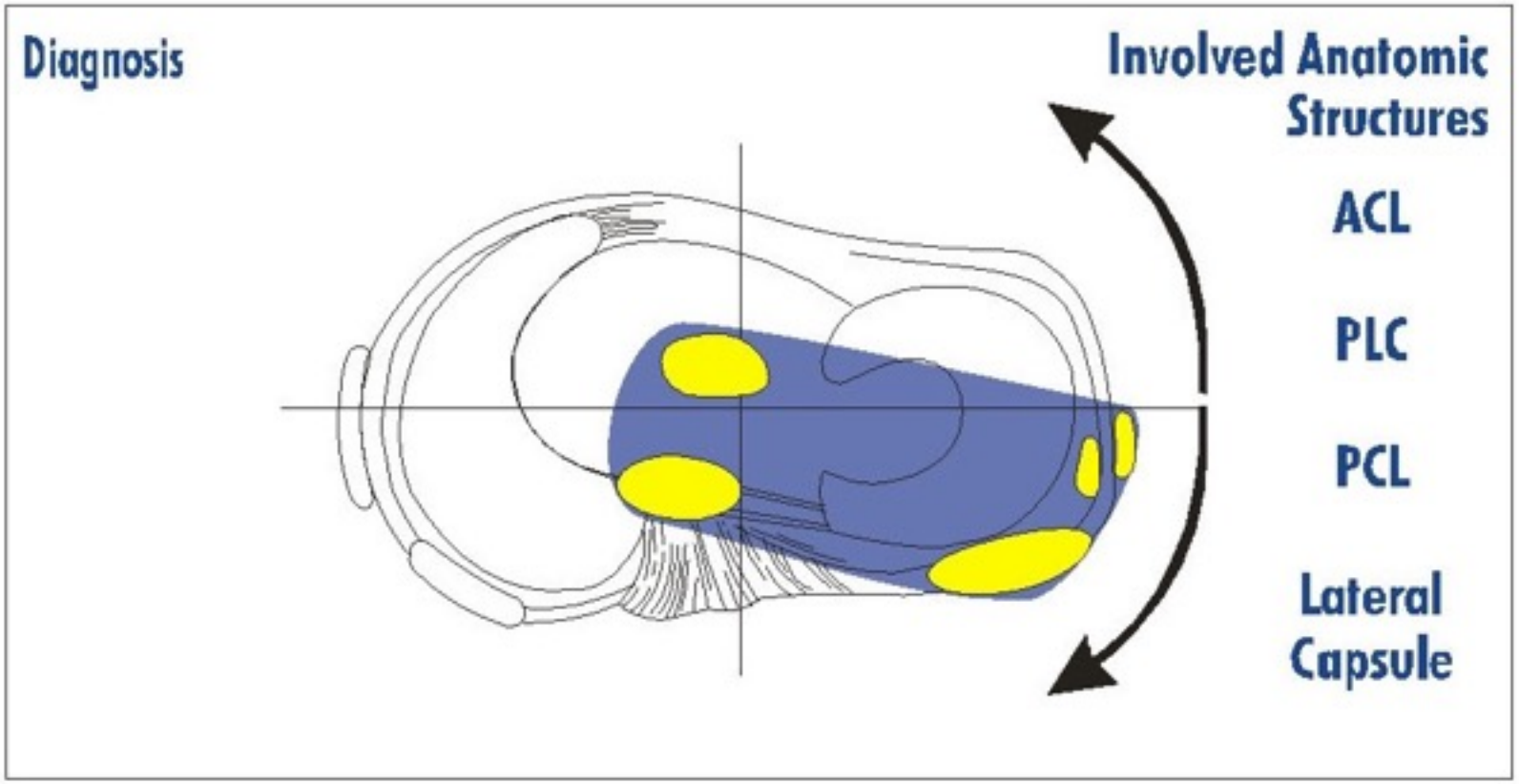
Posterior Drawer



Normal Knee Exam: PCL Exam



Knee Instability



Combined ALRI and PLRI

Normal Knee Exam: Reverse Pivot Shift, ER Recurvatum



Radiographs

- Standing 45º PA, bilateral
- Patellar Views: Merchant or Sunrise Bilateral
- Lateral 45º 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.

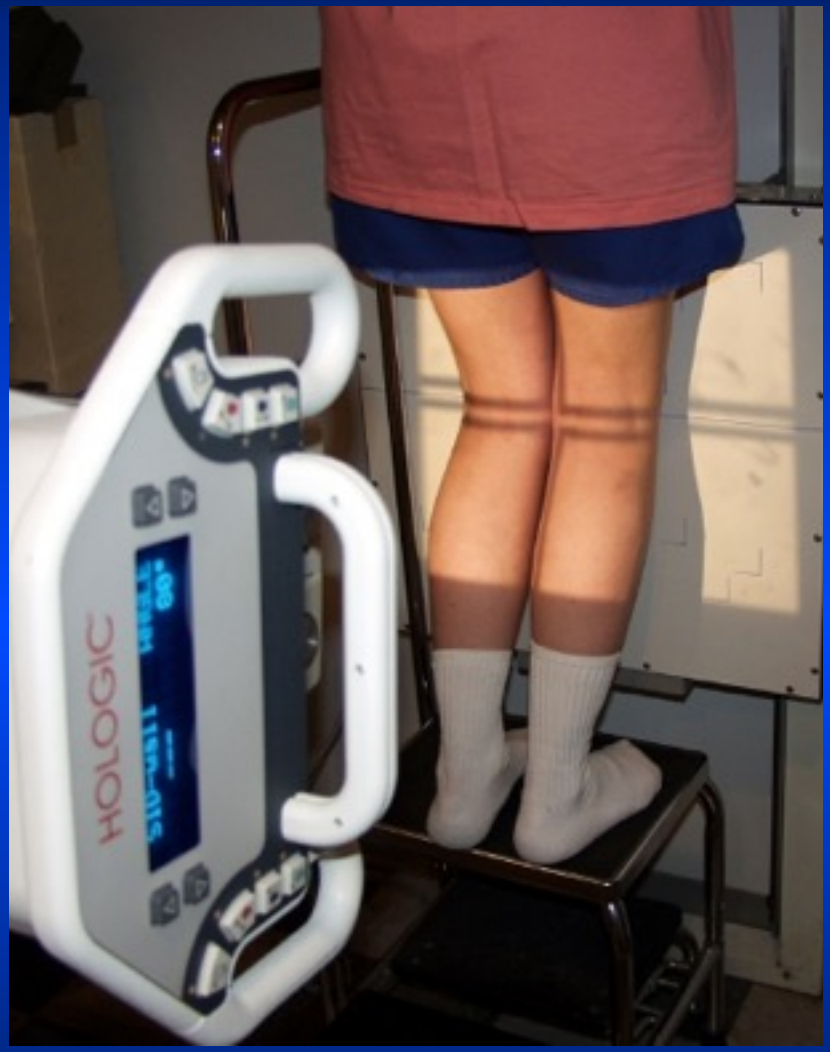
45 Degree Flexed Weight-Bearing PA View is most sensitive for detecting joint space loss

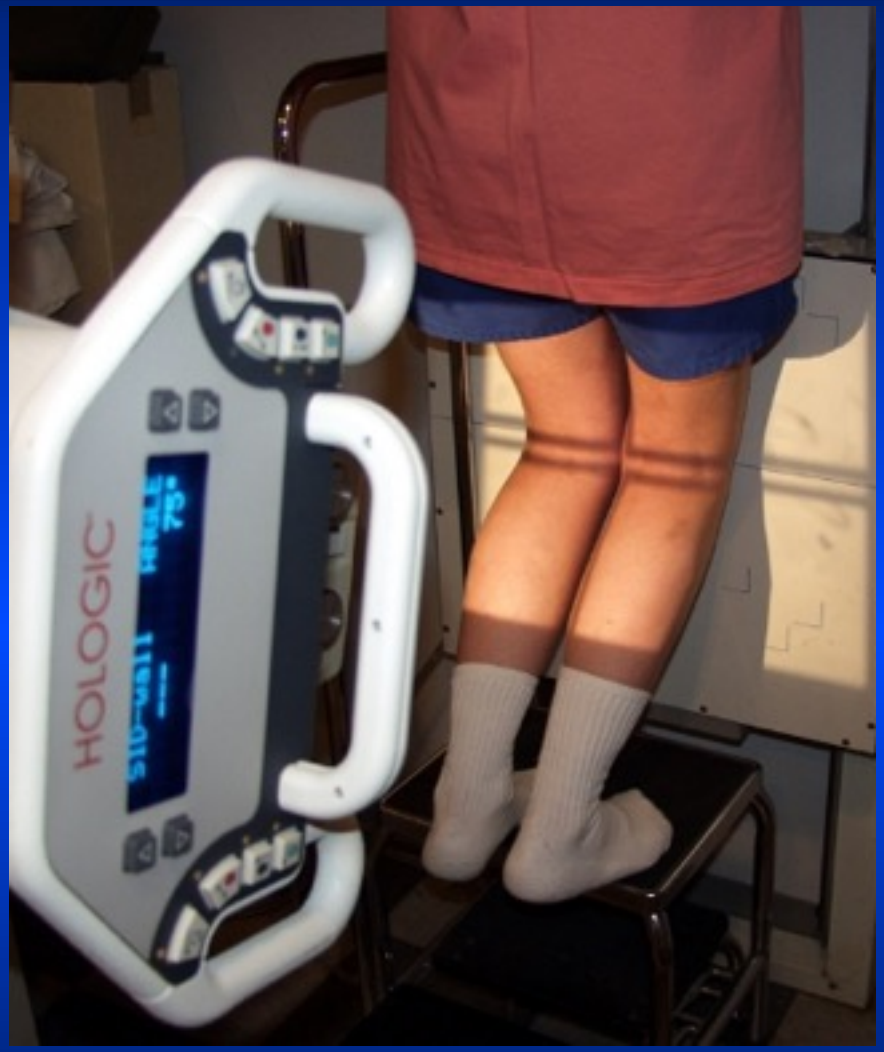
Cole BJ, Harner CD, Degenerative arthritis of the knee in active patients: evaluation and treatment. JAAOS 1999, Nov.-Dec. 7(6):389-402.

