

# Anatomy and Sports Injuries of the Knee

I. Anatomy

II. Assessment

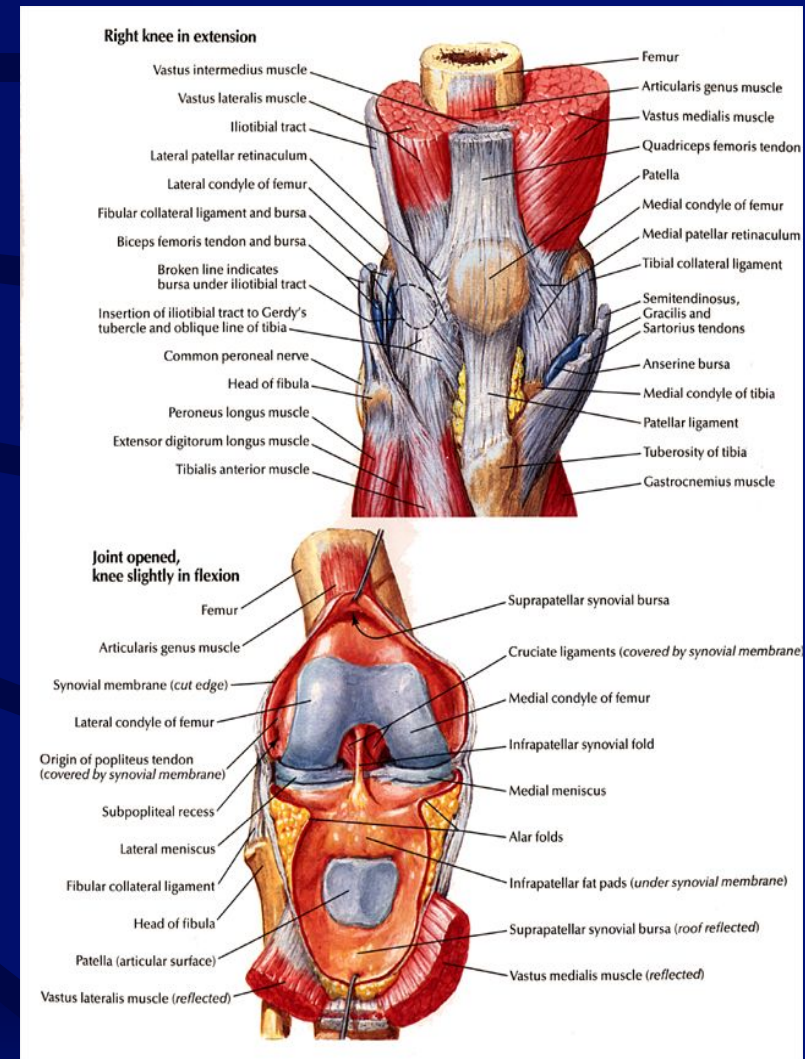
III. Treatment

IV. Case Study

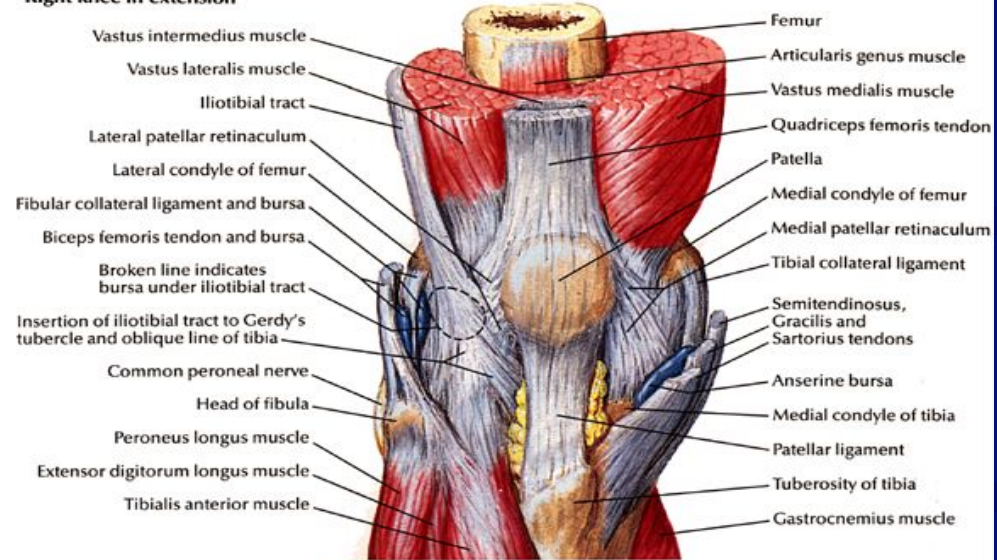
V. Dissection

# Anatomy

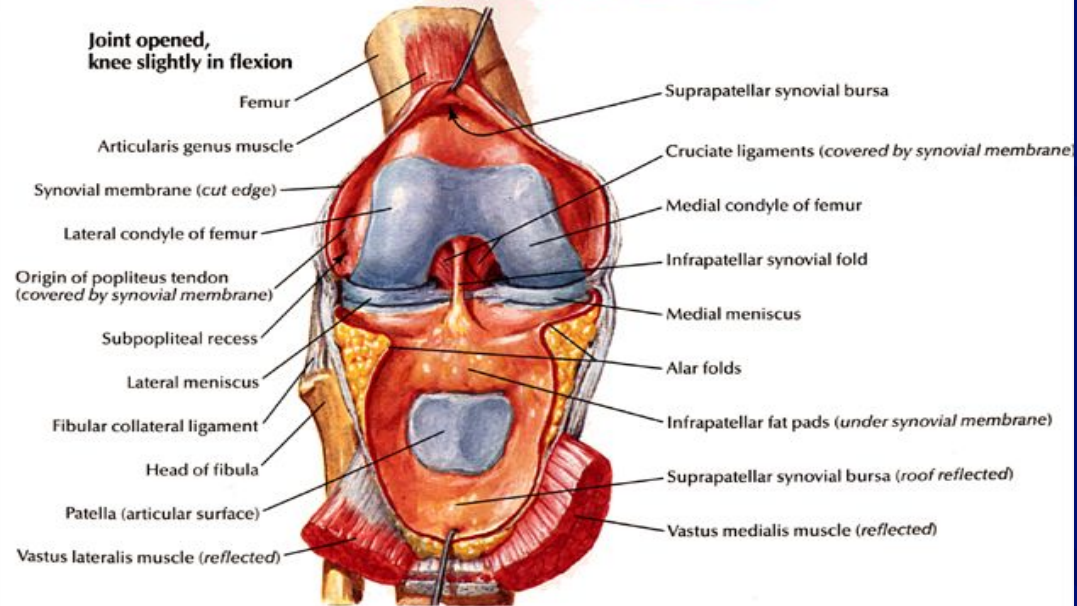
- Not a hinge joint
- 6 degrees of freedom
- Flexion/Extension
- Rotation
- Translation



