

UK Sports Medicine Symposium
Lexington, KY • July 15, 2011

KNEE Anatomy and Exam

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KNEE INJURIES



ACL Reconstructions

- **70s to Early 80s:**
 - Extraarticular IT band tenodesis
 - Arthrotomy, open ACL reconstruction
- **Mid-80s to Mid-90s:**
 - Arthroscopic intraarticular ACL reconstruction
 - Single bundle
- **Mid-90s:**
 - Anatomic ACL reconstruction
 - Single / Double bundle
 - Improved fixation techniques
 - Understanding anatomic landmarks
 - Improvement in guides, reaming — all inside, inside-out

Capsular Ligament Injuries

- **Pre-1975:**
 - Capsular repairs, cut out the ACL
- **Evolution to reconstruct ACL**
 - Ignore the capsule
- **2000: The capsule is BACK!**
 - Diagnose AMRI and PLRI
- **PCL injuries reconstruct if associated with medial or lateral injuries**

Flandry, F., et. al., Evaluation and Treatment of Acute and Chronic Injuries to the Capsular Ligaments of the Knee, AAOS Instructional Course Lectures, Vol. 58, 2009, 397-421.

Concept of Rotatory Instability, Not Cruciate-Deficient Knee

- Dr. Jack Hughston's legacy
 - My fellowship at Hughston Clinic, Columbus Georgia, 1984
 - Taught me how to listen to patients and examine knees



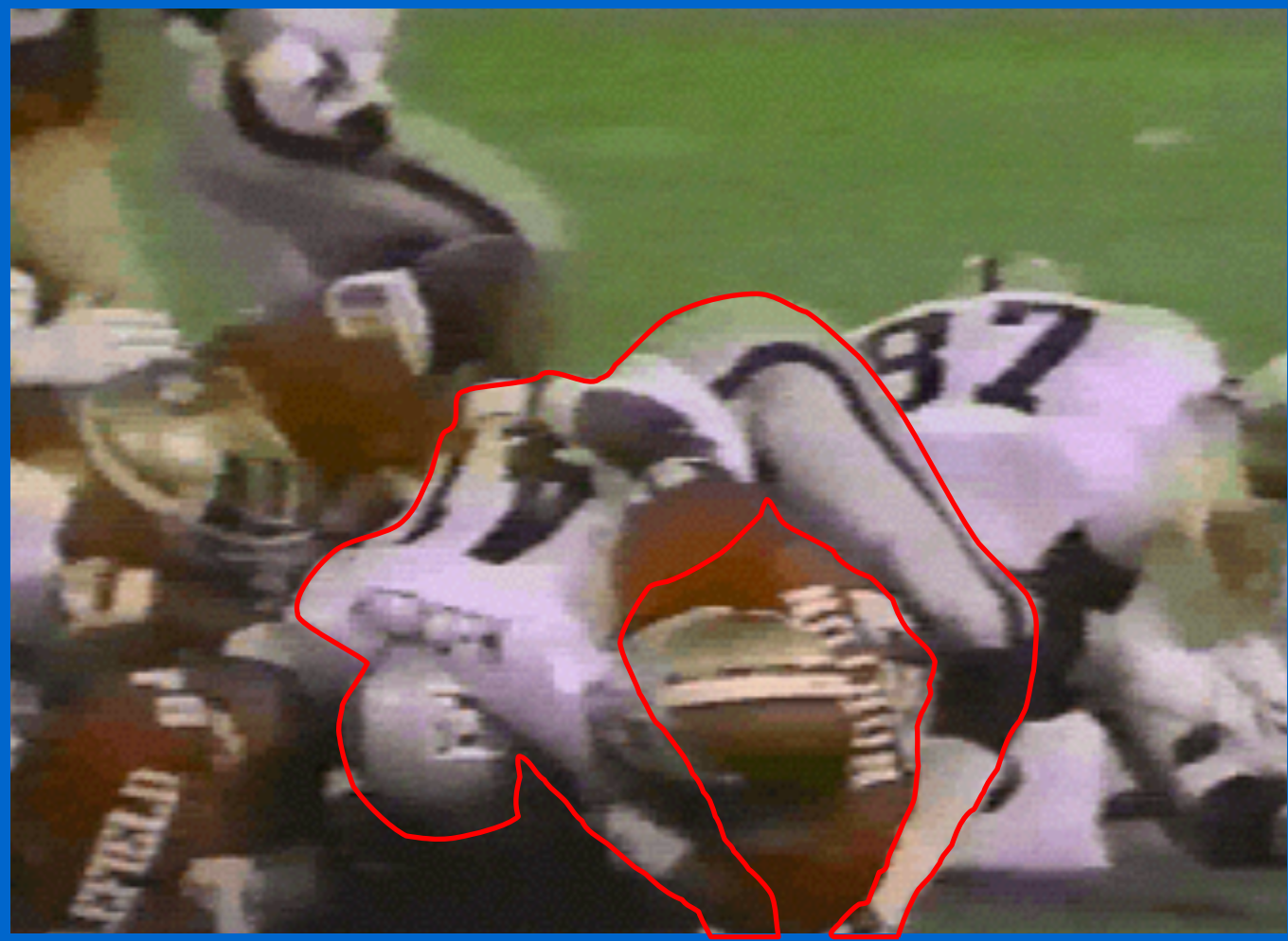
Hughston JC, Andrews JR, Cross MJ, Moschi A: Classification of knee ligament instabilities Part 1. The medial compartment and cruciate ligaments. Part 2: The lateral compartment. *J Bone Joint Surg Am* 1976;58:173-179.

KNEE



© 1996 Ky. Sports Medicine

Football: Knee Dislocation

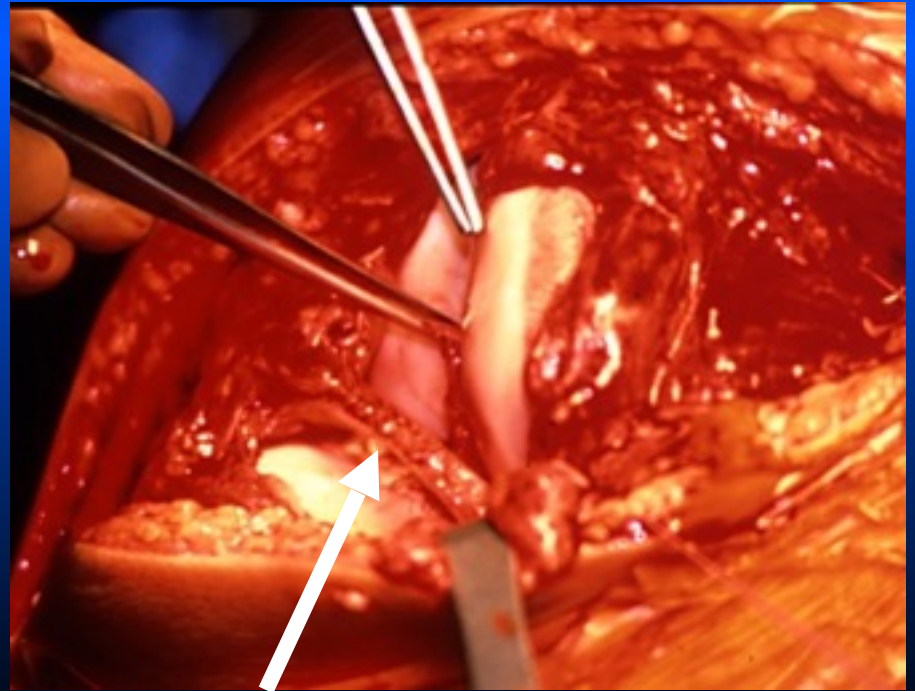
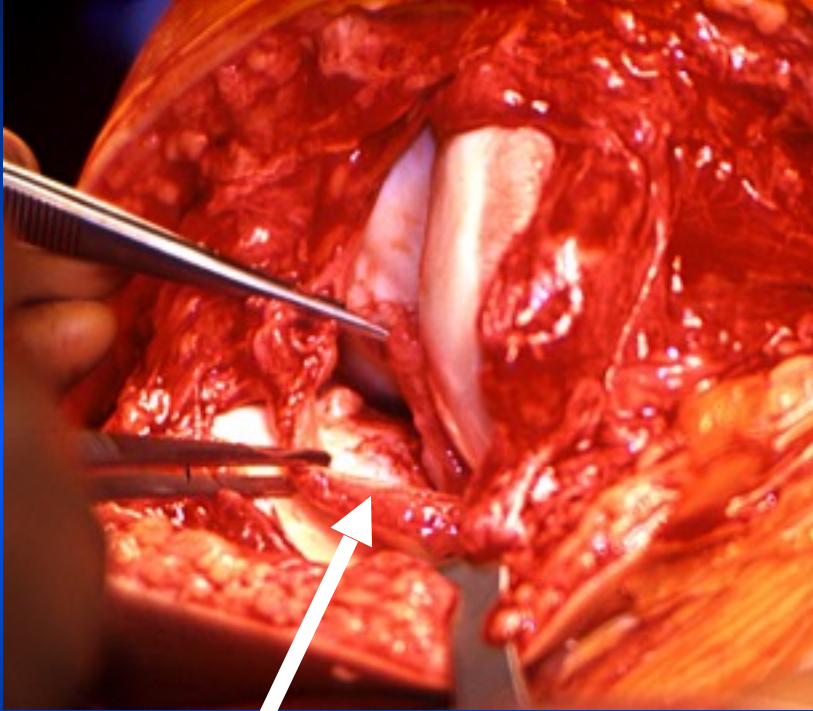


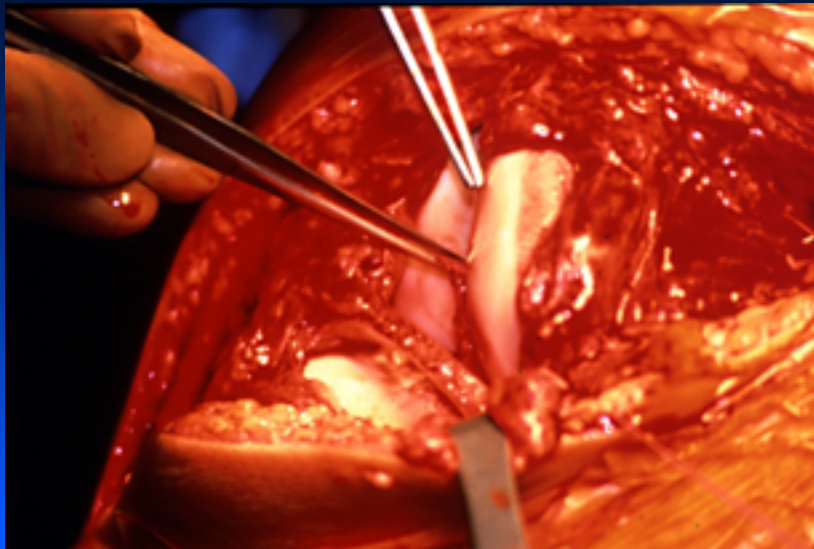
Knee dislocation ACL/PCL/MCL tears

Skin only stabilizing medial side of the



Medial meniscus



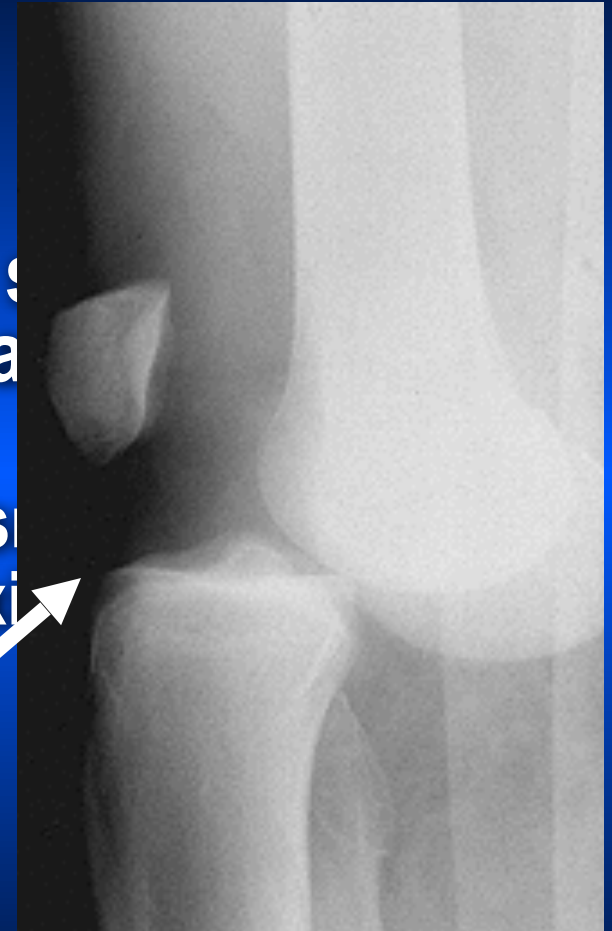


Knee Dislocation

- Happens on fields – not often, but:
- Don't miss
- Assess vascular status
 - Physical exam
 - Pulse ratios
 - MRI scan
 - Arteriogram