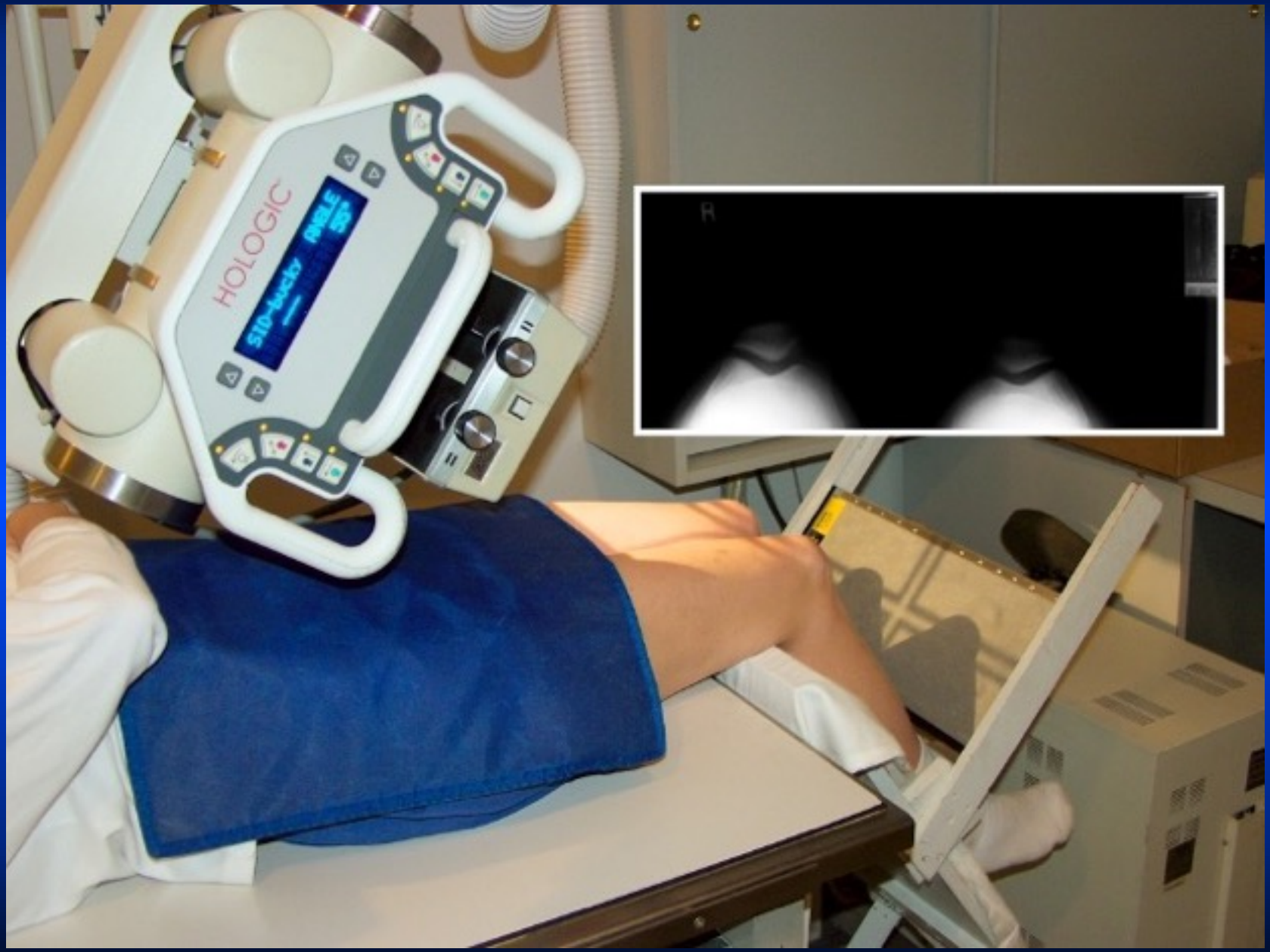
Dervin GF, Feibel RJ, Rody K, Grabowski J., 3-Foot standing AP versus 45 degrees PA radiograph for osteoarthritis of the knee. Clin J Sports Med. 2001 Jan;11(1):10-6.






HOLOGIC


HOLOGIC


HOLOGIC
R


HOLOGIC


HOLOGIC

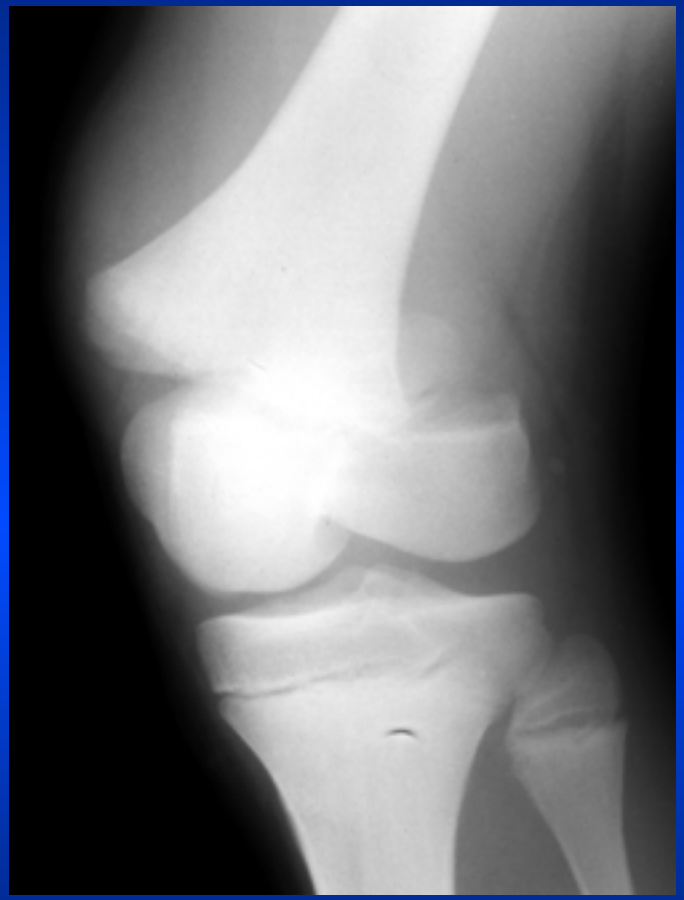
14 YO punter was crushed by defensive line