**Right knee in extension**

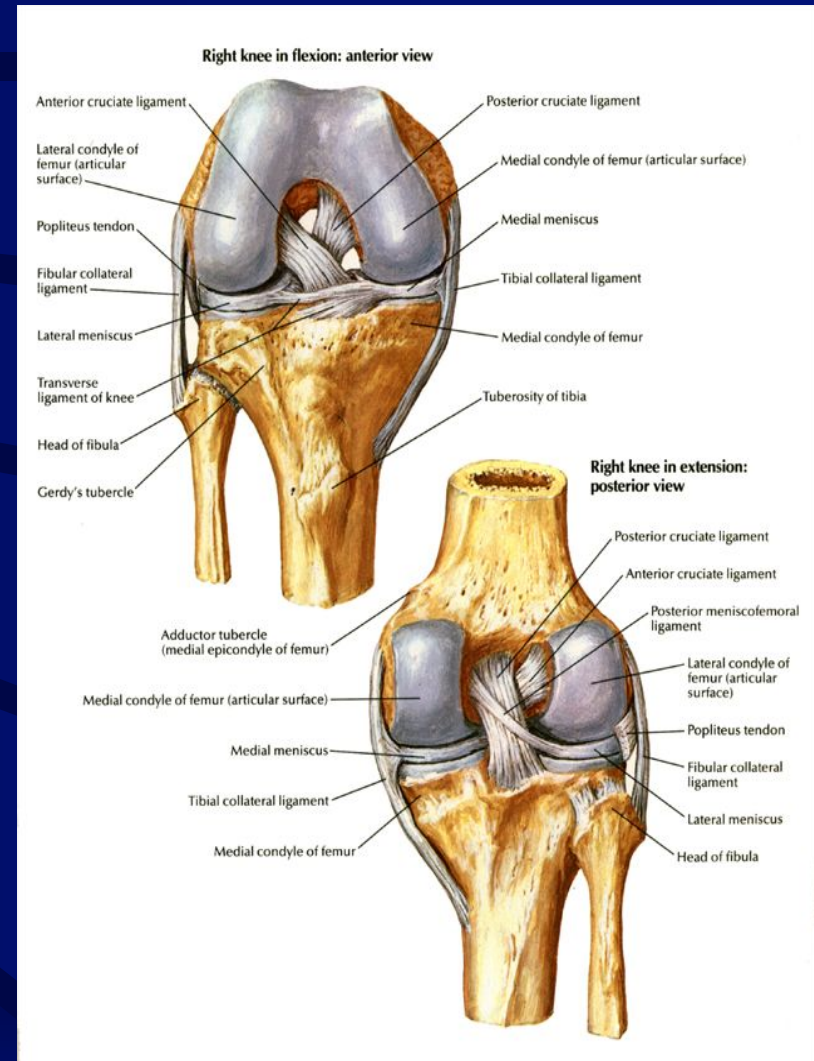


**Joint opened, knee slightly in flexion**

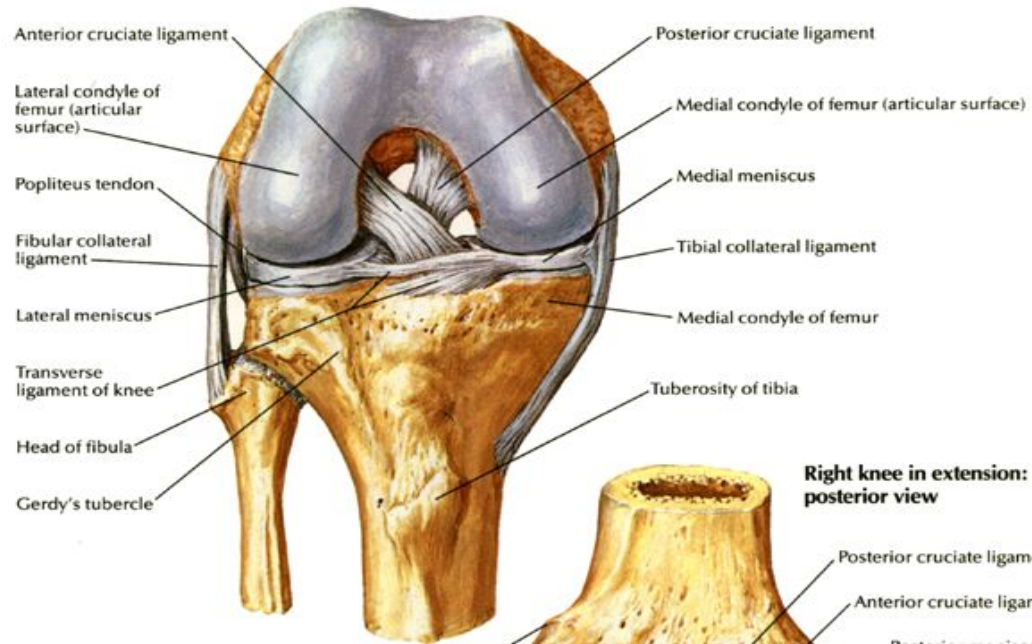


# Anatomy

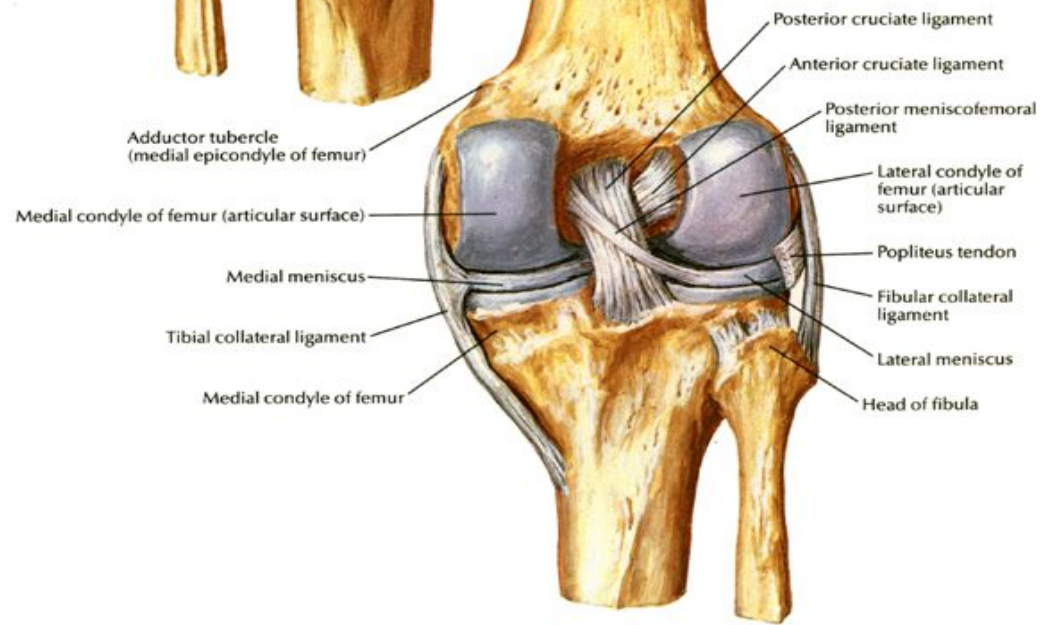
- Three Compartments
- Proximal Tib/Fib Joint
- Has not fully adapted
- Patella a sesamoid?