Acute Knee Dislocations

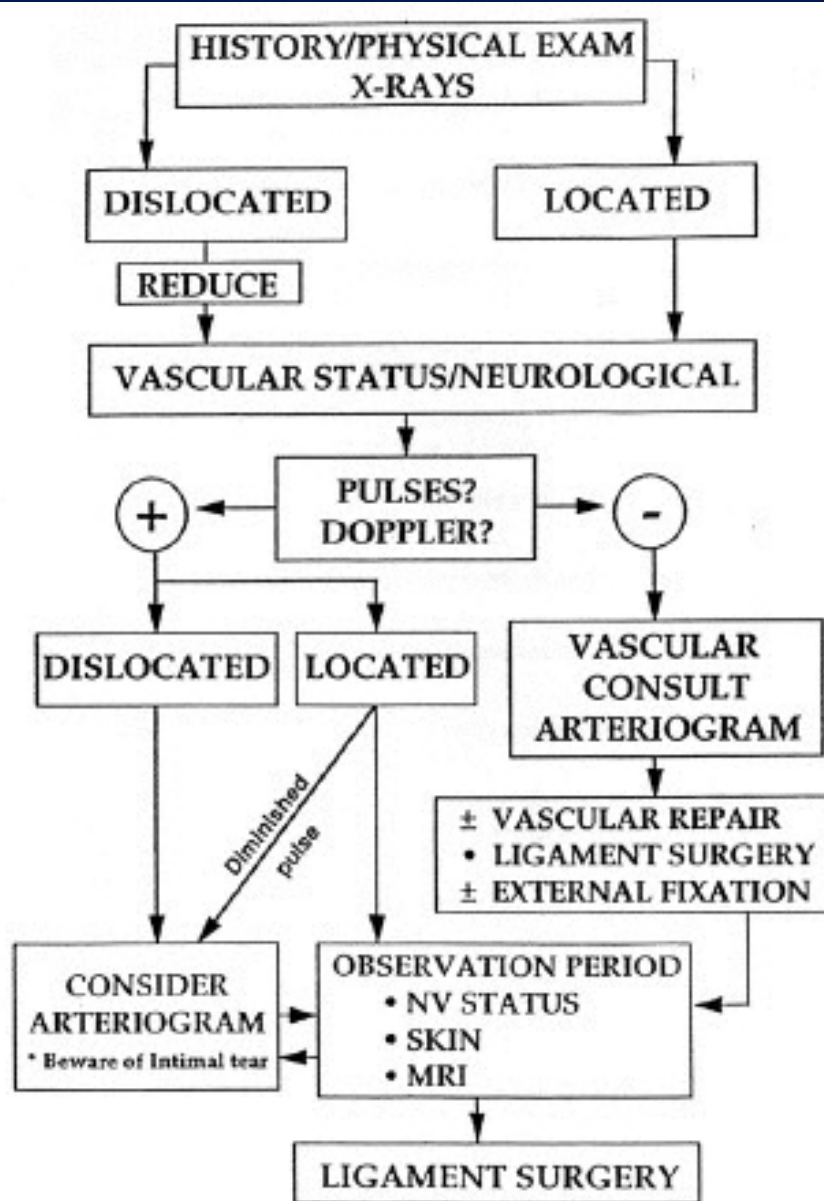
- Uncommon, but . . .
 - May be underdiagnosed
- If knee opens up to varus/valgus or extension, assume a knee dislocation
- Direction of dislocation
 - Anterior: hyperextension mechanism
 - Posterior: direct blow anterior proximal tibia



Knee Dislocations

- Most knee dislocations reduce spontaneously
- Refer to center with vascular surgeon
- Communicate with ER
 - Use your cell phone to call the ER
 - Put a note on the patient
 - Transfer to facility with angiography suite and vascular surgeon on call
- If high suspicion, do arteriogram

Knee Dislocation Algorithm



Algorithm for treatment of the Multiple Ligament Injured Knee, from Harner, CD, "Complex Knee Injuries including dislocation: Preoperative planning, evaluation and pitfalls," AAOS, Phoenix AZ, Feb. 3-6, 2000.

Vascular Injury

Arteriogram Gold Standard

Injury ranges from :

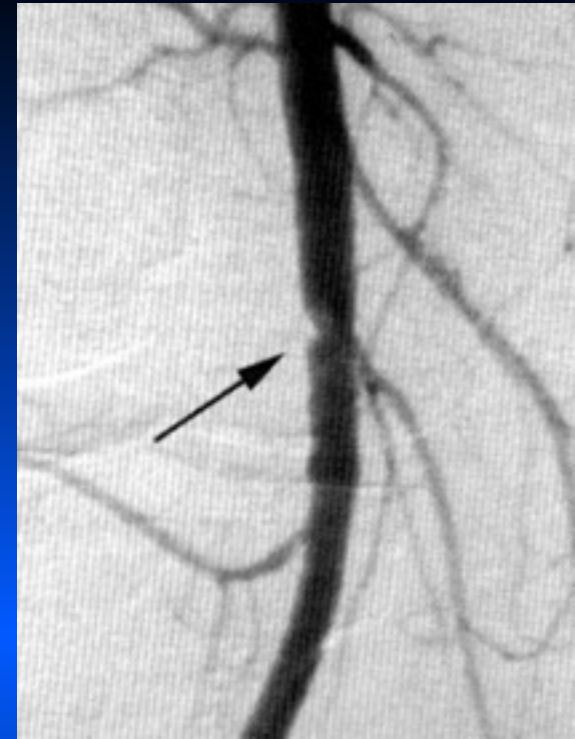
Thrombus

Tear:

Intimal

Partial

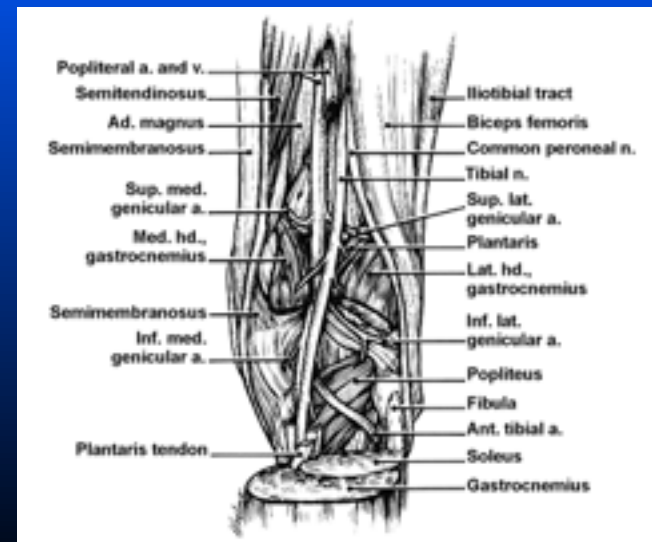
Complete



Late Vascular compromise from:

Thrombus

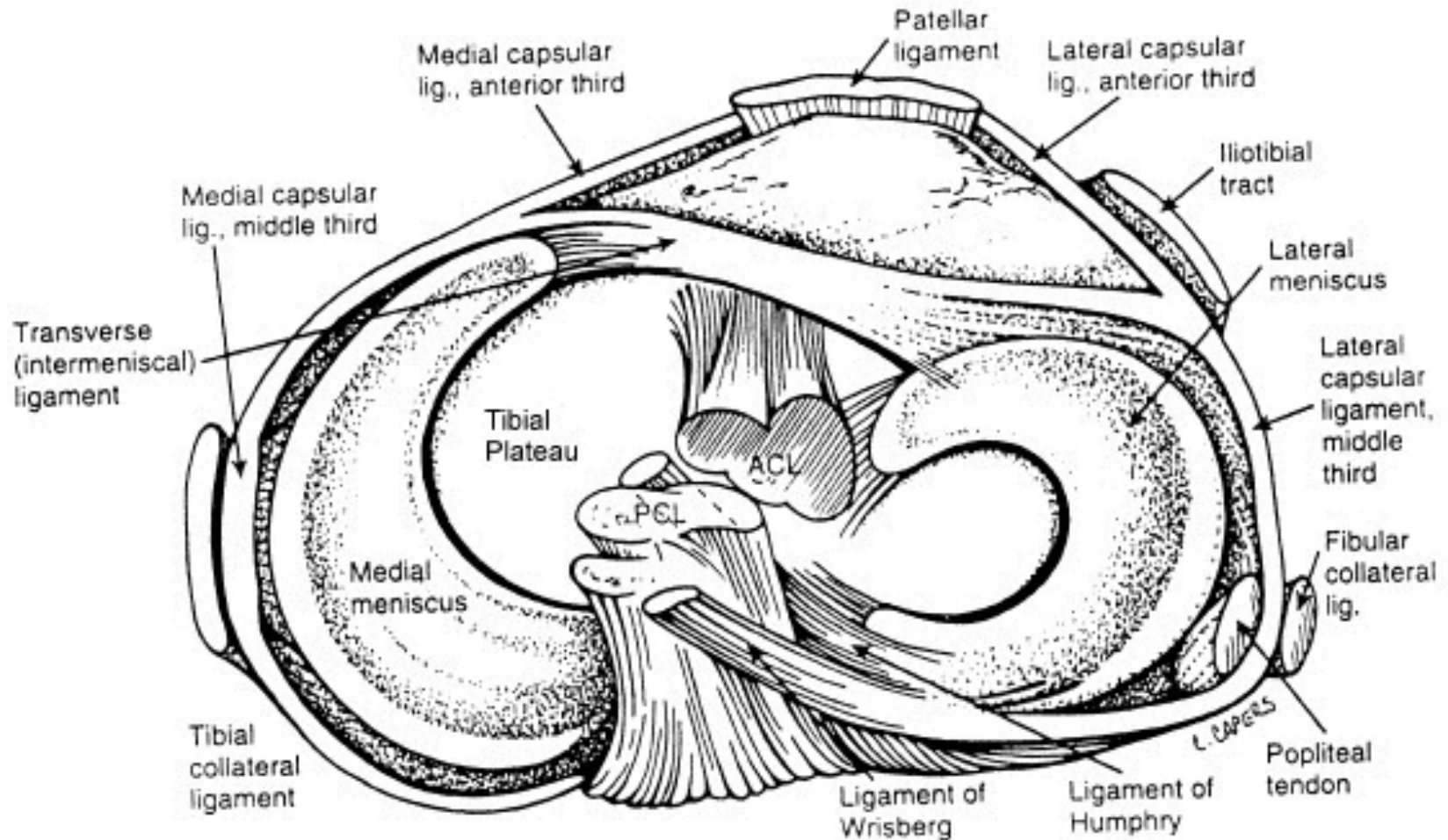
Propagation of Intimal Tear

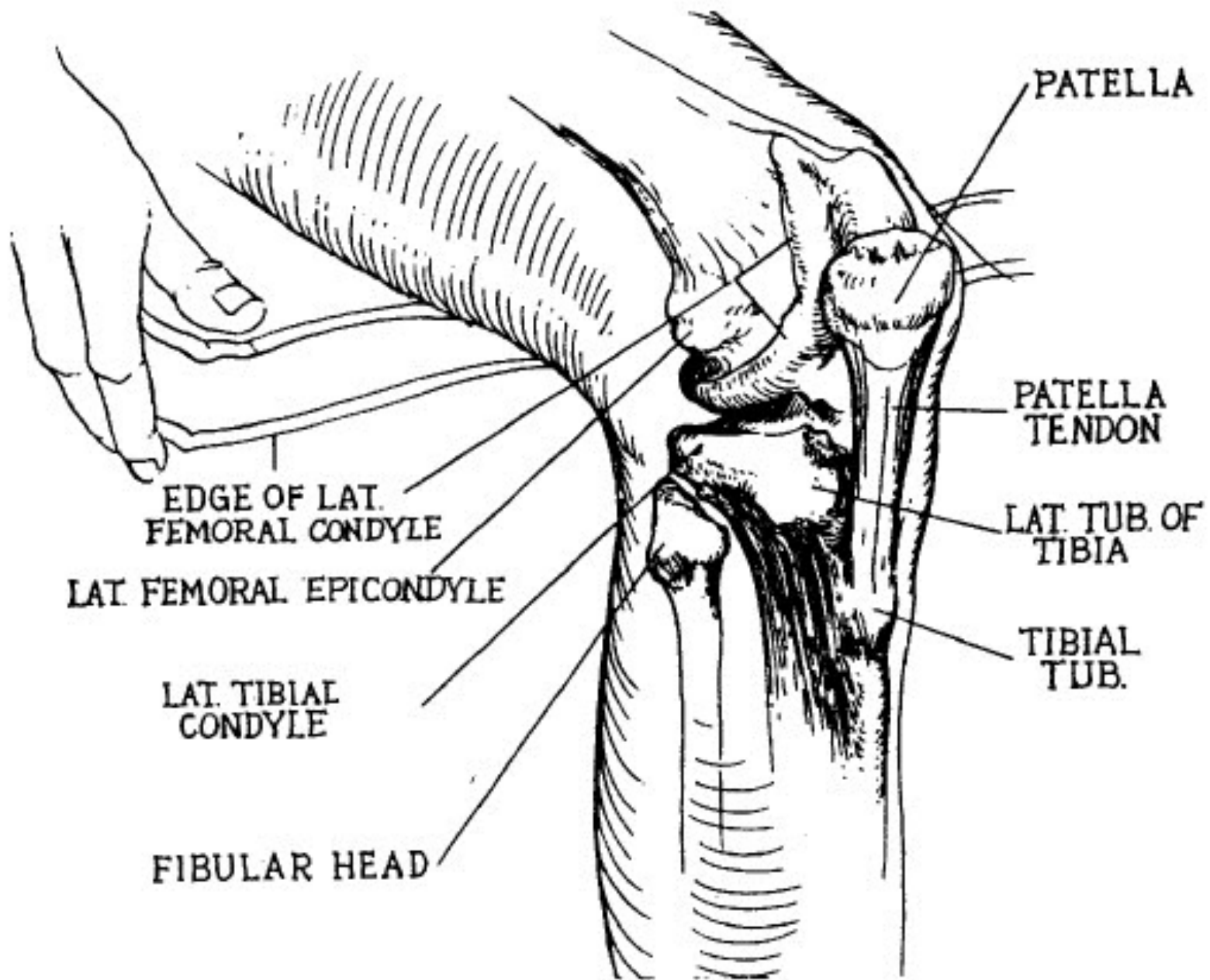


- **Acute Complete ACL Tear**
 - **Lateral Capsule**
 - **Severe ALRI**
 - **Severe PLRI**

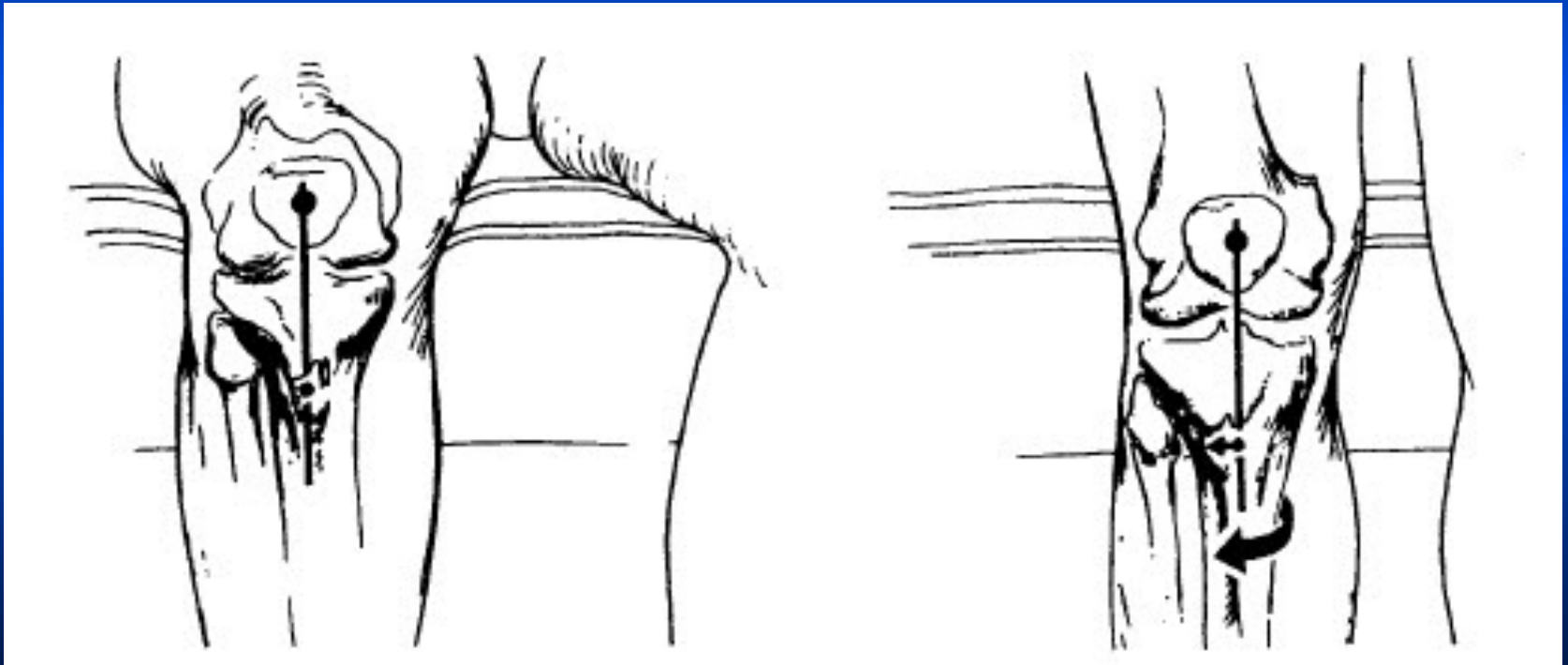


FUNCTIONAL KNEE ANATOMY

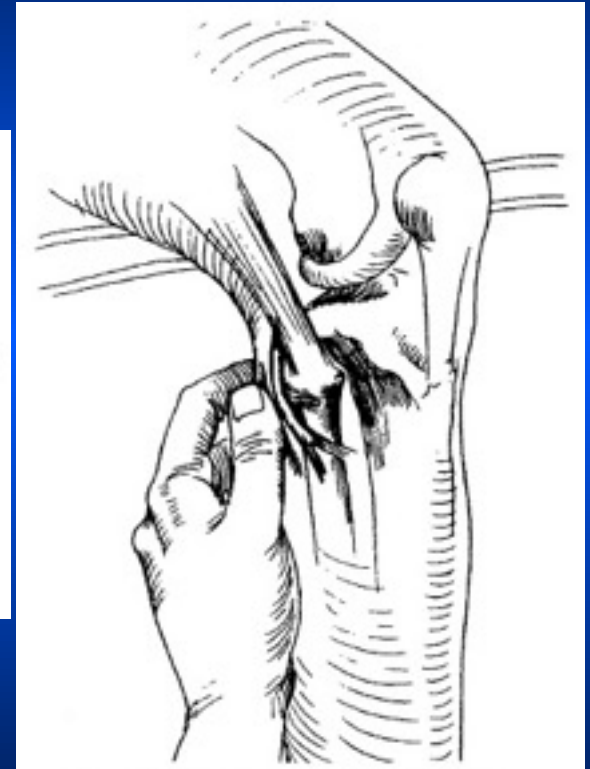
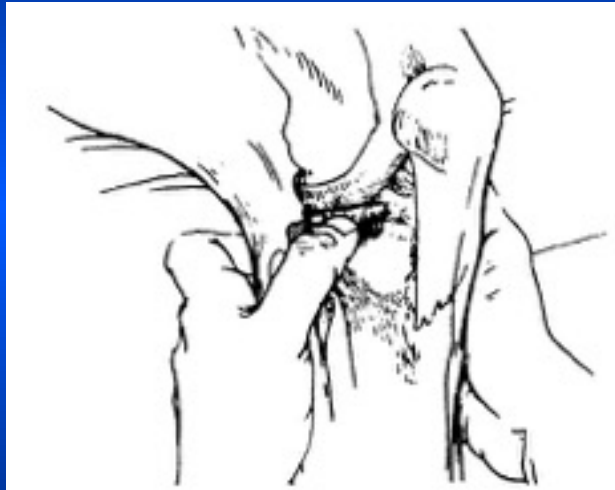
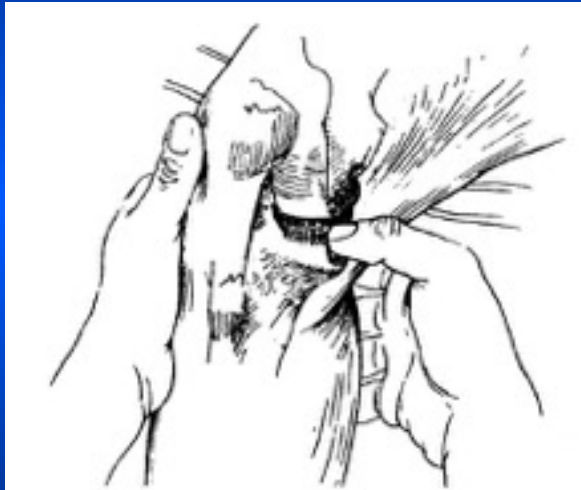