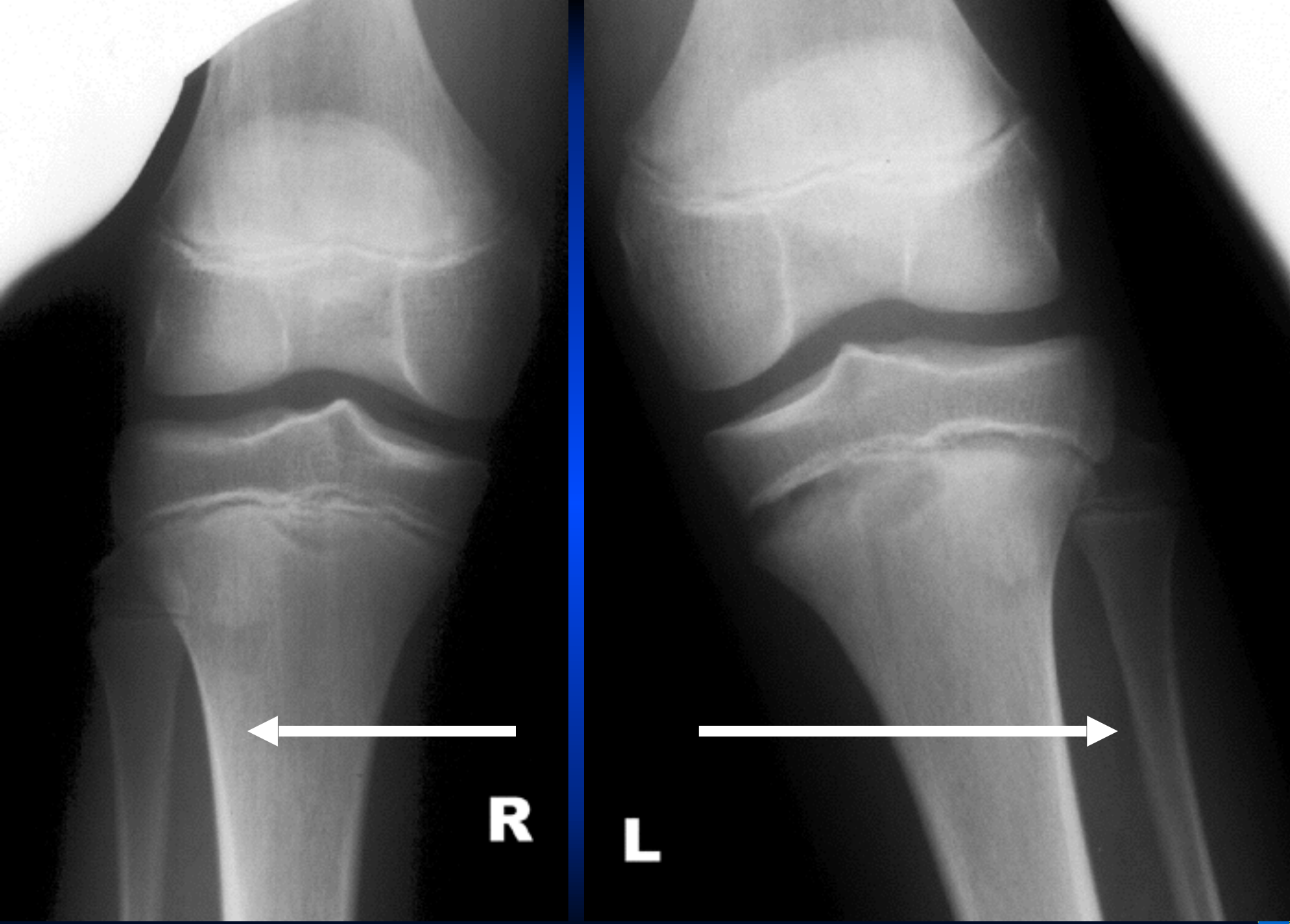




16 YO WM Football Athlete
Struck from Lateral Side of Knee


L

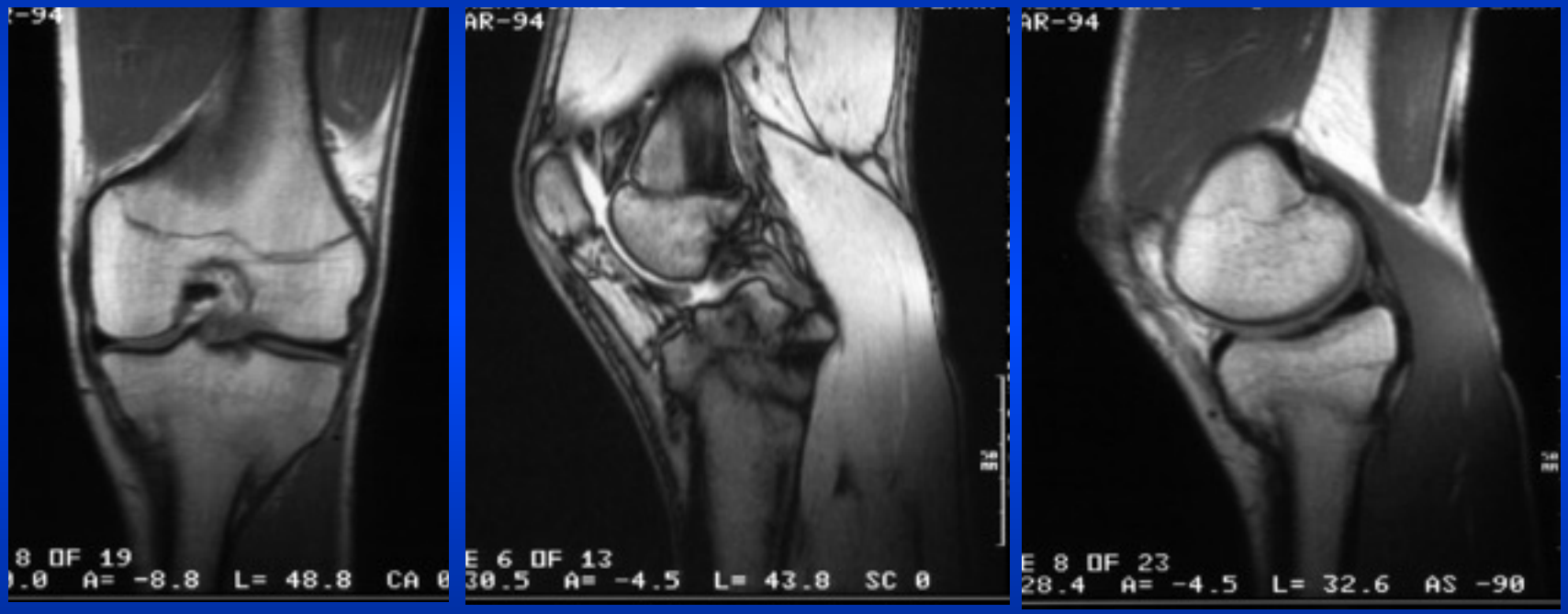

L


R
L

Angular Deformity from 20° Malunion from Proximal tibial growth arrest

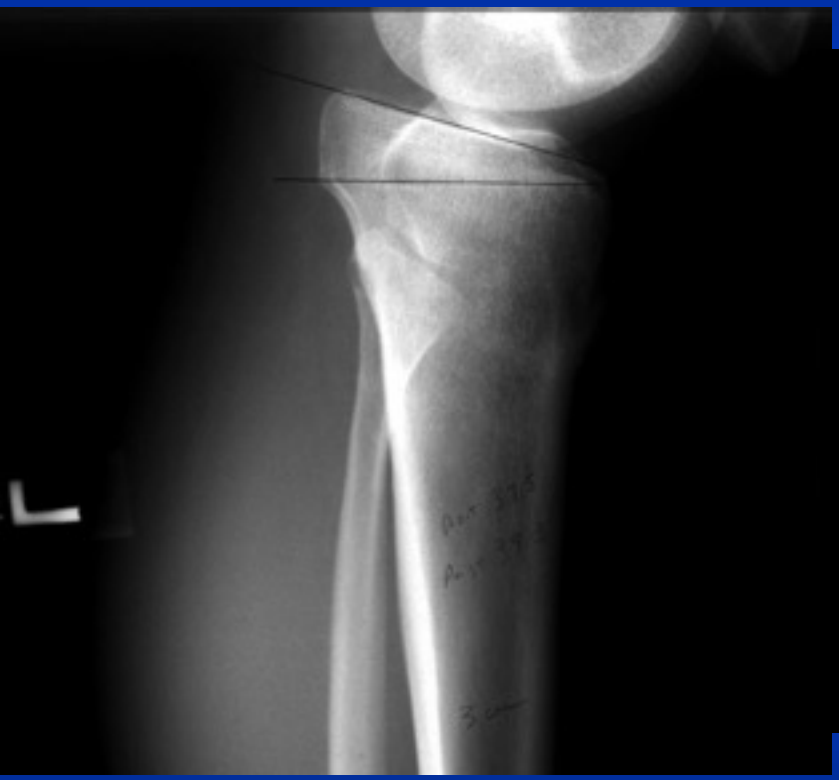


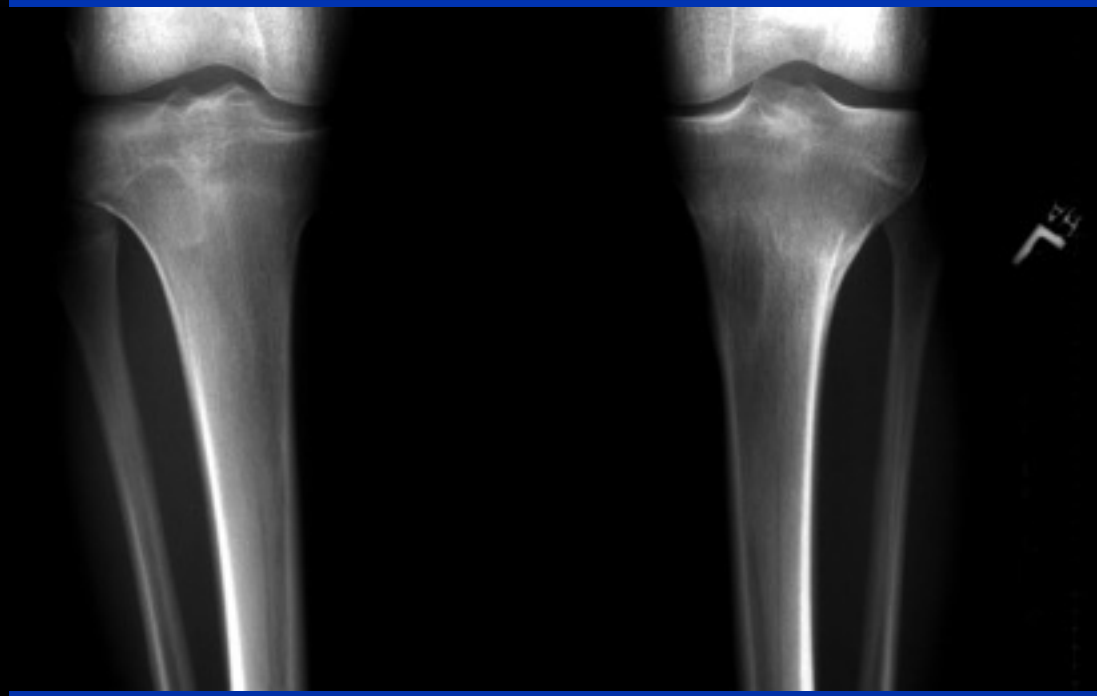
MRI scan at time of initial injury




NORMAL 10° POSTERIOR TILT