**Right knee in flexion: anterior view**

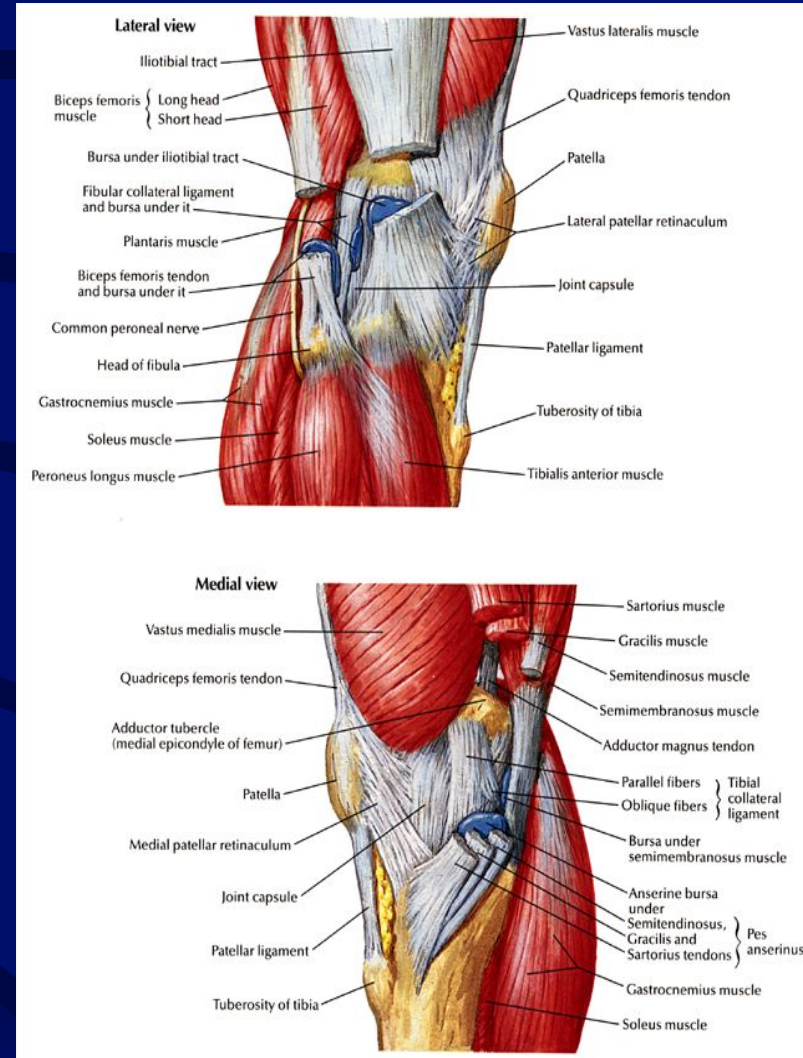


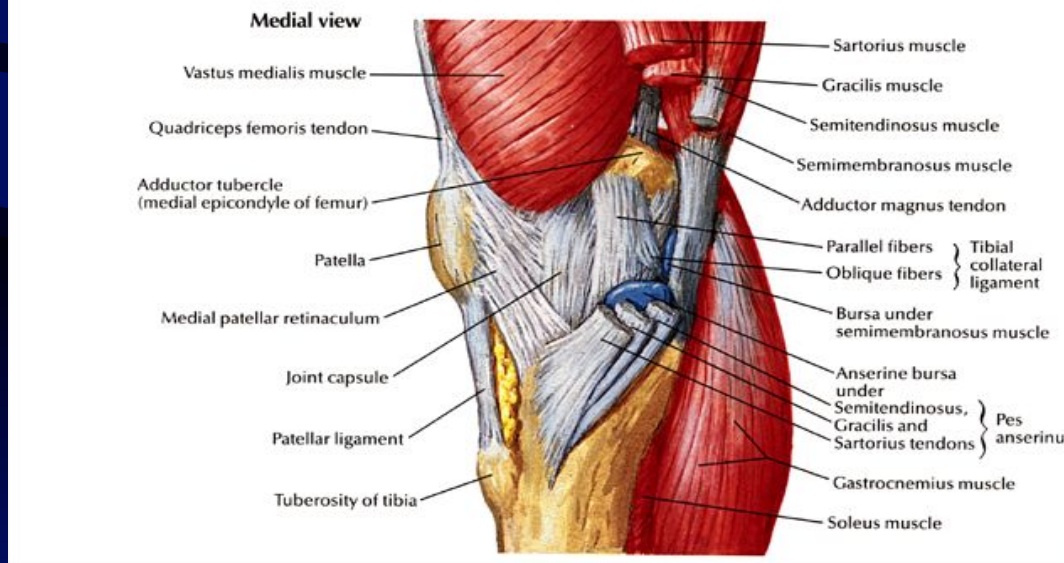
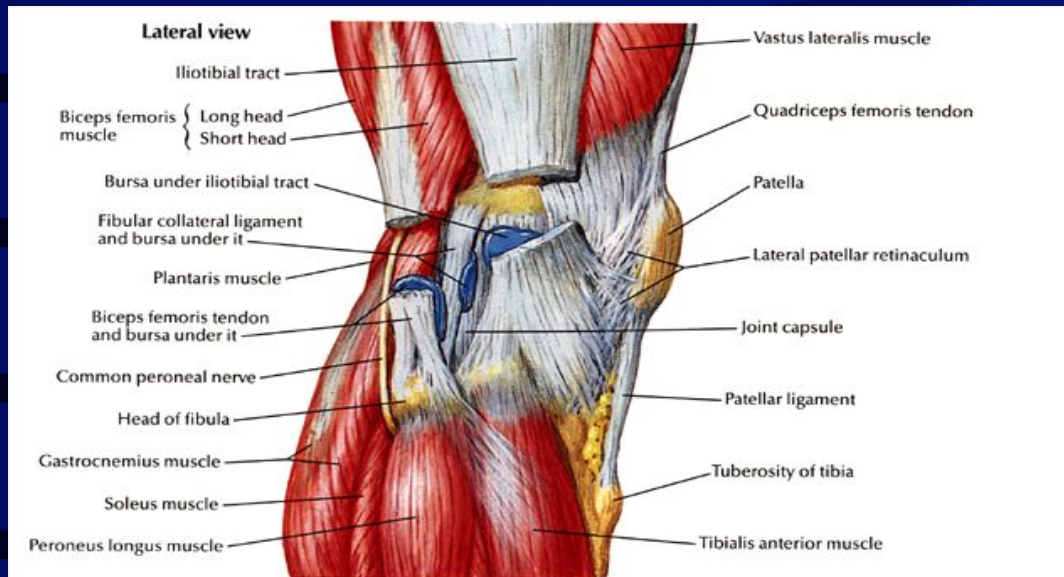