Screw home mechanism (Smillie) tibial externally rotates in terminal knee

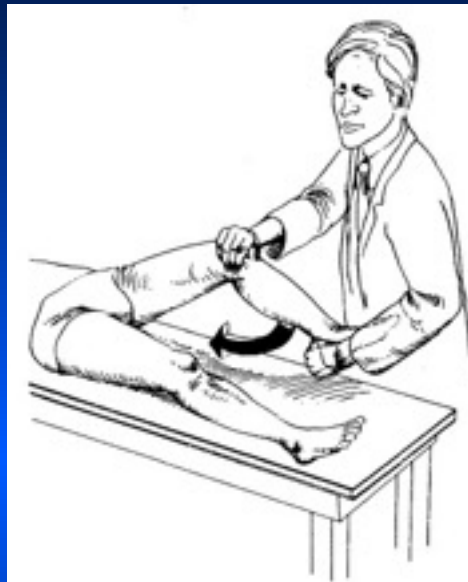


Joint line palpation with knee flexed should produce pain if meniscus is torn



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

McMurray's Test: Medial Meniscus

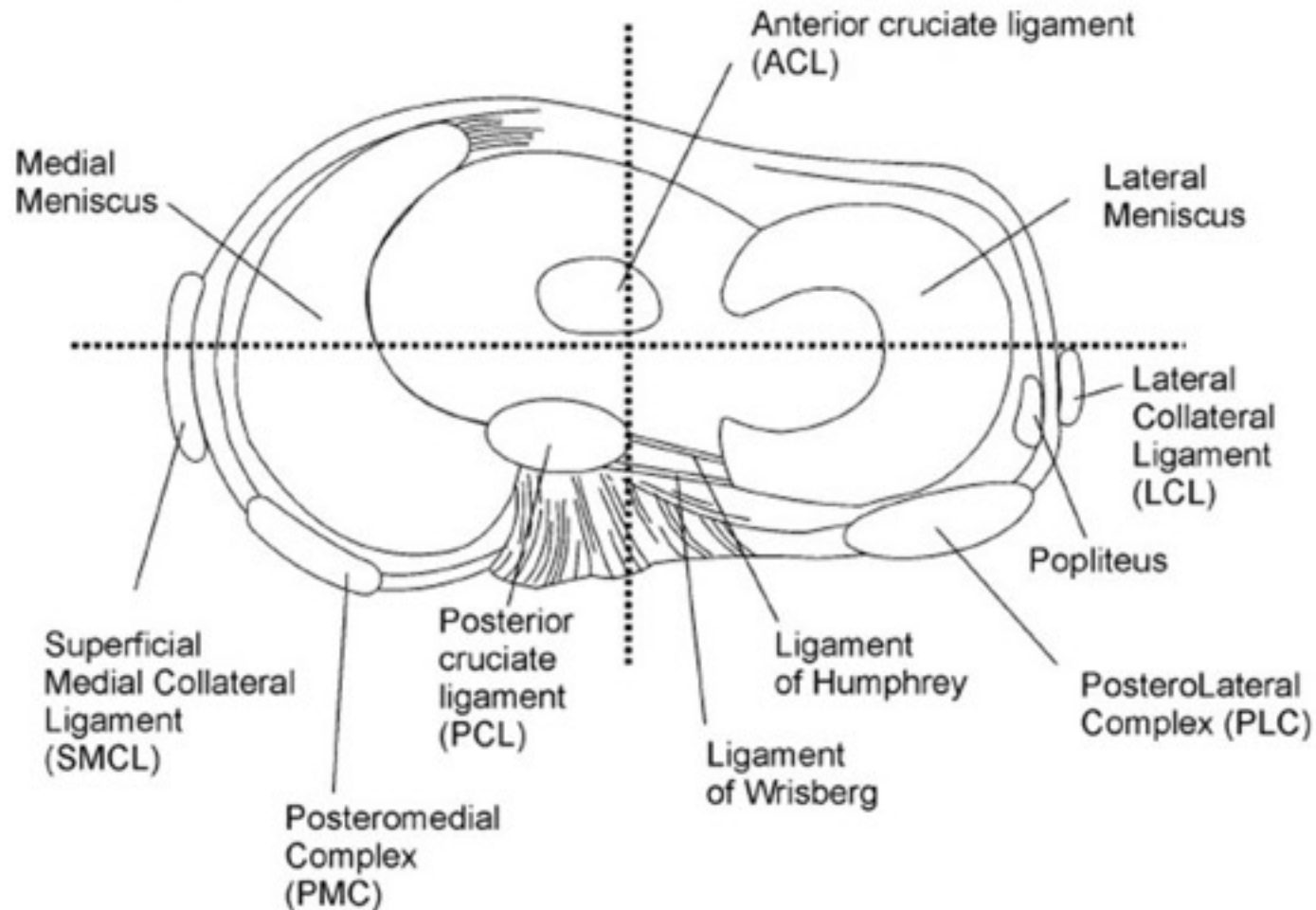


Normal Knee Exam: Lateral Aspect



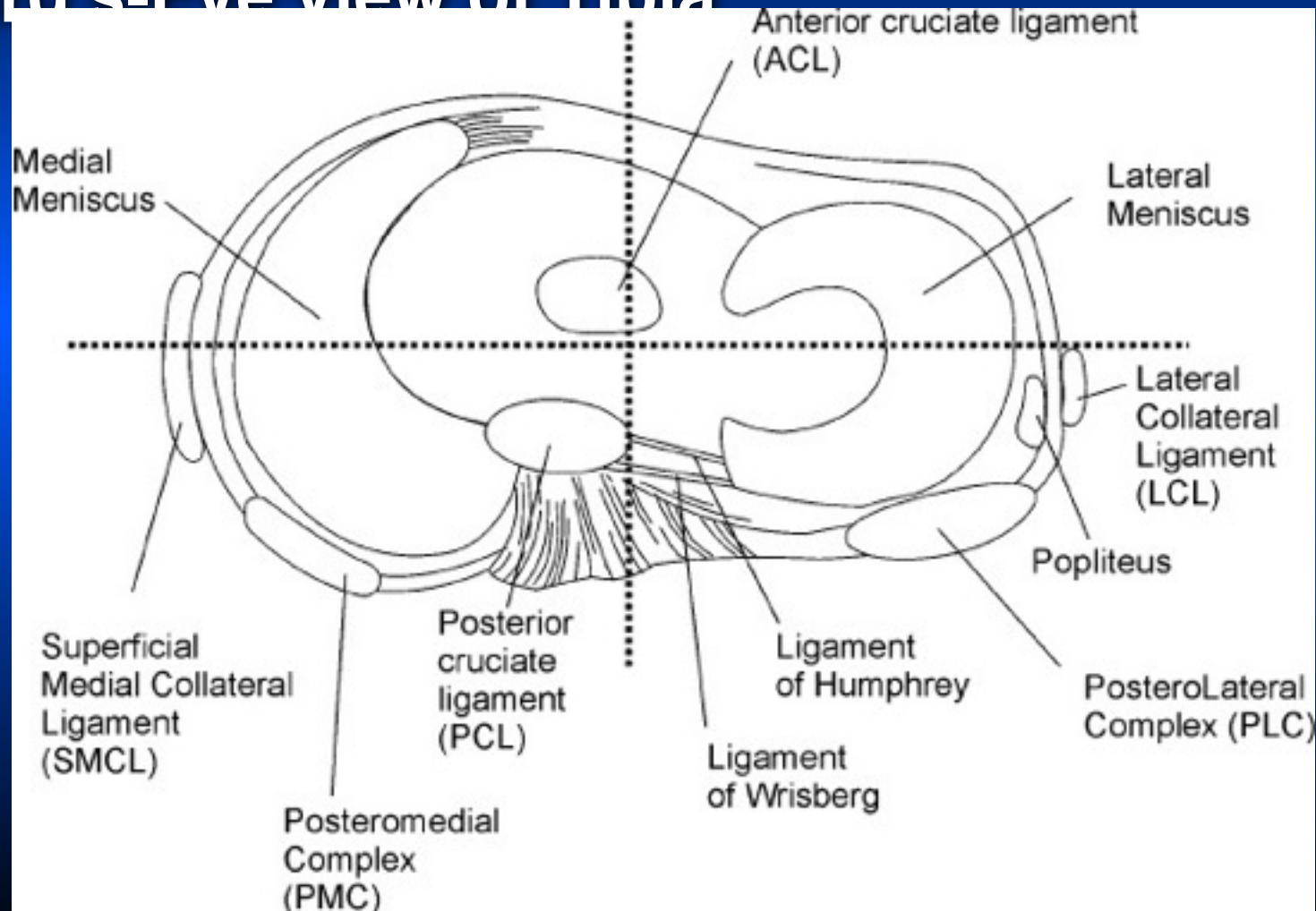
Knee Instabilities

Bird's-Eye view of Tibia



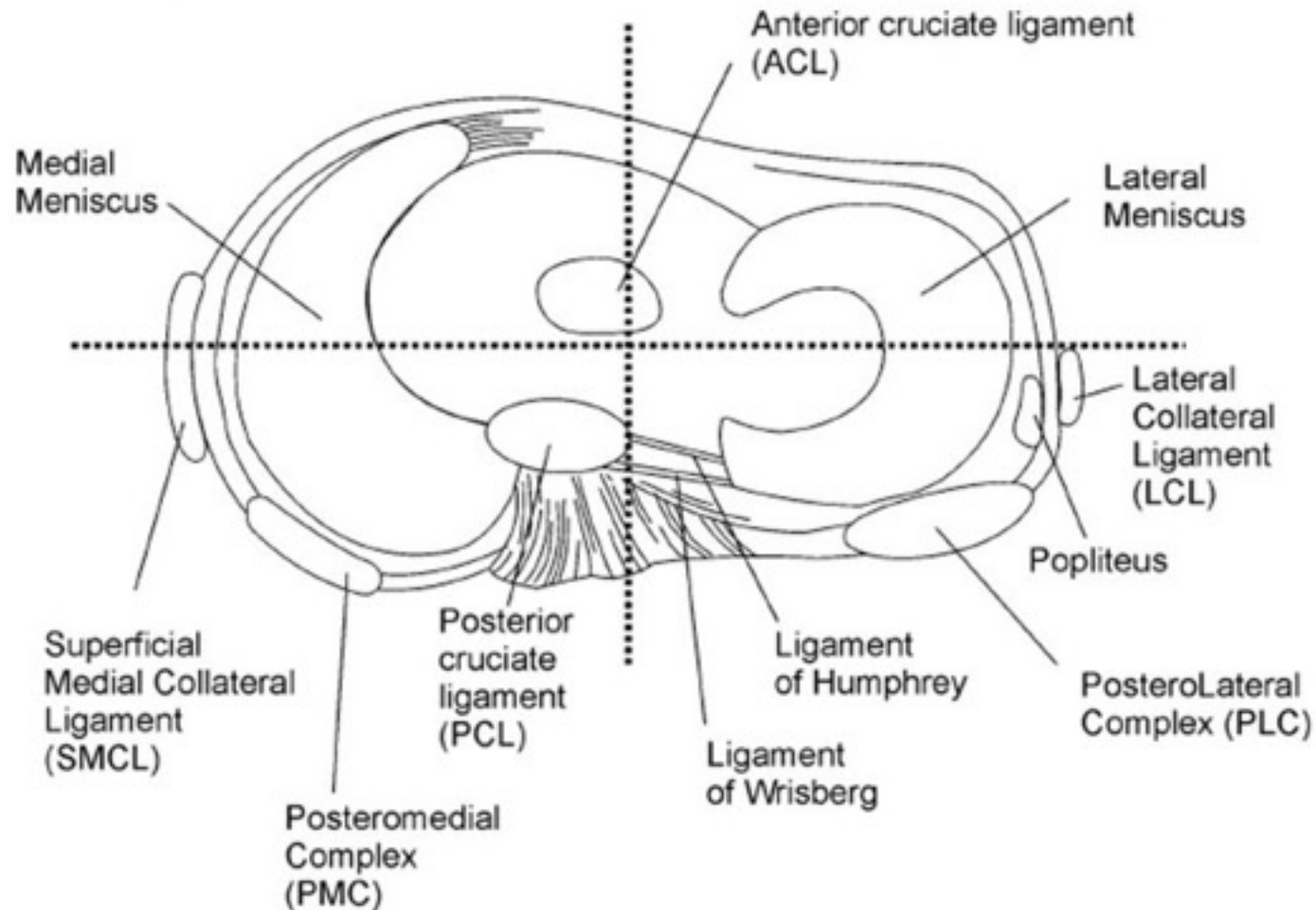
Knee Instabilities

– Bird's-Eye view of Tibia



Knee Instabilities

Bird's-Eye view of Tibia

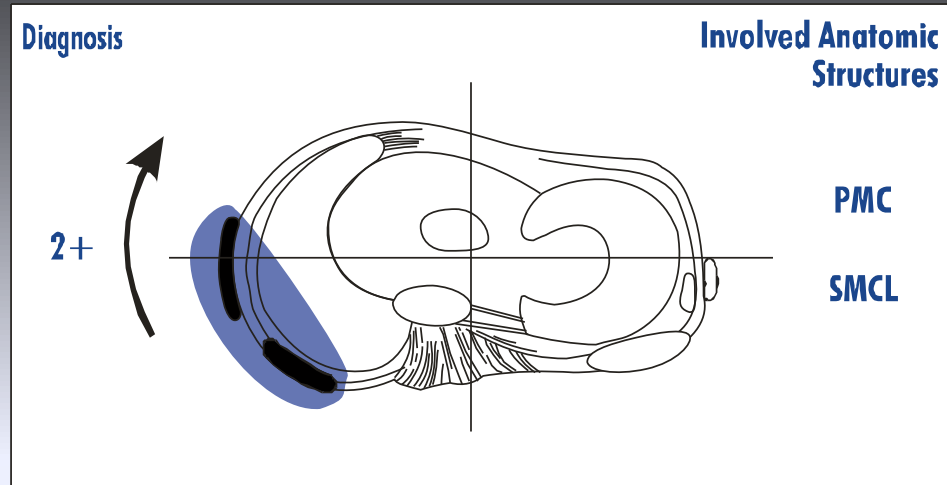
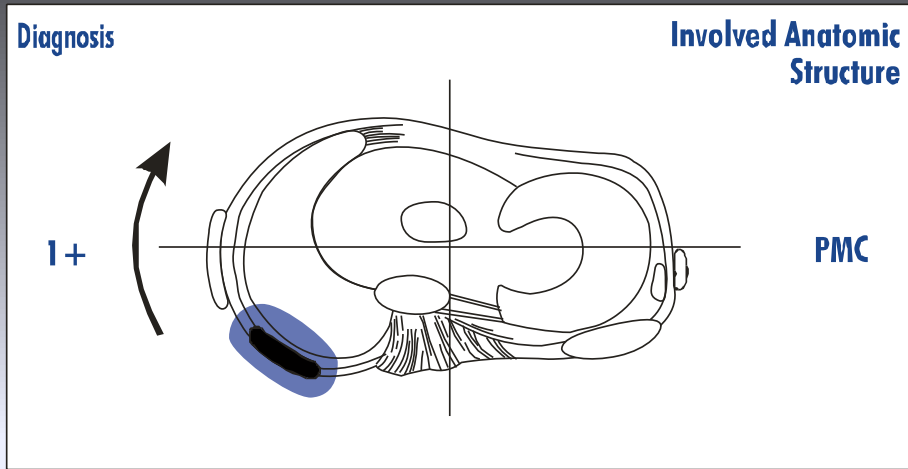