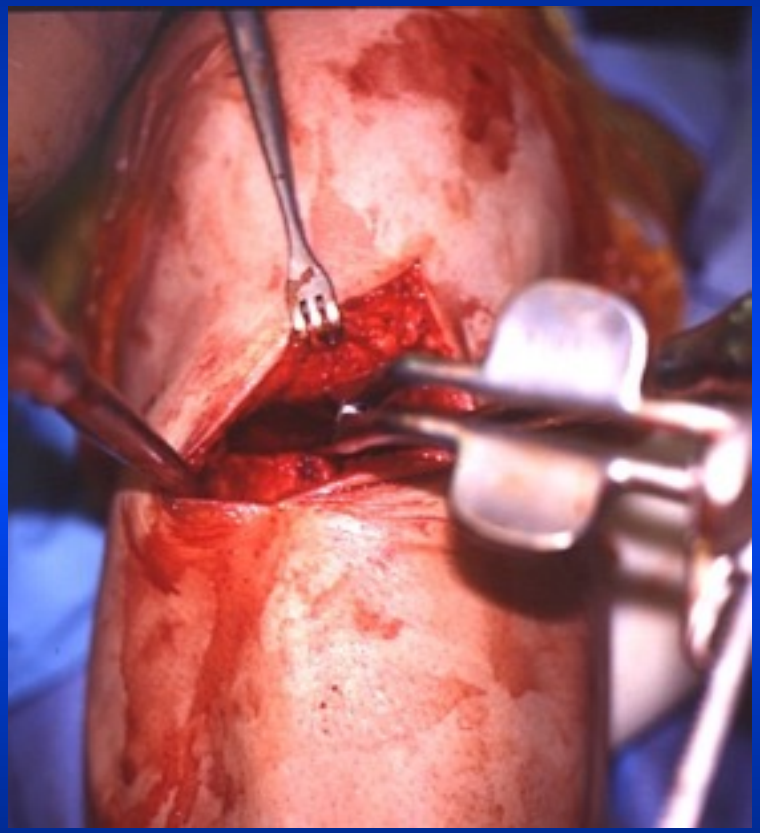

ABNORMAL 10° ANTERIOR TILT
Changed by 20°







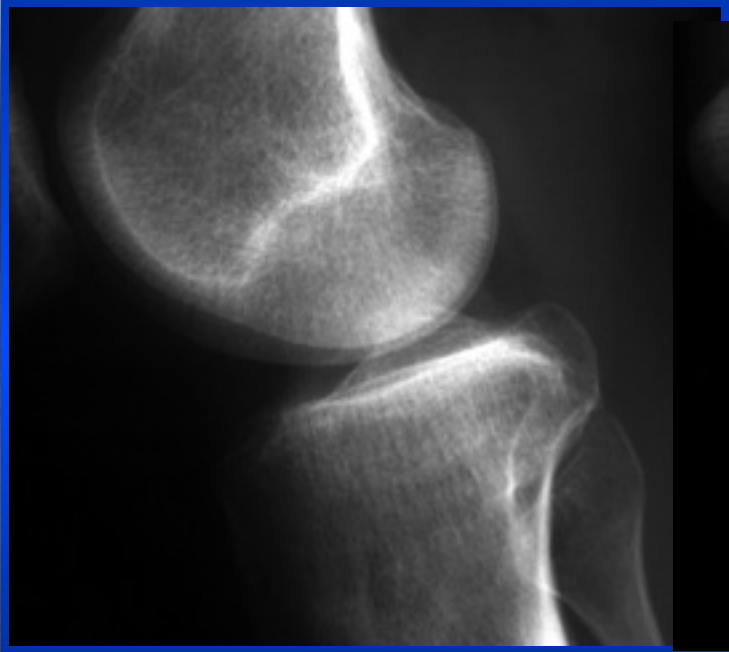
Anterior opening wedge osteotomy





Post op:
~ 1 week **22 weeks** **28 weeks**





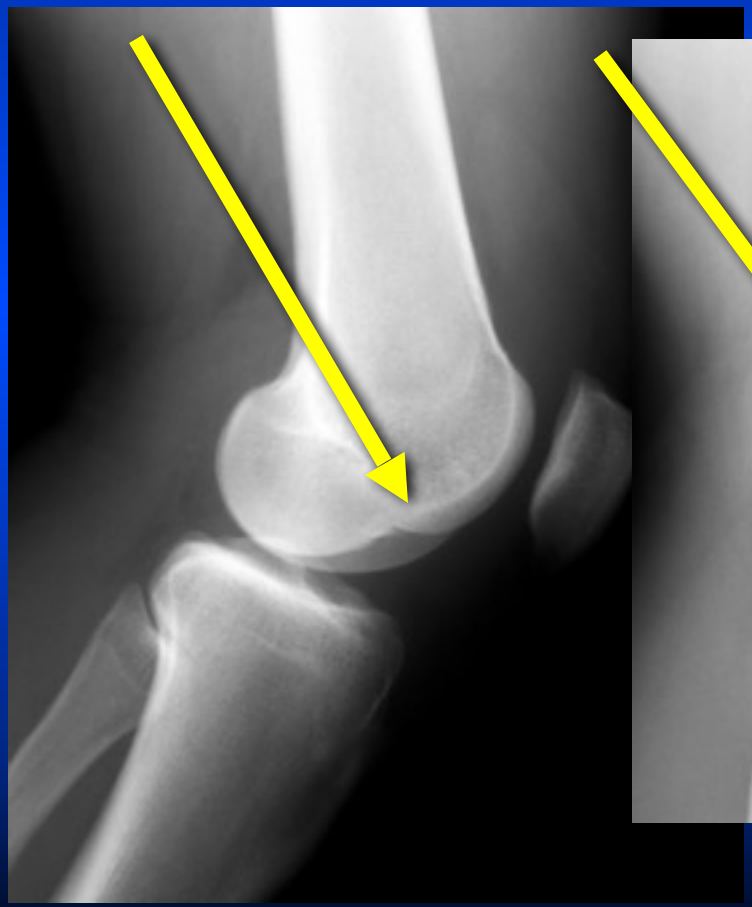


19 YO Female

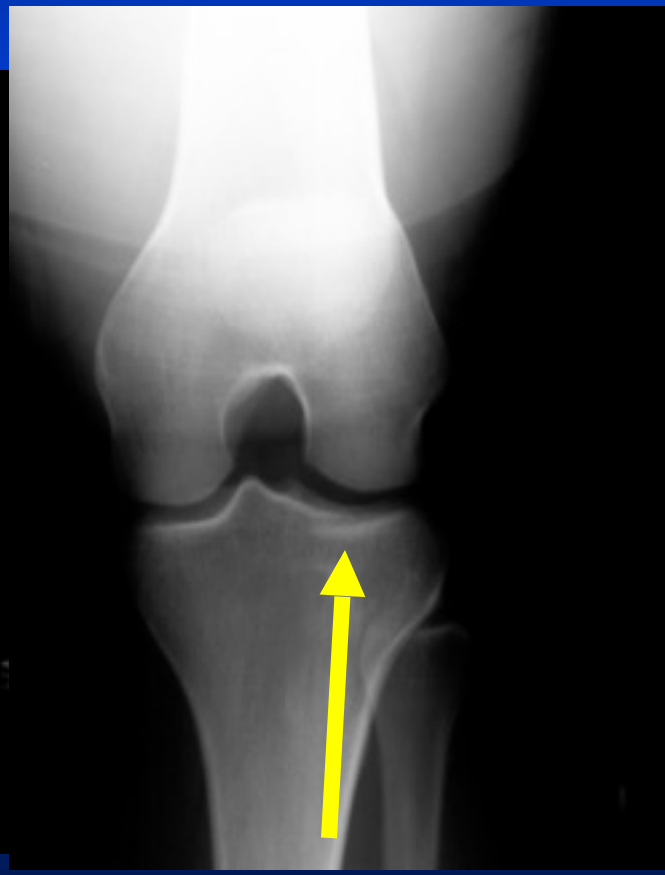
- Collegiate basketball athlete
- Landed awkwardly in a game
- PE: ACL Tear, Left knee