**Right knee in extension: posterior view**



# Muscles

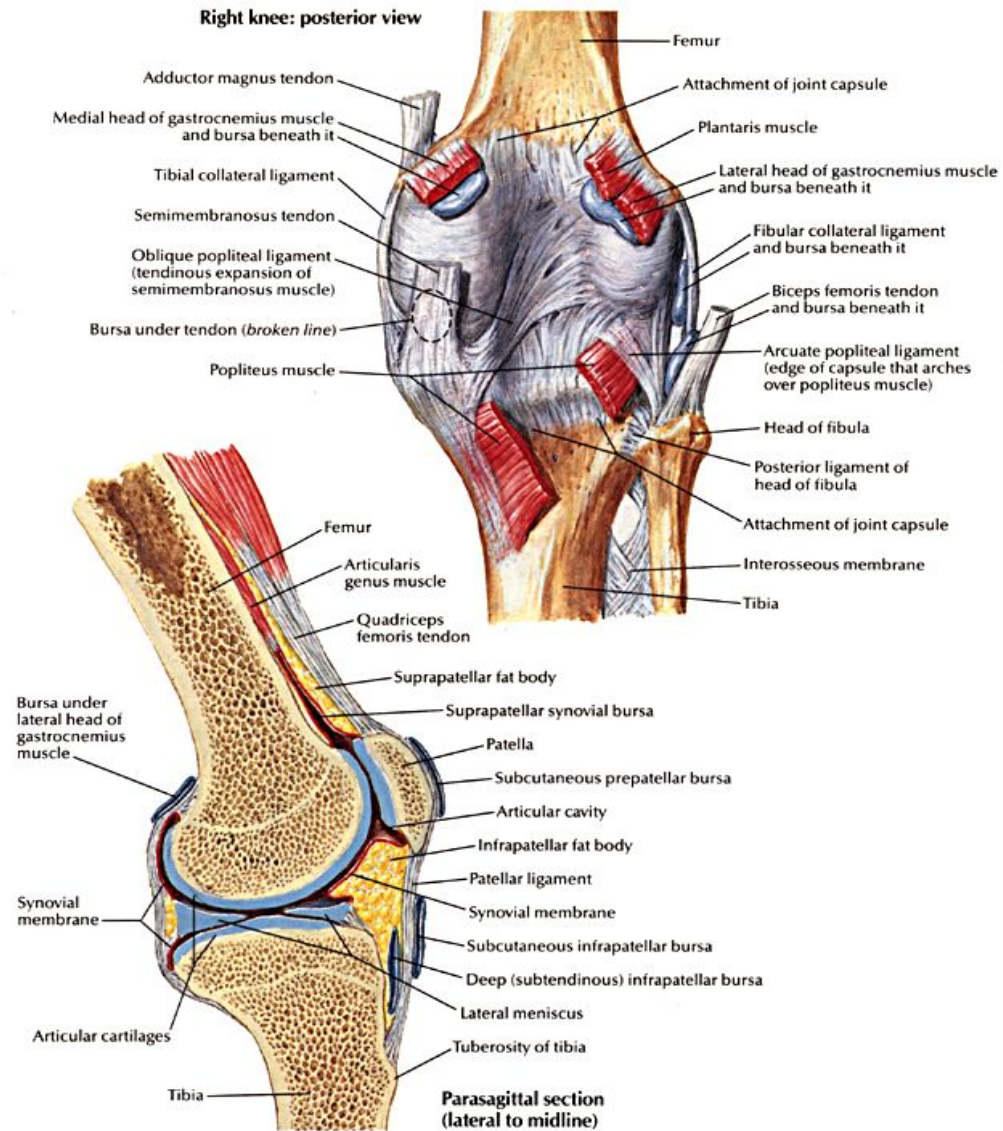
- Quadriceps
- Hamstrings
- IT Band/Tract
- Popliteus