Classification of Knee Instabilities

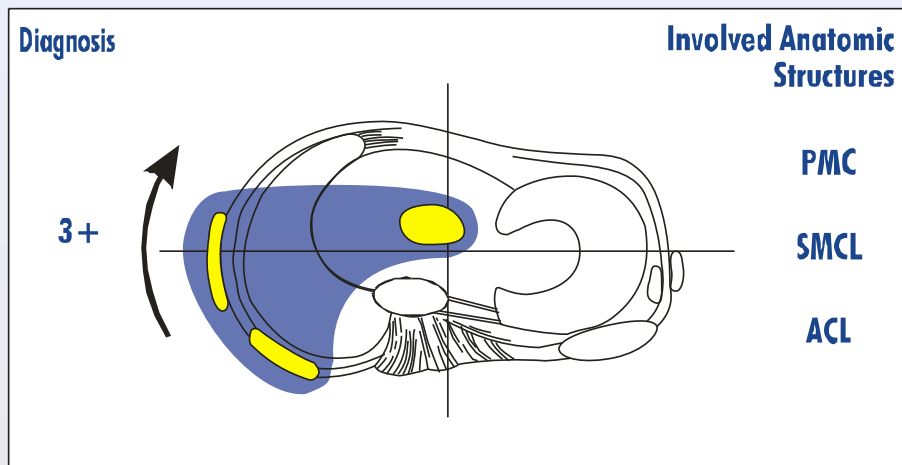
Rotatory, Straight and Combined

- **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**

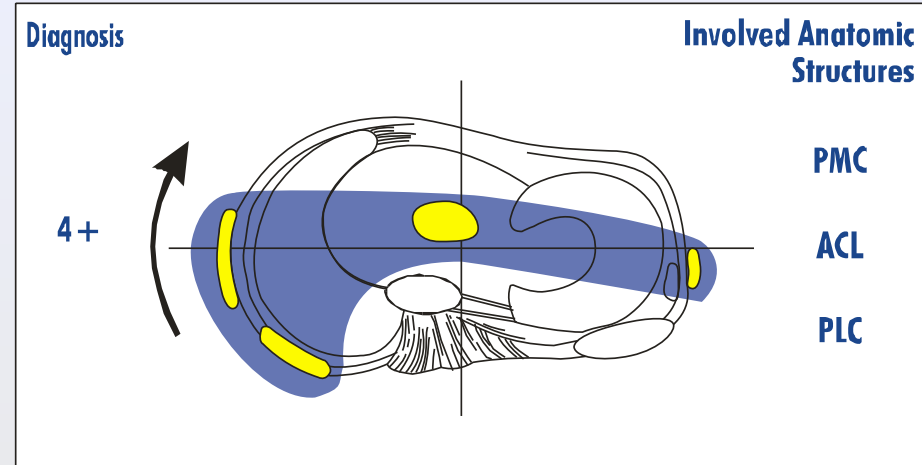
Anterior Instabilities



Antero-Medial Rotatory Instabilities (AMRI)



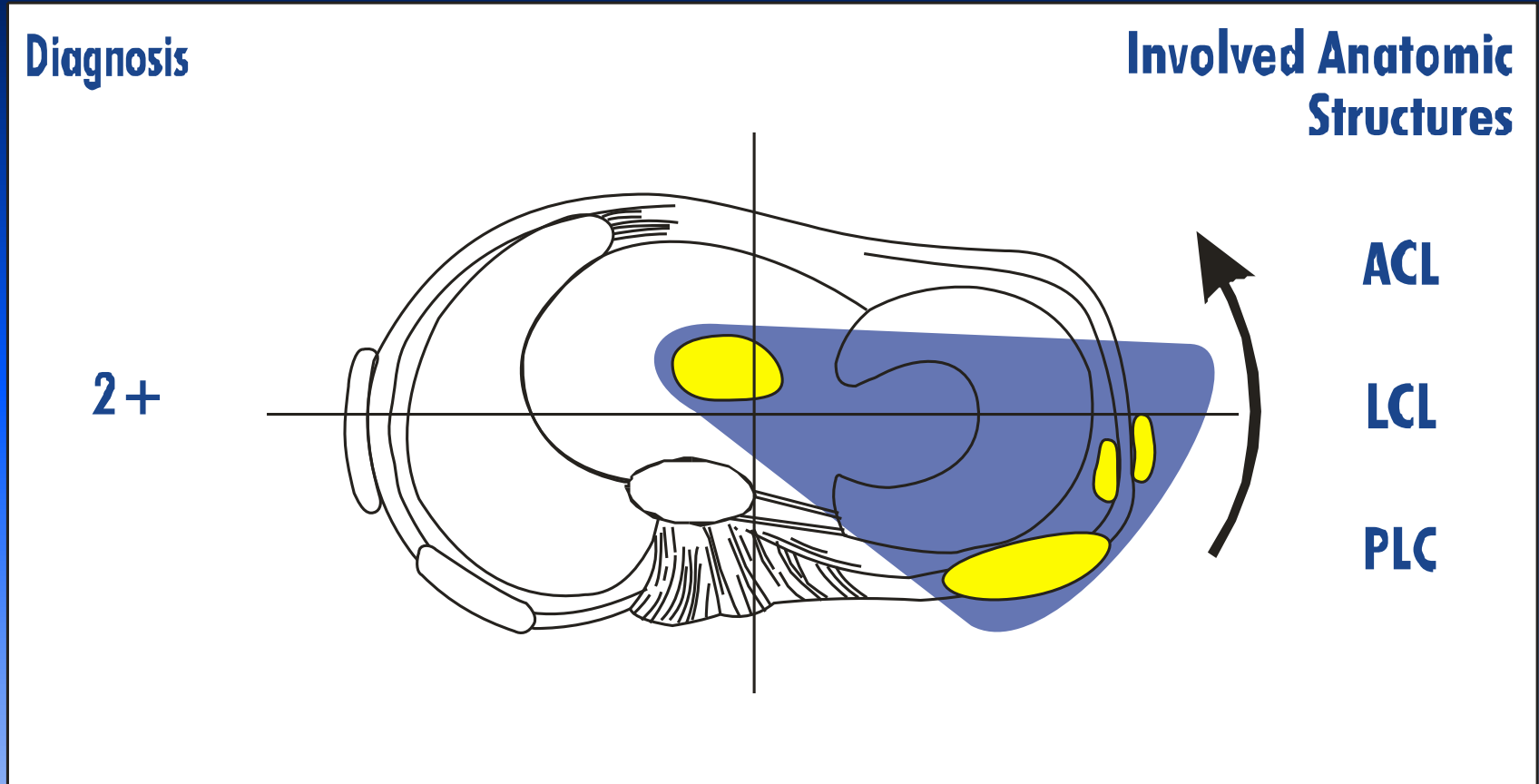
Antero-Medial Rotatory Instabilities (AMRI)



Combined AMRI and ALRI

Combined AMRI and ALRI

Knee Instability



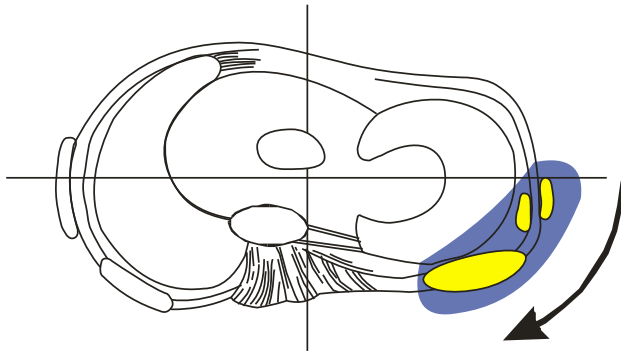
Antero-Lateral Rotatory Instabilities (ALRI)

Posterolateral Instabilities

Diagnosis

Involved Anatomic Structures

1+



LCL

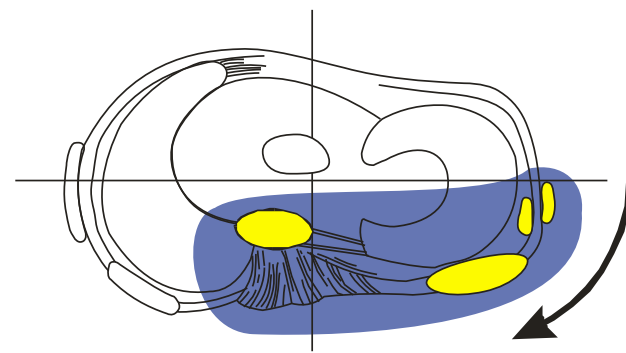
PLC

Postero-Lateral Rotatory Instabilities (PLRI)

Diagnosis

Involved Anatomic Structures

2+



PCL

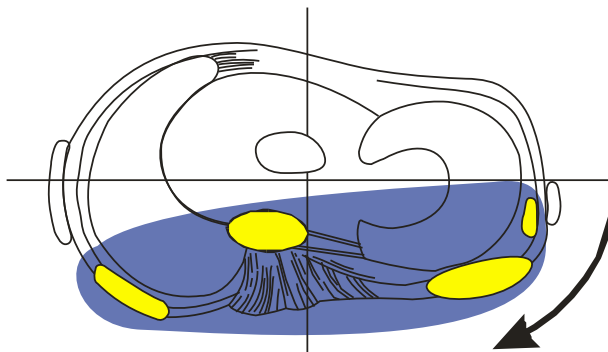
PLC

Postero-Lateral Rotatory Instabilities (PLRI)

Diagnosis

Involved Anatomic Structures

3+



LCL

PLC

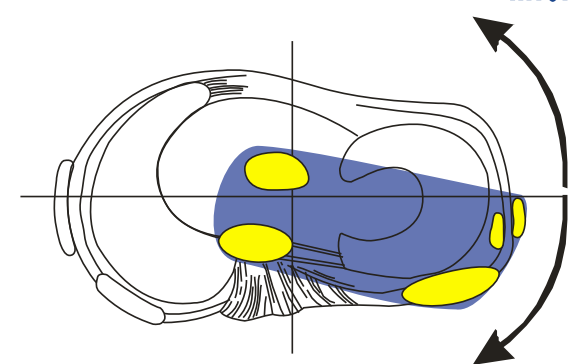
PCL

PMC

Postero-Lateral Rotatory Instabilities (PLRI)