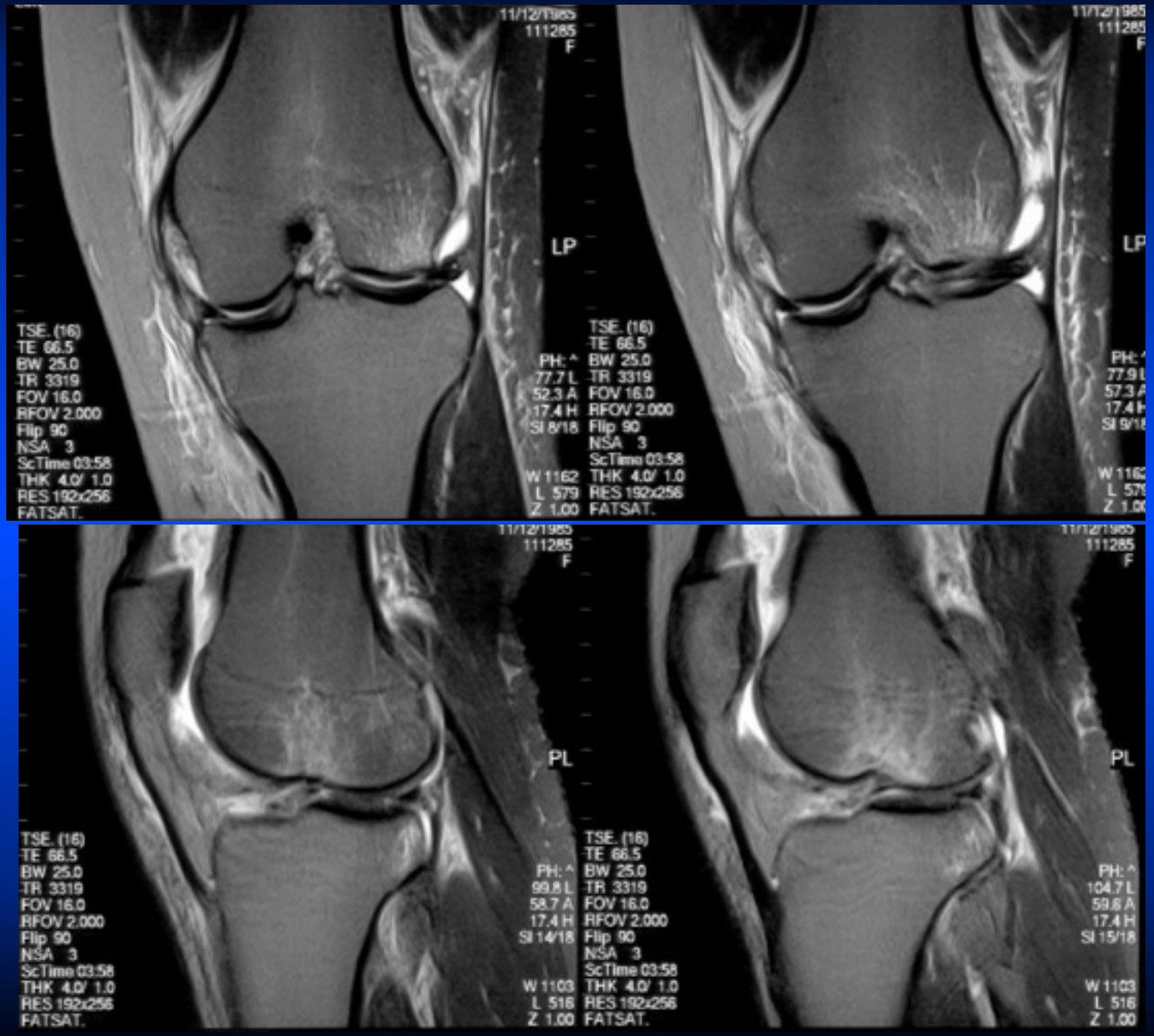


Suspected osteochondral fracture LFC, possible anterior aspect LTP fracture

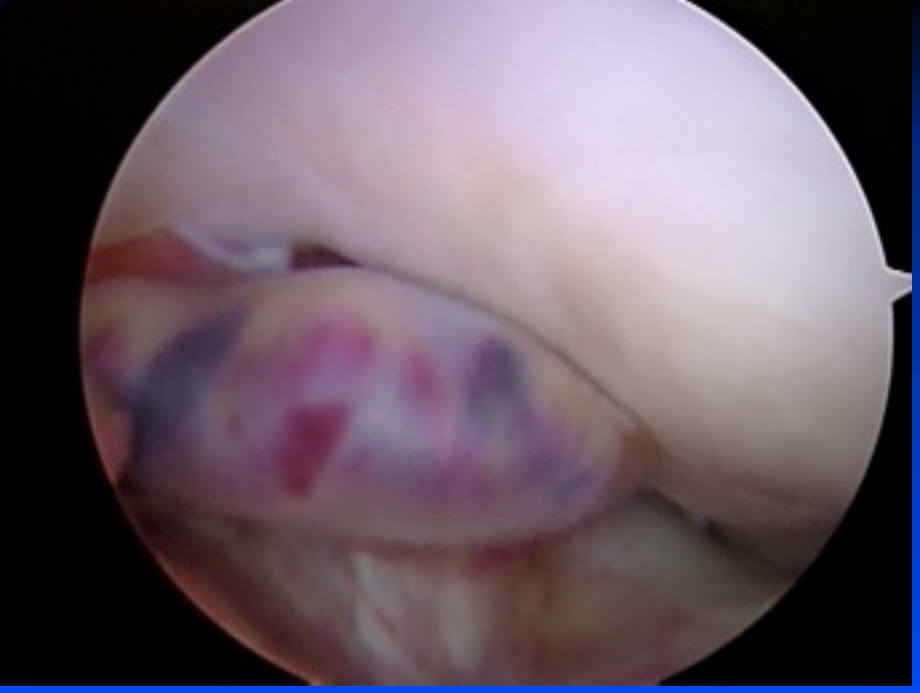







111285
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RFOV 2.000
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ScTime 03:58
THK 4.0/ 1.0
RES 192x256
FATSAT.
PH: ^
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52.3 A
17.4 H
SI 8/18
W 1162
L 579
Z 1.00
PL
PH: ^
99.8 L
58.7 A
17.4 H
SI 14/18
W 1103
L 516
PH: ^
104.7 L
59.6 A
17.4 H
SI 15/18


11/12/1985
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THK 4.0/ 1.0
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Left
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Philips Infinion 1.5T
PROFESSIONAL MRI





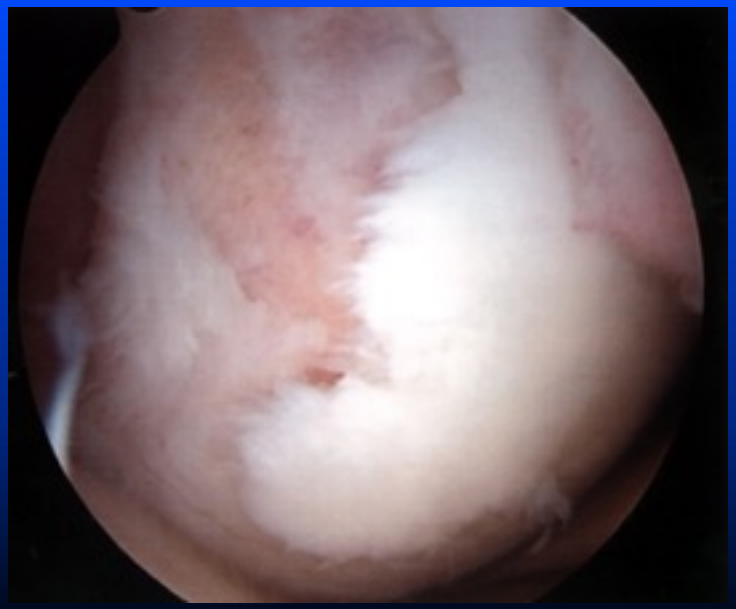

42 YO Male: ACL Tear

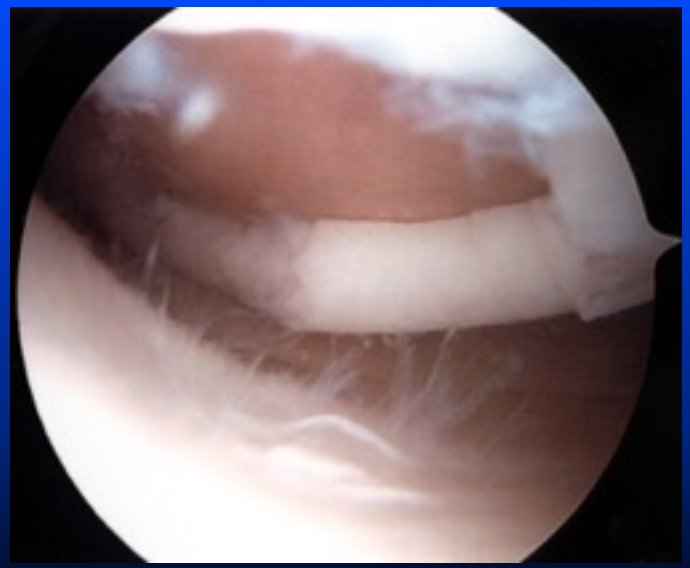
- Injured playing soccer
- Beware articular surface injuries