**Right knee: posterior view**

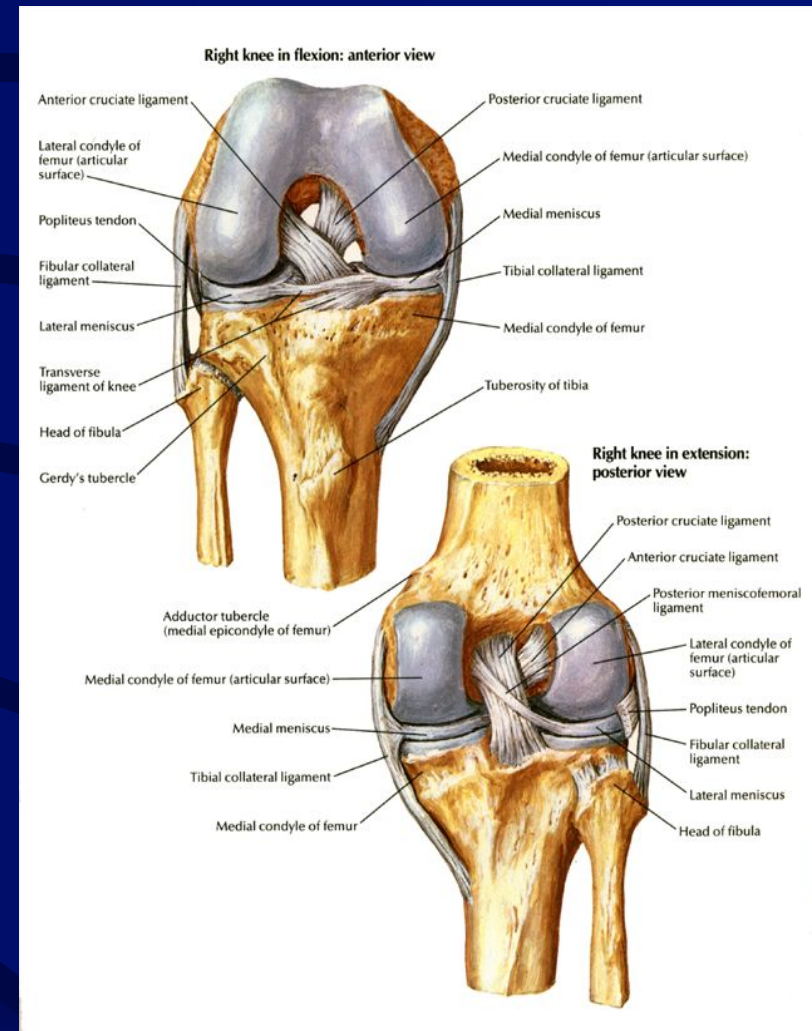


# Neurovascular Structures

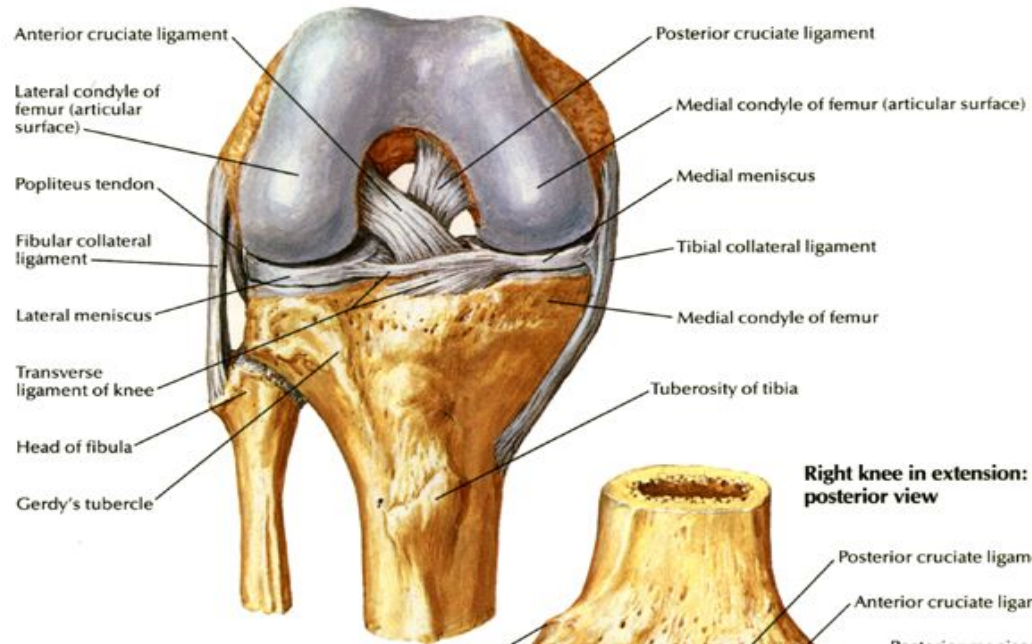
- Posterior Tibial Artery
- Tibial Nerve
- Peroneal Nerve
- Saphenous Nerve