Diagnosis

Involved Anatomic Structures



ACL

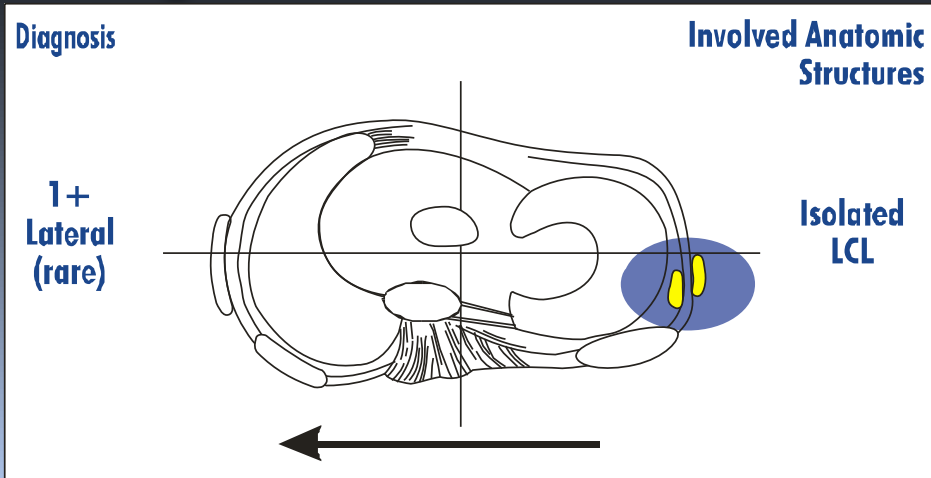
PLC

PCL

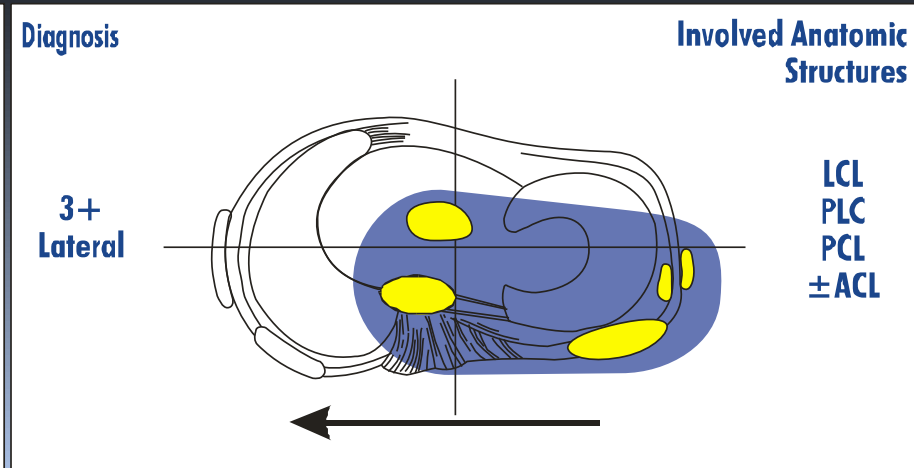
Lateral Capsule

Combined ALRI and PLRI

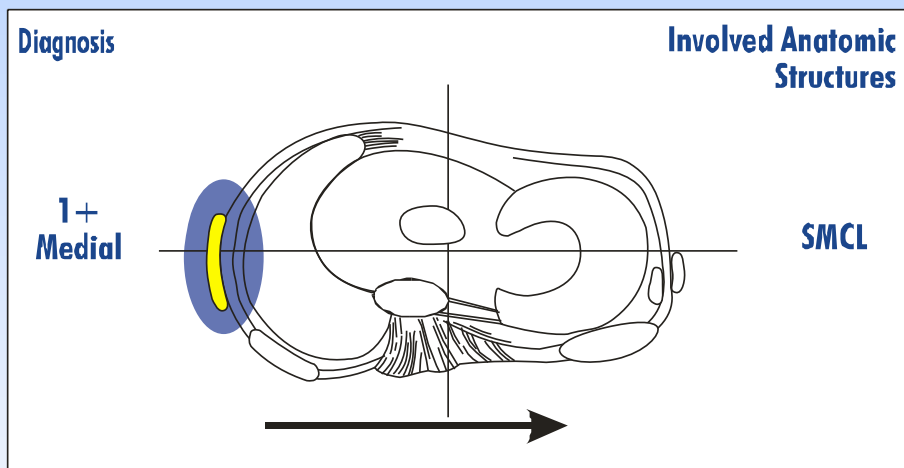
Straight Instabilities



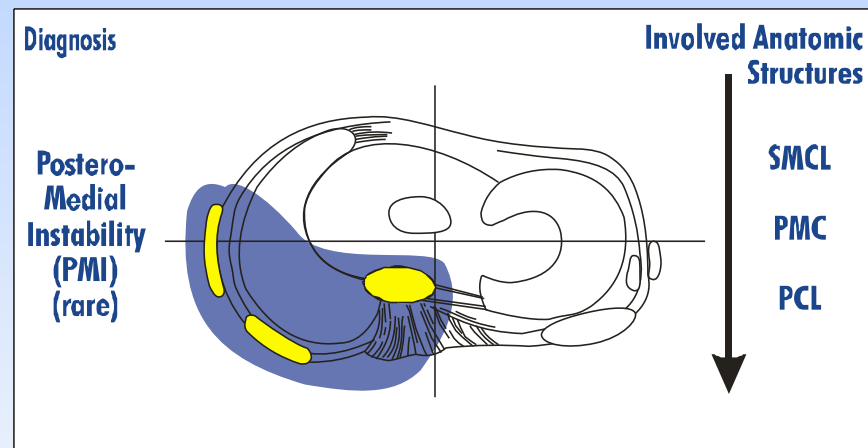
Straight Instabilities



Straight Instabilities

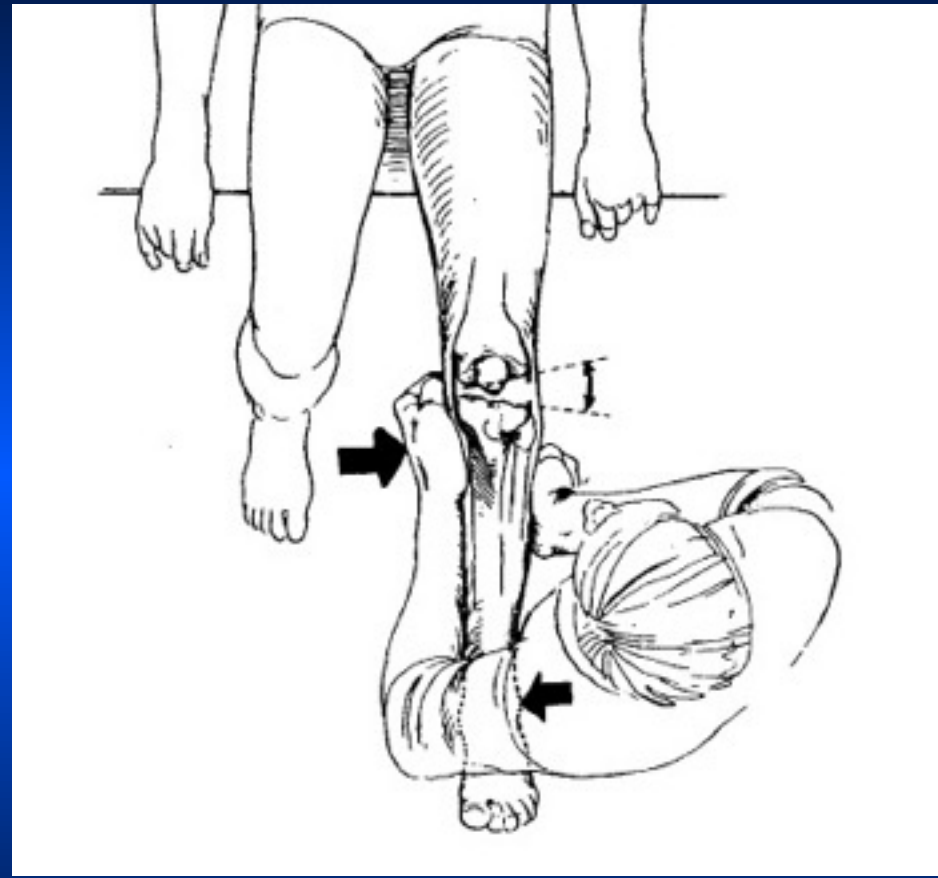
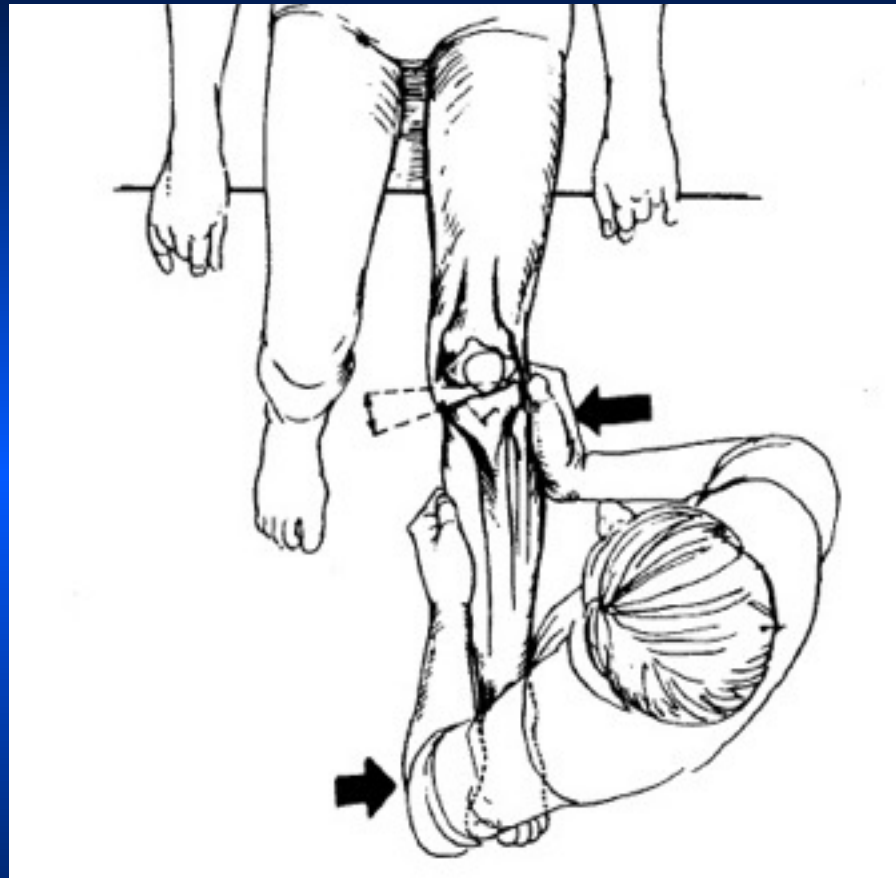


Straight Instabilities

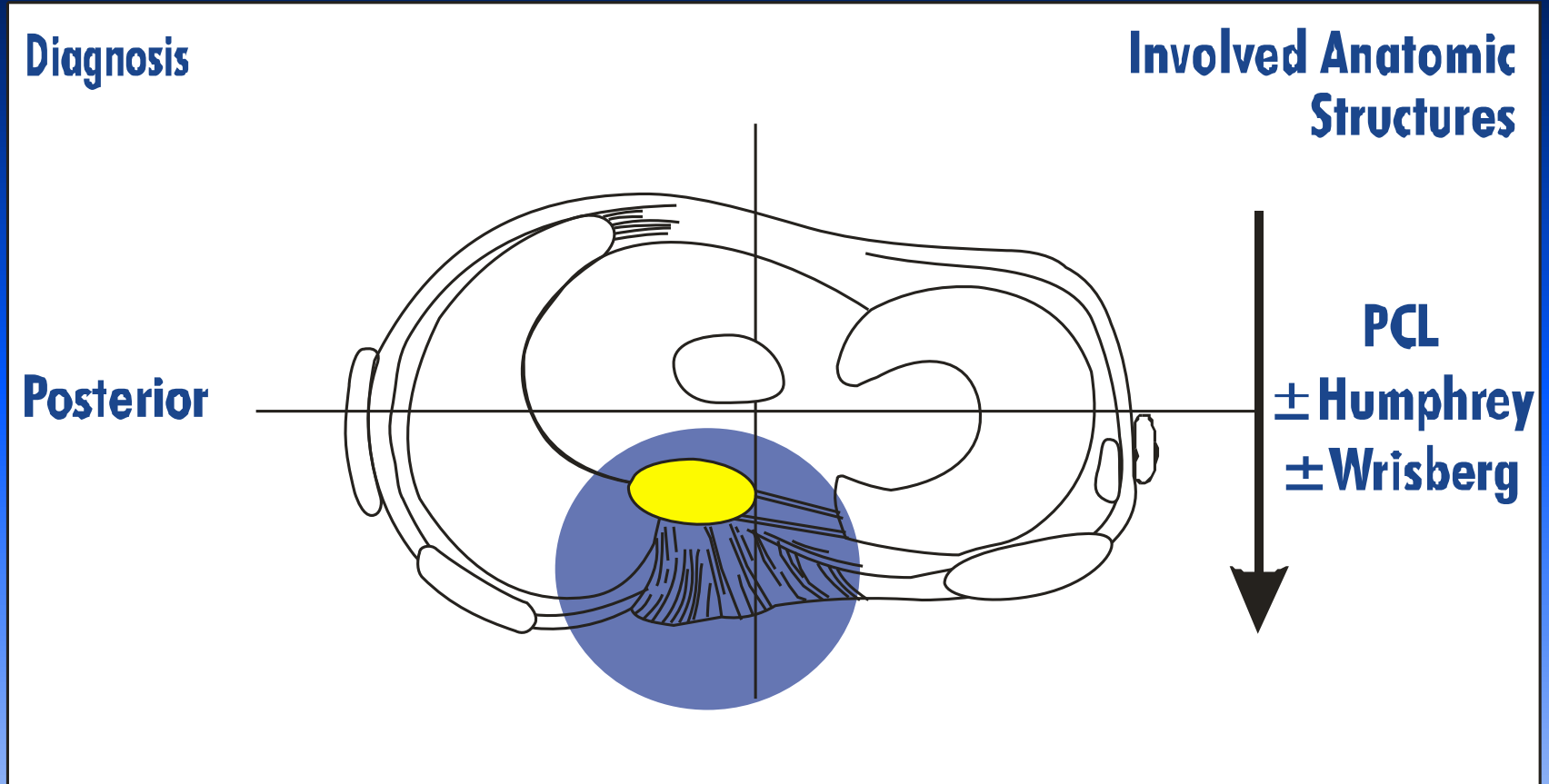


Straight Instabilities

Valgus Stress Varus Stress



Knee Instability



Straight Posterior

Normal Knee Exam: PCL Exam





Instabilities

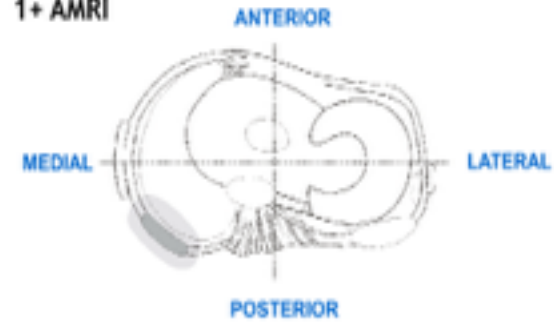
- Anteromedial rotatory instabilities (AMRI)
- Combined AMRI and ALRI
- Anterolateral rotatory instabilities (ALRI)
- Straight posterior
- Posterolateral rotatory instabilities (PLRI)
- Combined ALRI and PLRI
- Straight instabilities