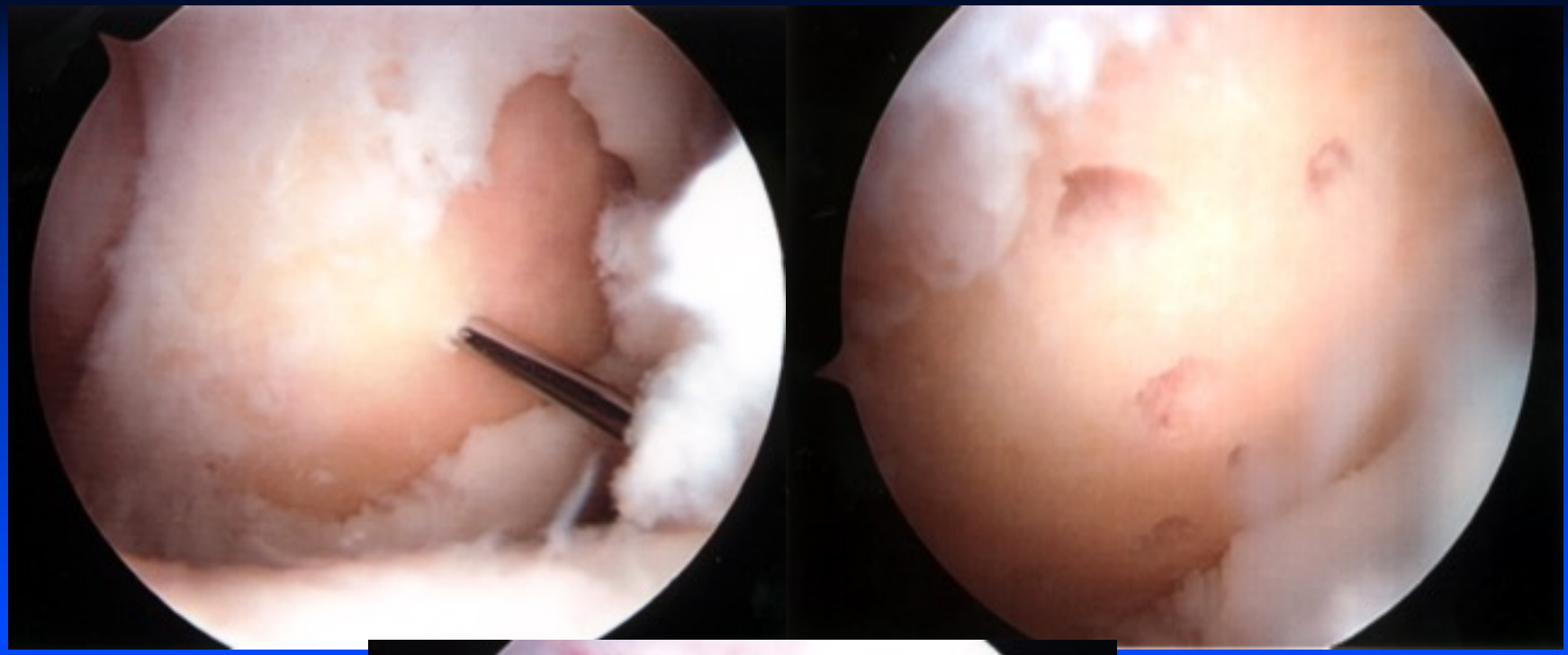



Sc 7
TSE/M
SL 4
H
P
5 cm
RL –82 right
Sc 7
TSE/M
SL 3
H
P
5 cm
RL –79 right


Sc 6
IR-TSE/M
SL 12
H
L
5 cm
Sc 6
IR-TSE/M
SL 11
H
L
5 cm







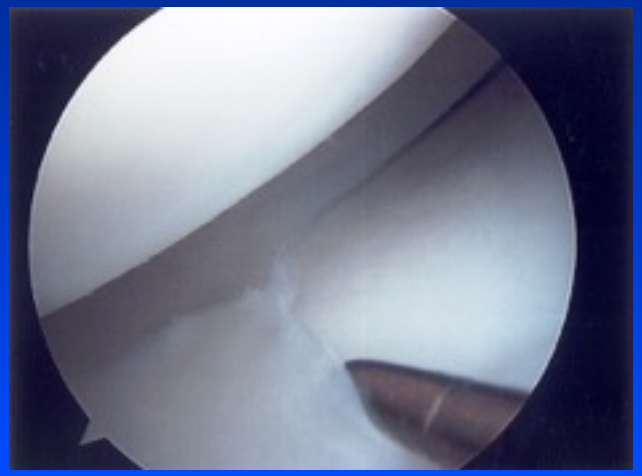
Technetium Bone Scan LE

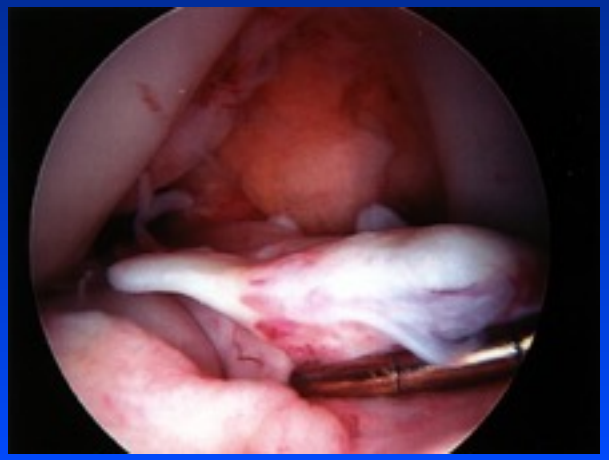
- Informative for MD + Patient



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 ≠ 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.

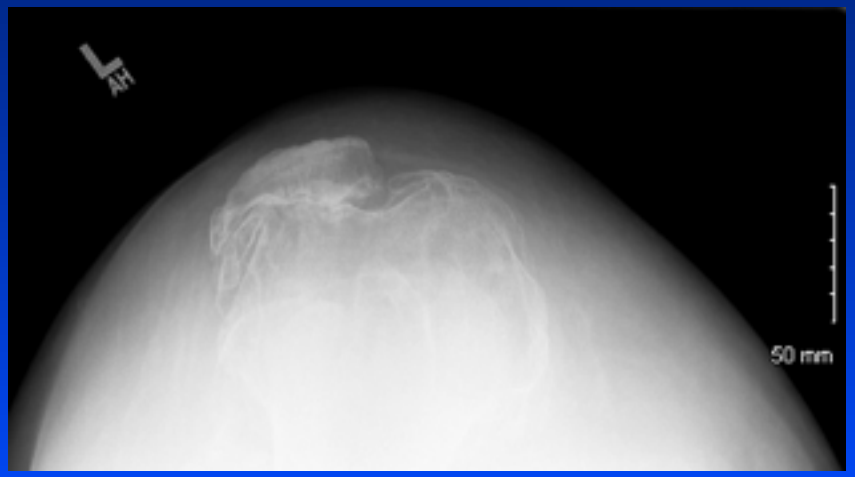
- Discussion by **Dr. Don H. O'Donoghue**, Oklahoma City, Oklahoma
  - I think the authors are to be congratulated on their efforts to obtain a valid series. As I have indicated, it is extremely difficult to get an uncontaminated series. Probably a study should be initiated, not after operation but before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