# Menisci Anatomy

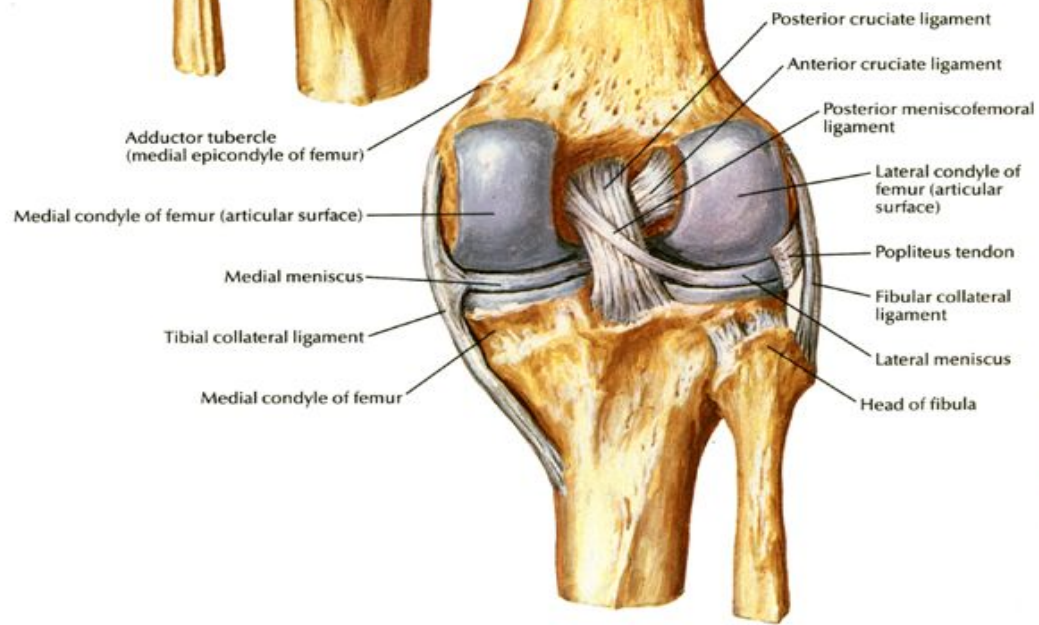
- Zones
- Ultrastructure
- Intermeniscal ligament
- Coronary ligament
- Mensicofemoral ligaments