Knee Instabilities

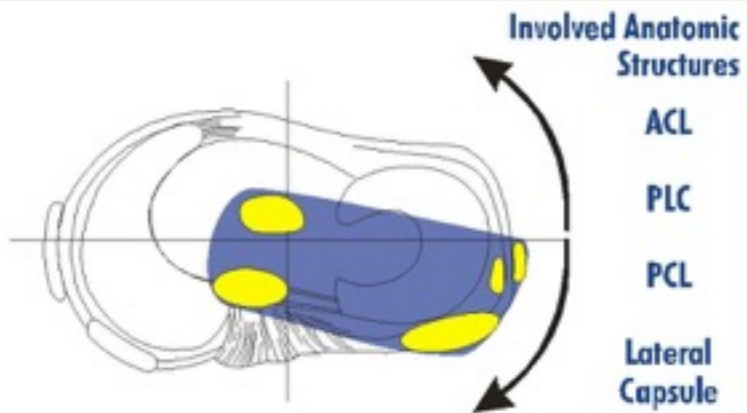
AMRI



1+ AMRI

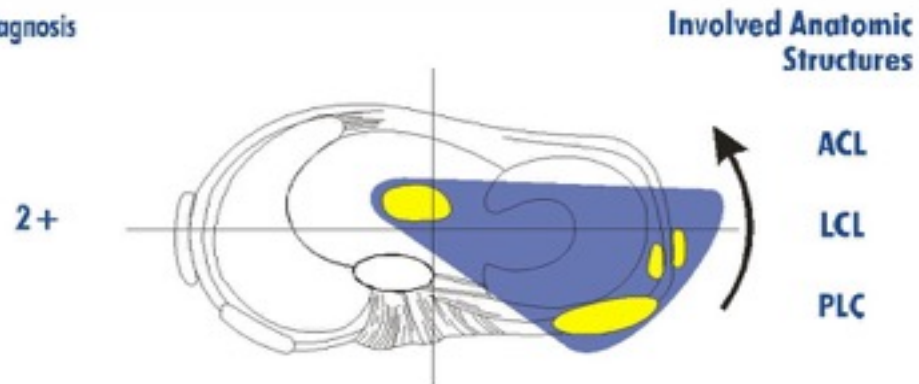


Diagnosis



Combined ALRI and PLRI

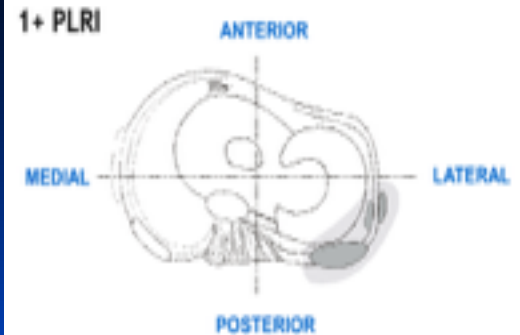
Diagnosis



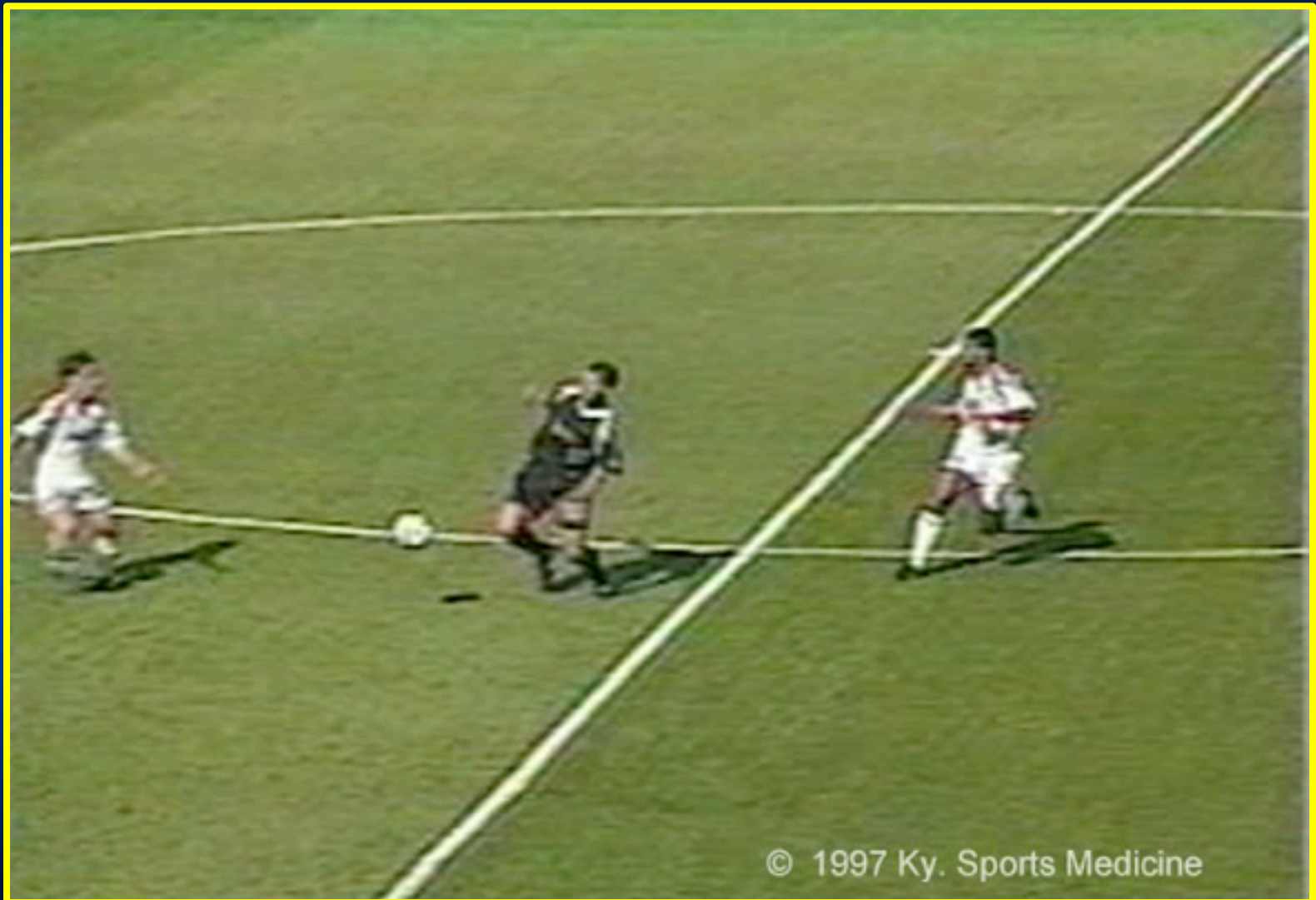
Antero-Lateral Rotatory Instabilities (ALRI)

Knee Instabilities

PLRI



Soccer



Injury Mechanisms – Body Positions

POSITION OF SAFETY			POSITION OF NO RETURN		
	MUSCLE ACTIVITY	BODY ALIGNMENT		BODY ALIGNMENT	MUSCLE ACTIVITY
BACK		Normal lordosis		Forward flexed, rotated opposite side	
HIPS		Flexed Neutral Abduction/Adduction Neutral Rotation		Adduction Internal Rotation	FLEXORS ADDUCTORS ILIOPSOAS
KNEE	EXTENSORS ABDUCTORS GLUTEALS				
		Flexed		Less flexed, valgus	EXTENSORS QUAD RICEPS
TIBIAL ROTATION	FLEXORS HAMSTRINGS				
		Neutral		External	DORSI FLEXORS
LANDING PATTERN	PLANTAR FLEXORS				
		Both Feet Control		One foot Out of Control	PERONEALS
	GASTROCNEMIUS				
	POSTERIOR TIBIALIS	Balanced		Unbalanced	TIBIALIS ANTERIOR

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Anterior Drawer



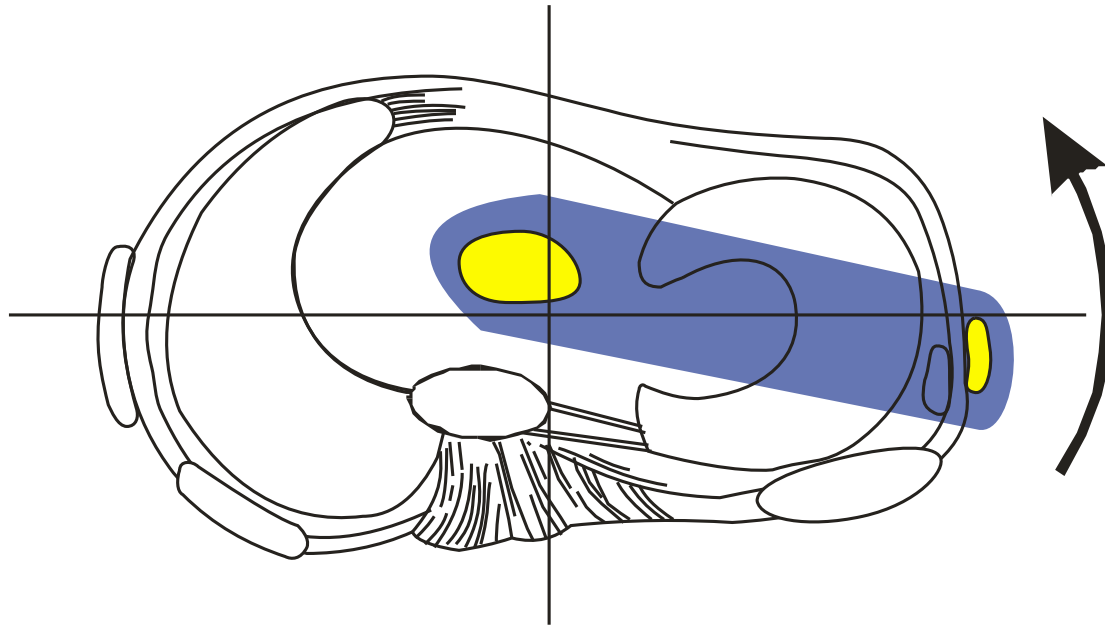
Normal Knee Exam: Ligaments



Knee Instability

Diagnosis

1+



Involved Anatomic Structures

ACL

Lateral Capsule

Antero-Lateral Rotatory Instabilities (ALRI)

Soccer

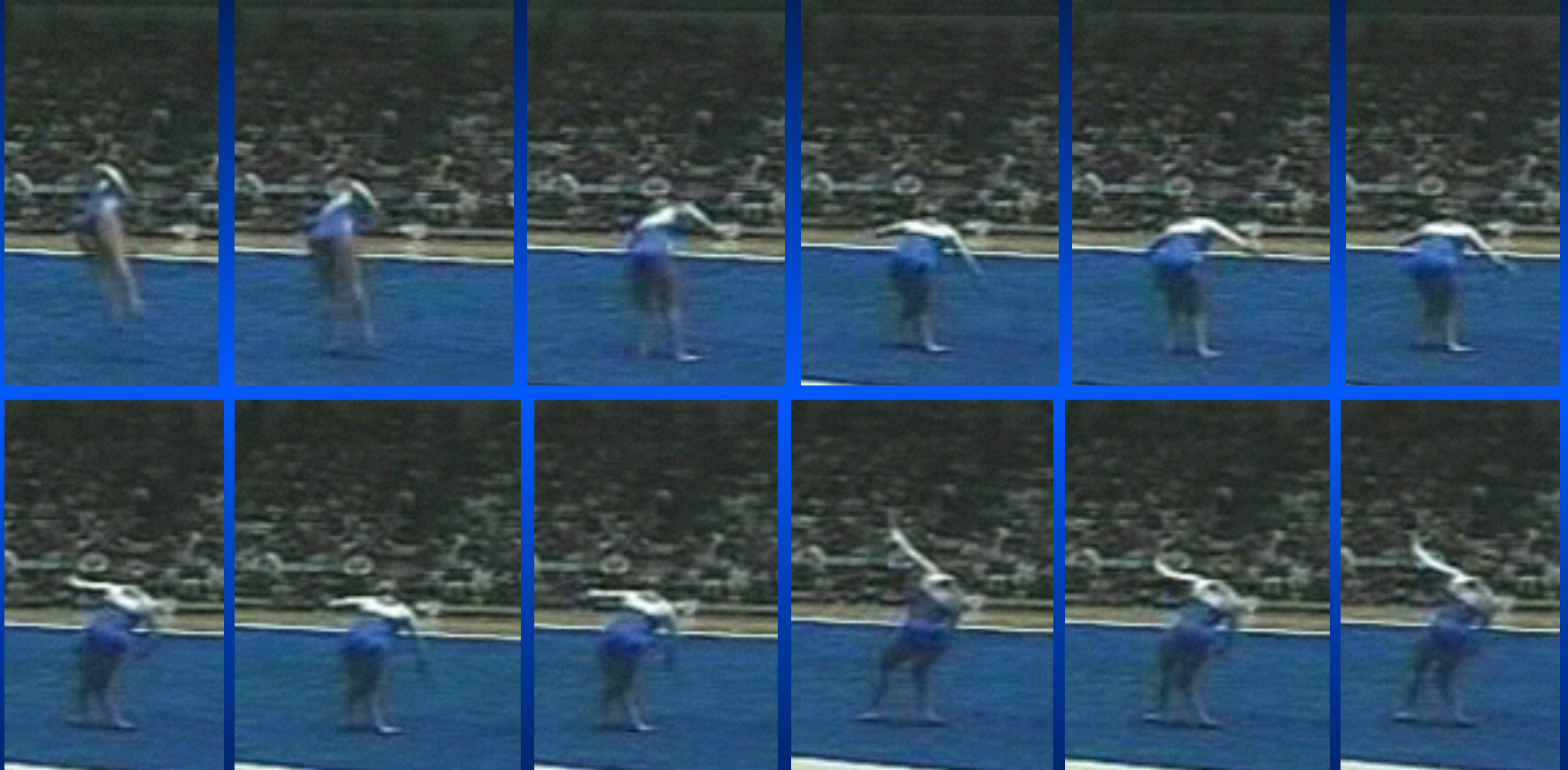


Gymnastics





[Actual time for these images $\approx .4$ seconds]