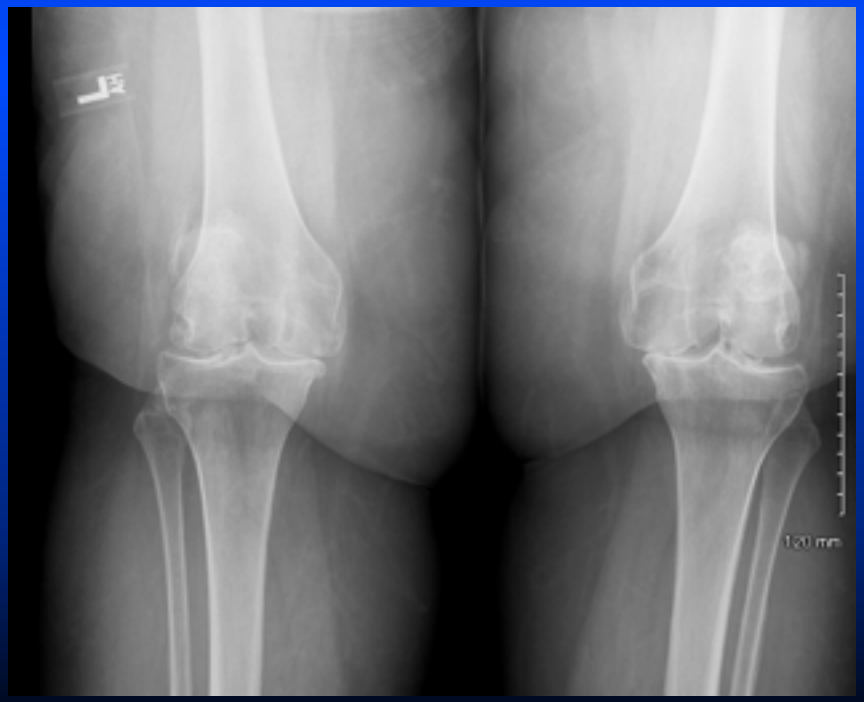
History & PE

- 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



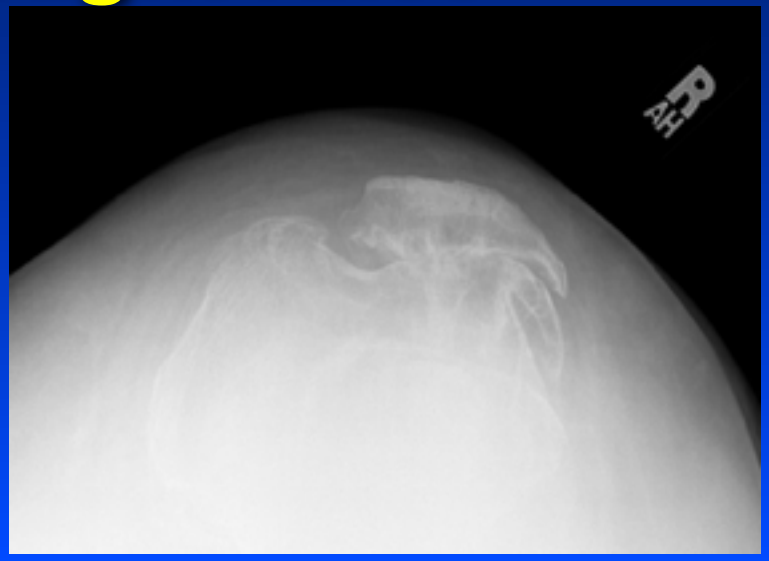
Left Knee

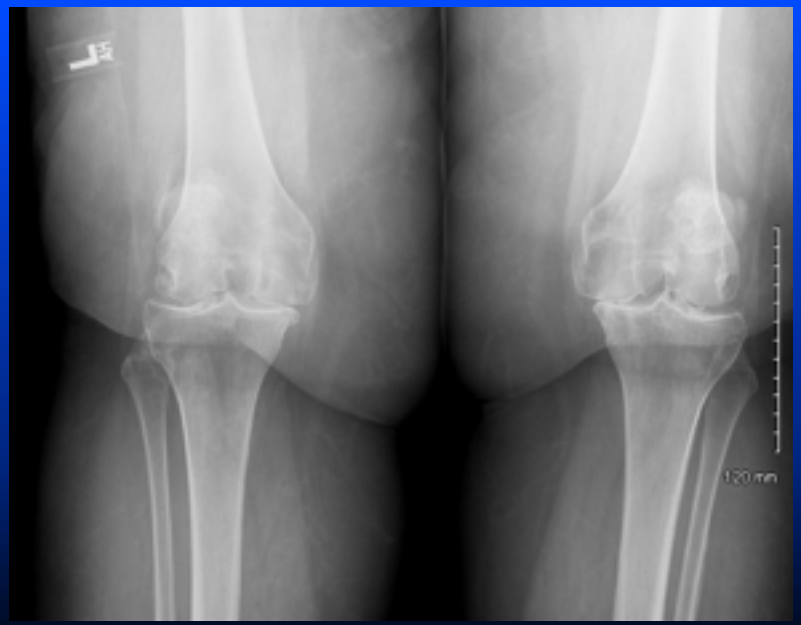






Right Knee

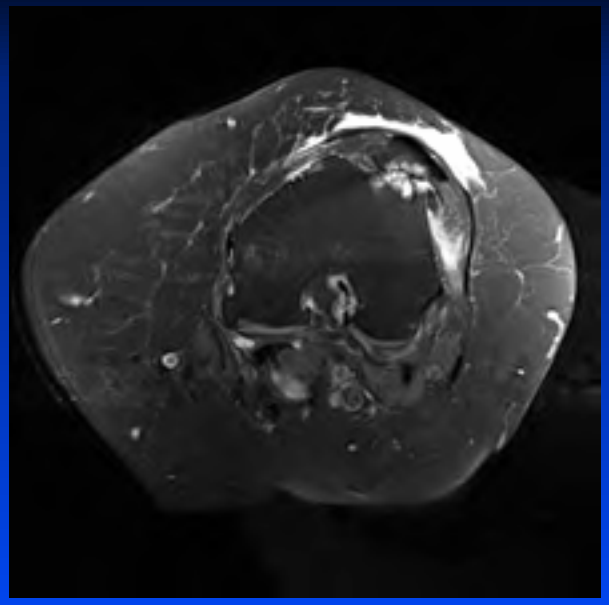


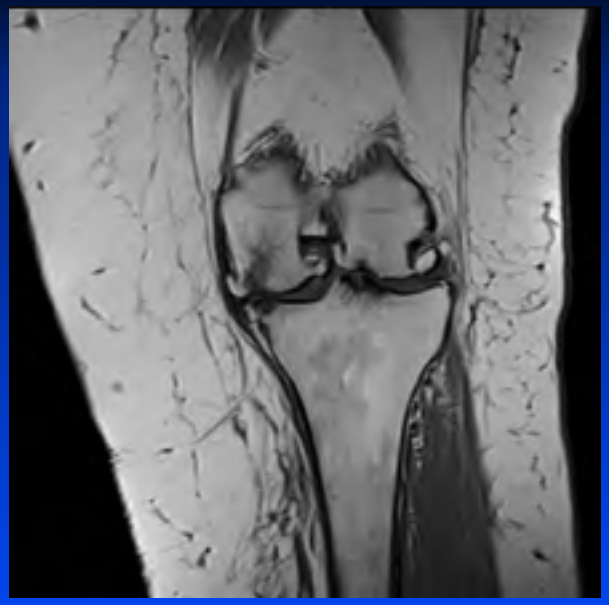


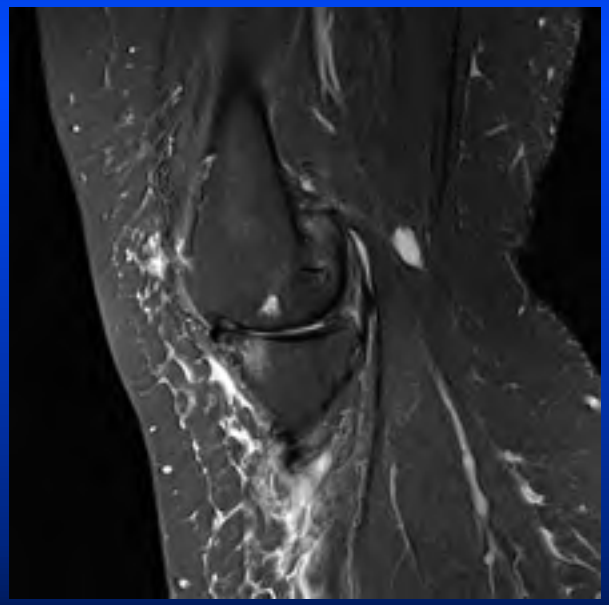


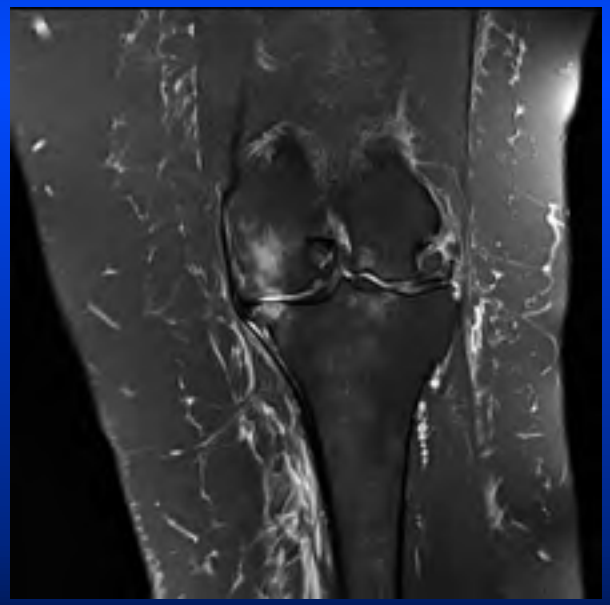
What test would you do next?

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"

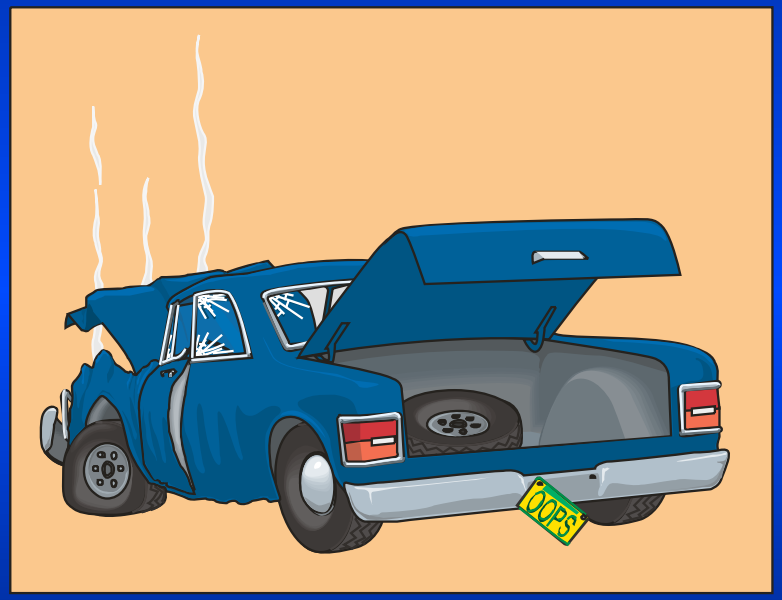
Scott Dye. The Knee as a Biologic Transmission with an Envelope of Function. *Clin Orthop Rel Res* 1996;325:(April): 10-18.