**Right knee in flexion: anterior view**



**Right knee in extension: posterior view**

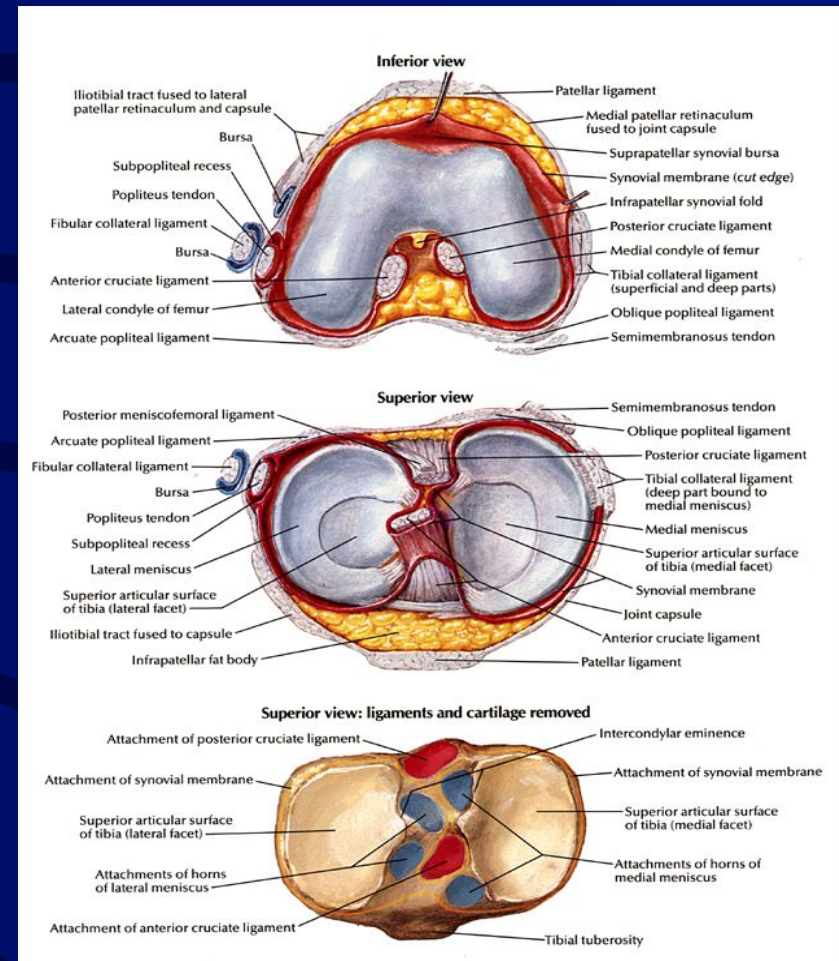


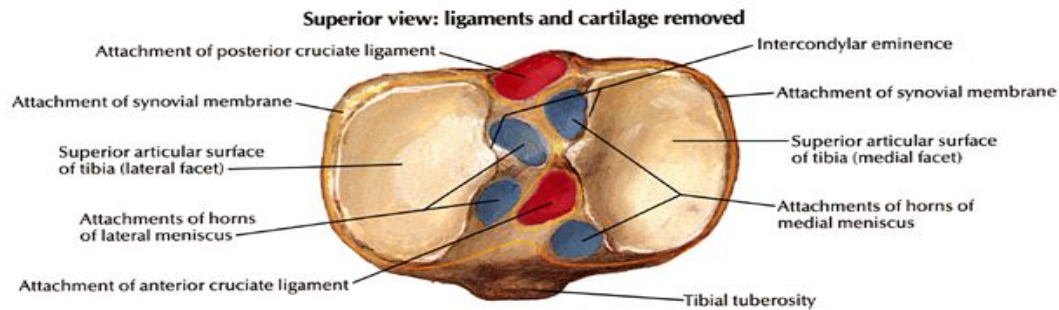
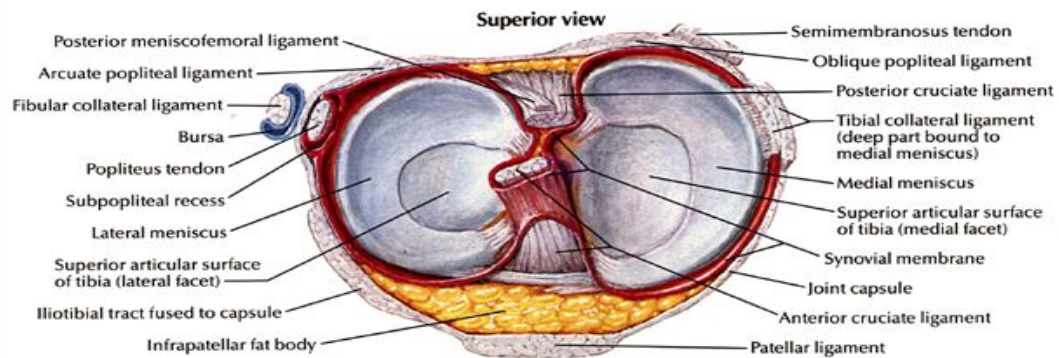
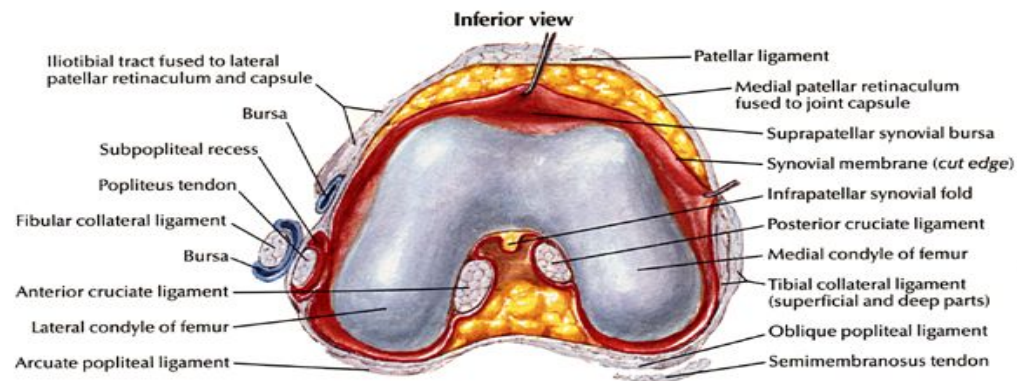
# Role of Menisci

- Biomechanics “Shock Absorbers”
- Load Transmission
  - 50% in extension, 85% in 90 flexion
- Partial Meniscectomy (15-34%) increases contact pressure 350% !

# Meniscal Functions

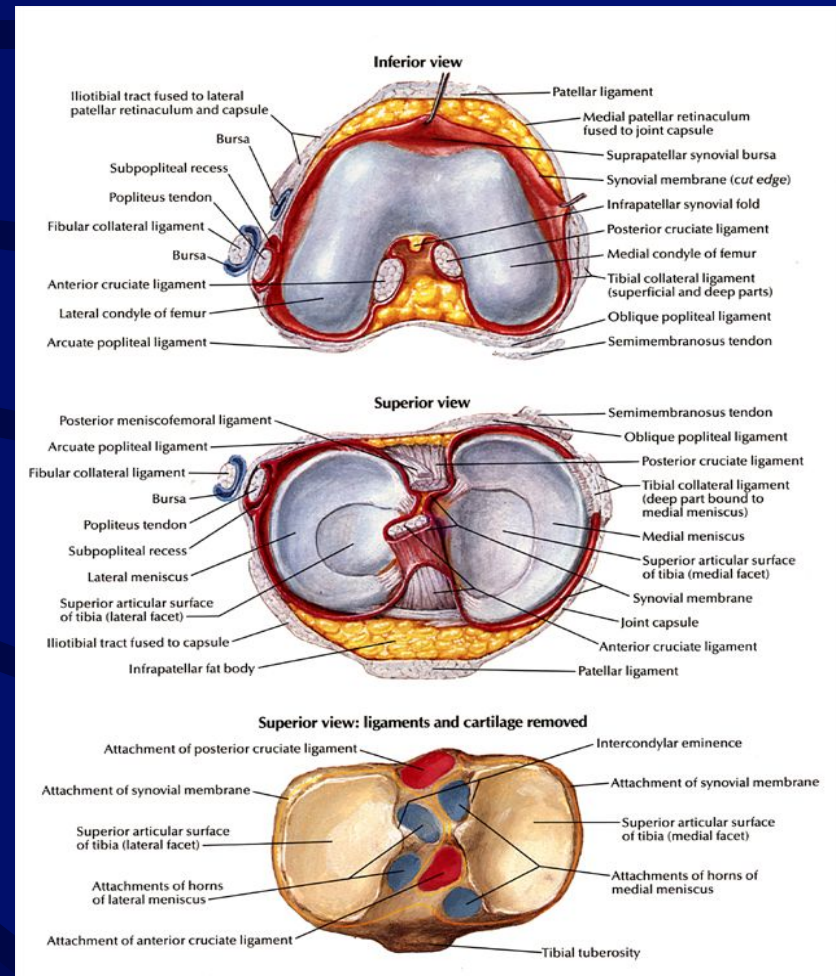
- Increase congruity  
= Stability
- Proprioception