ACL Tear



Basketball



Basketball



© 2002 Ky. Sports Medicine

Basketball



Basketball



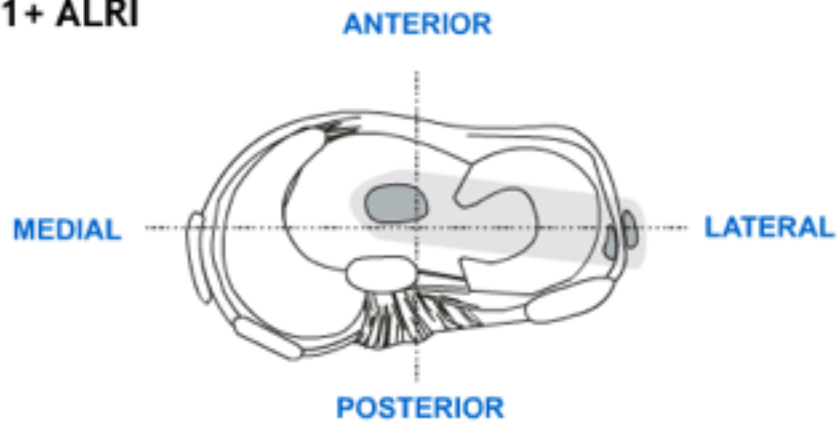
Basketball



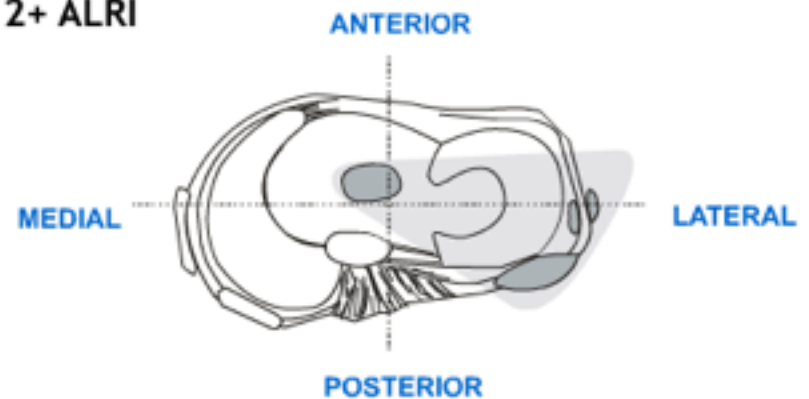
Knee Instabilities

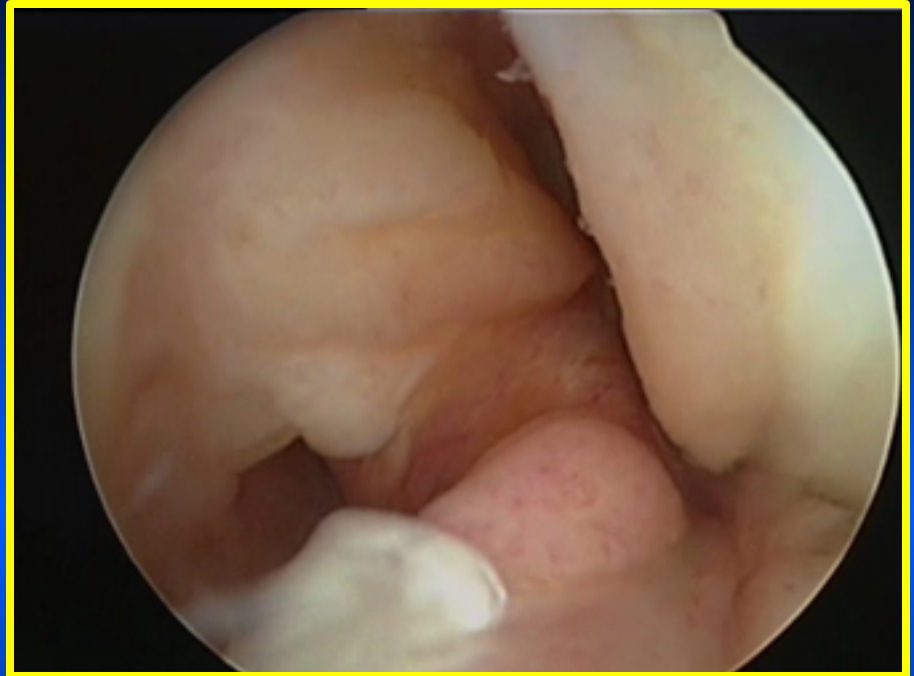
ALRI

1+ ALRI



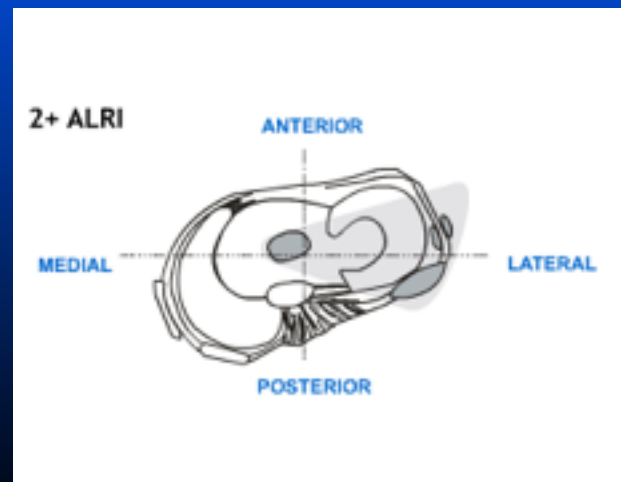
2+ ALRI



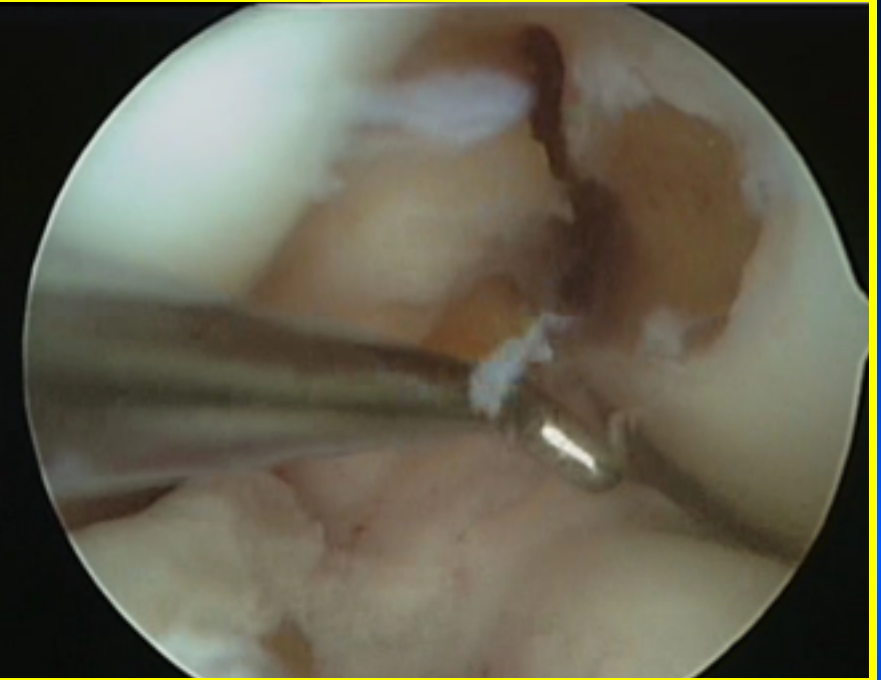


EUA:

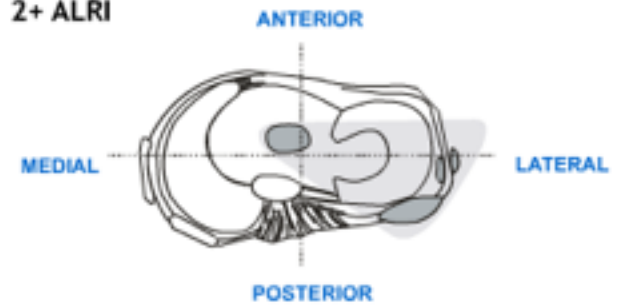
Correlate mechanism of injury, anatomy, surgical findings to study design in the lab

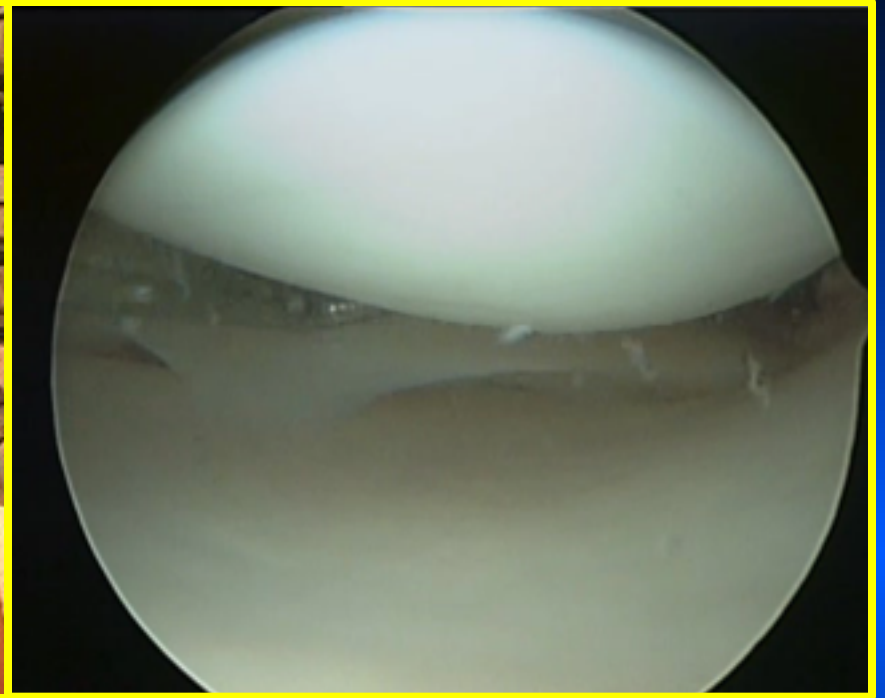


Pivot Shift

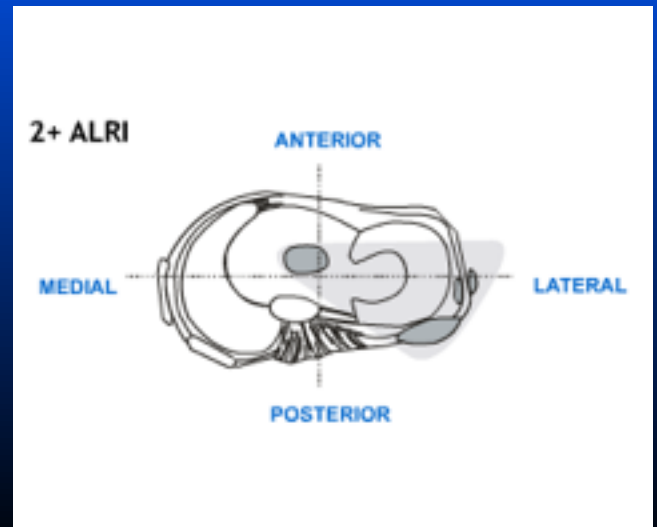


2+ ALRI





Medial compartment:
compressive forces
posterior medial
meniscus, typical tear
pattern vertical, posterior



Thomas D. Brower, MD

(March 15, 1924–Nov. 16, 1998)

- First Chief of Orthopaedics at UK, until 1989
- First to show that both epiphyseal and articular cartilage chondrocytes can divide
- Showed that the nutrition support of articular cartilage is through perfusion of intra-articular fluid



The End . . .

Thank

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