Envelope of Knee Function

- Factors:
  - Anatomy
  - Kinetics
  - Physiology
  - Treatment

The Knee as a Biologic Transmission with an Envelope of Function



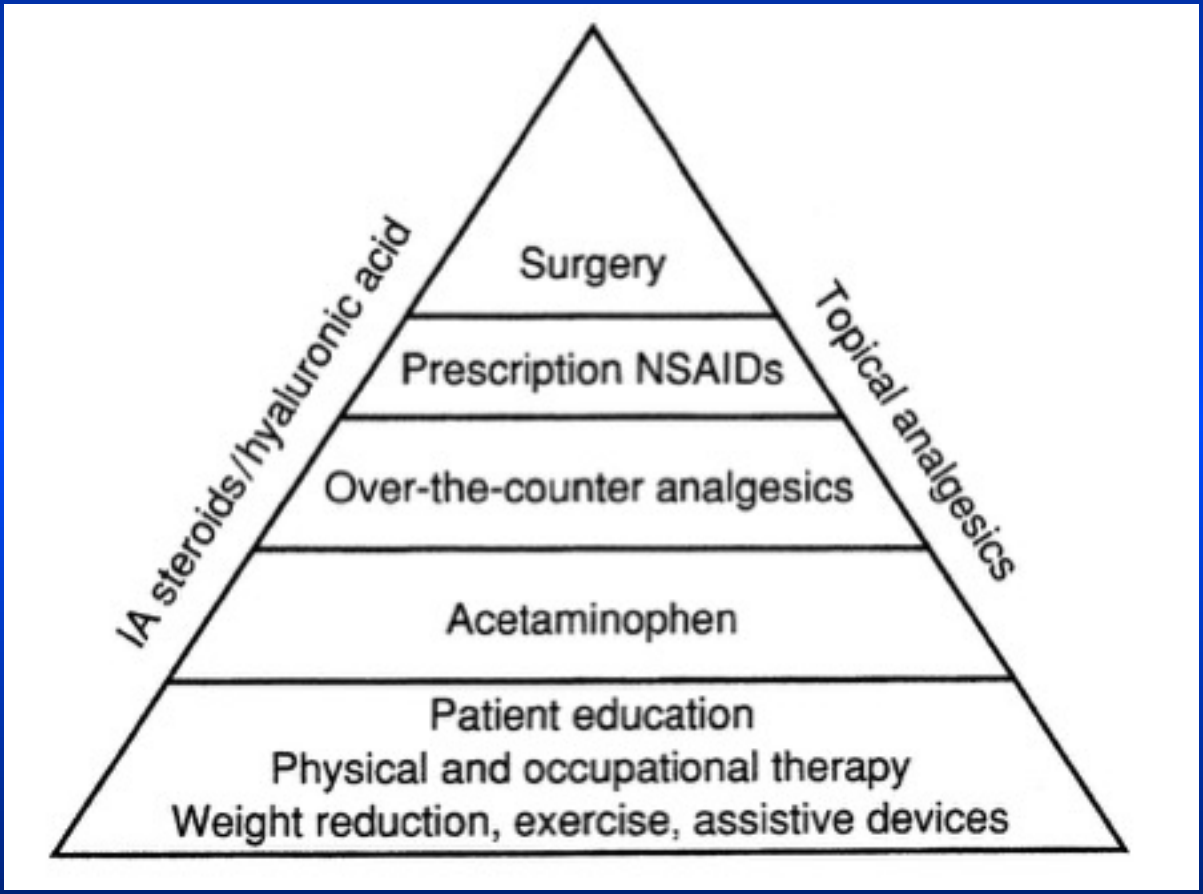


A Knee Injury is like a car wreck

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



Creamer P and Hochberg MC, "Osteoarthritis" (Seminar).
Lancet 1997;350:503-509.

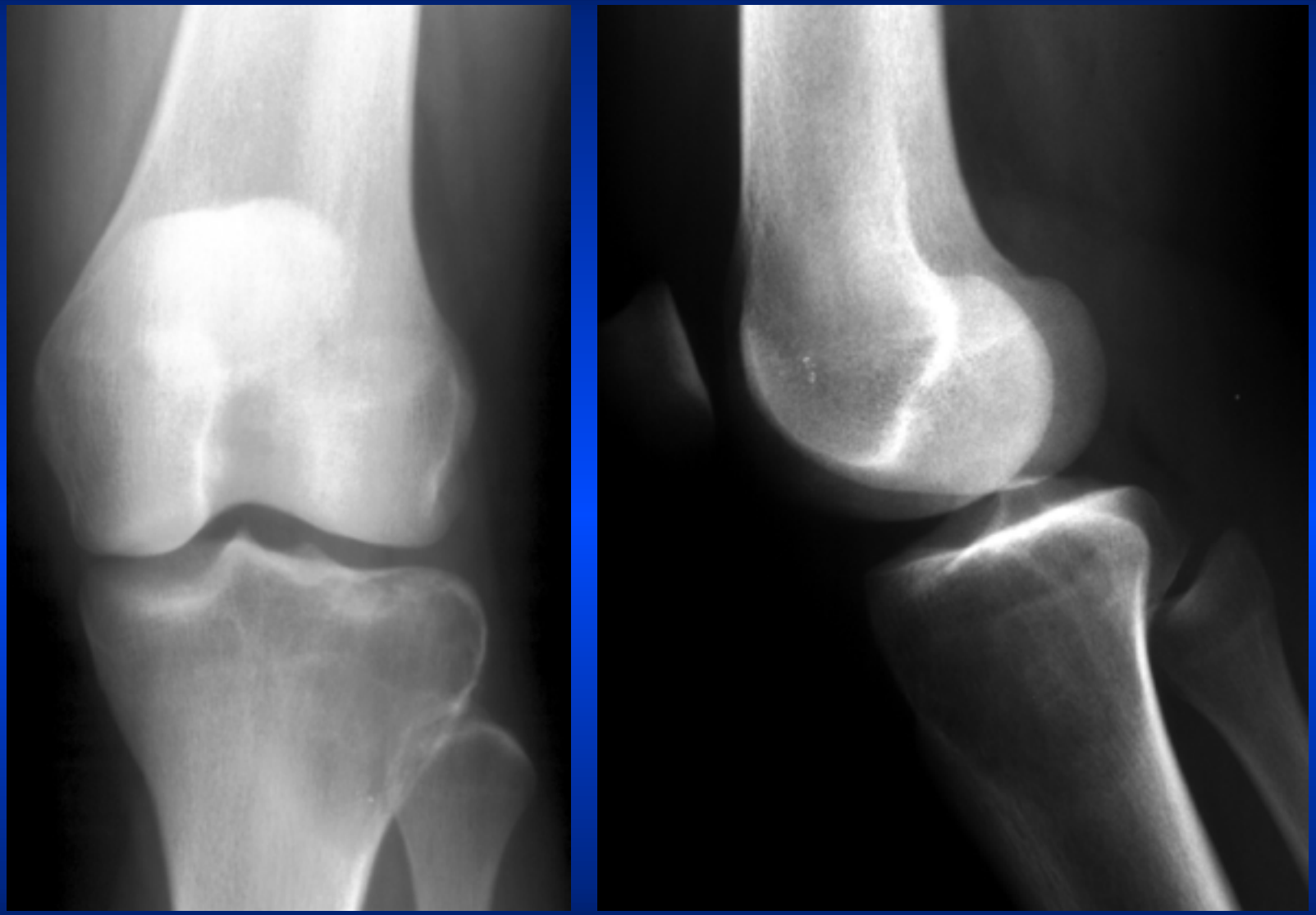
You May Not Have Seen It, But It Has Seen You





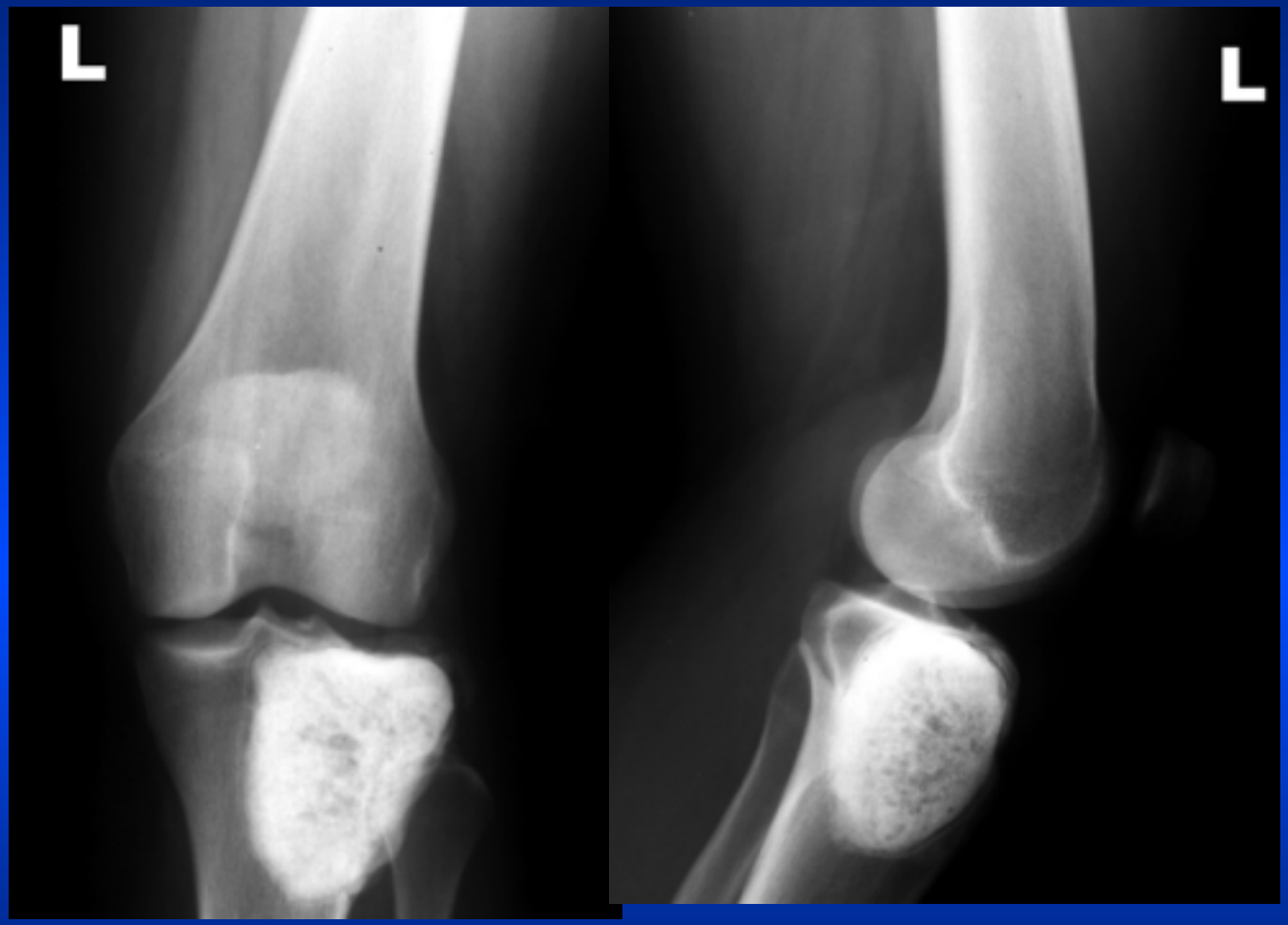


Right distal femur osteosarcoma









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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Miami, Florida
February 9, 2013