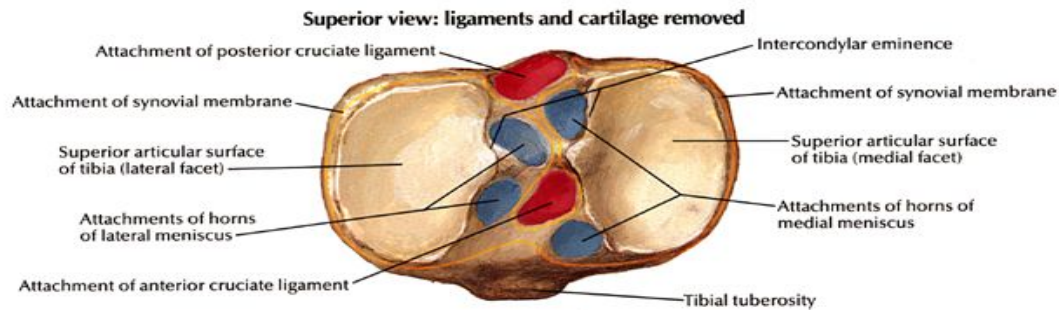
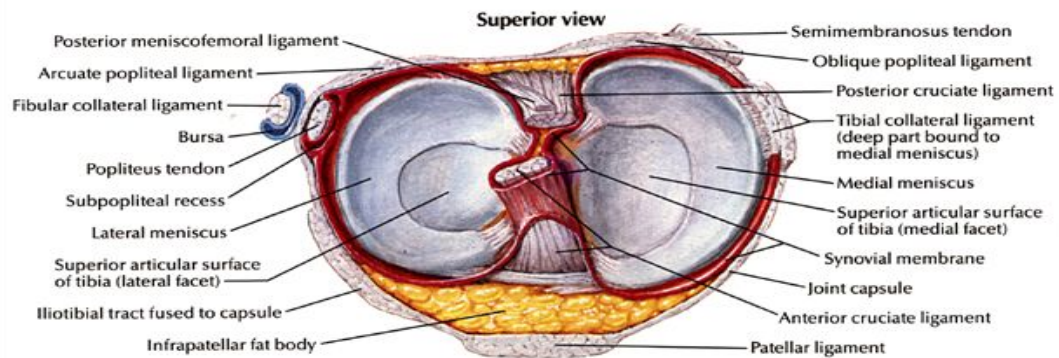
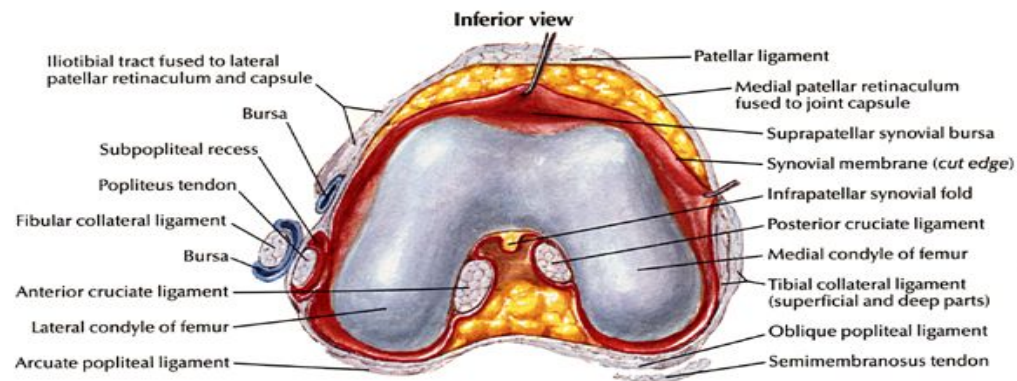


# Medial Meniscus

- C-shaped
- Wider posteriorly
- More commonly torn
- Restraint to anterior translation





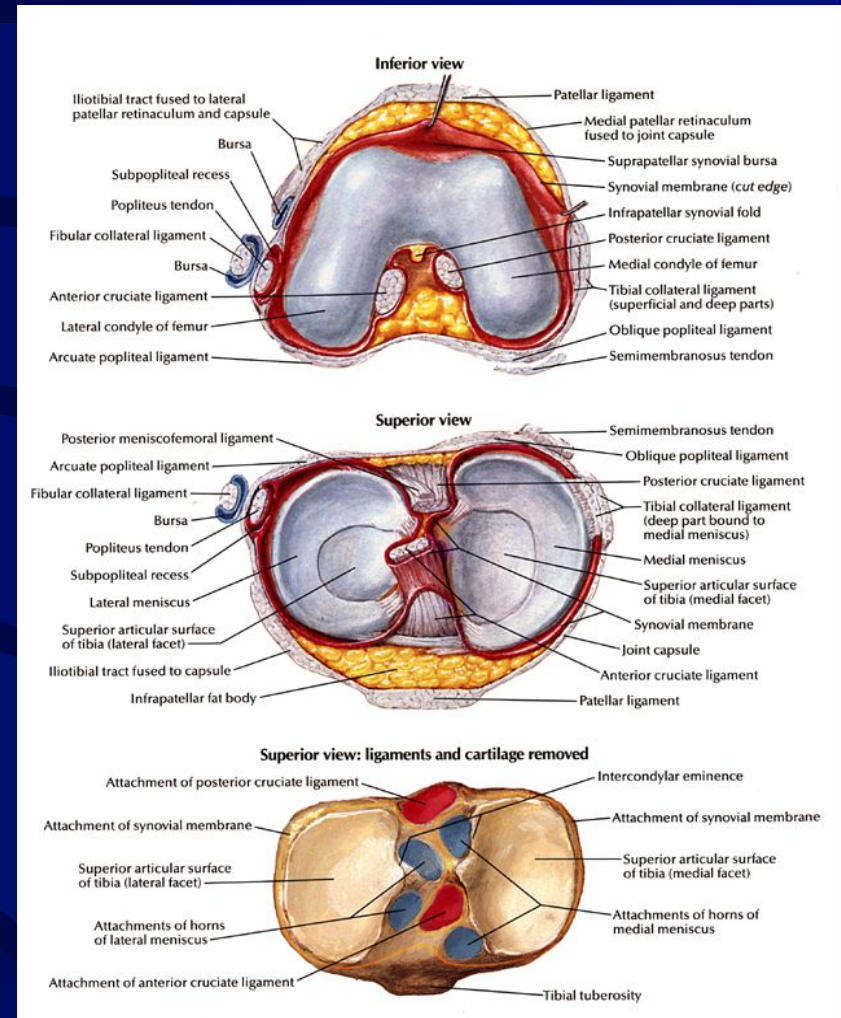


# Medial Compartment



# Lateral Meniscus

- More Discoid
- Popliteal Hiatus
- More difficult to repair
- Worse prognosis

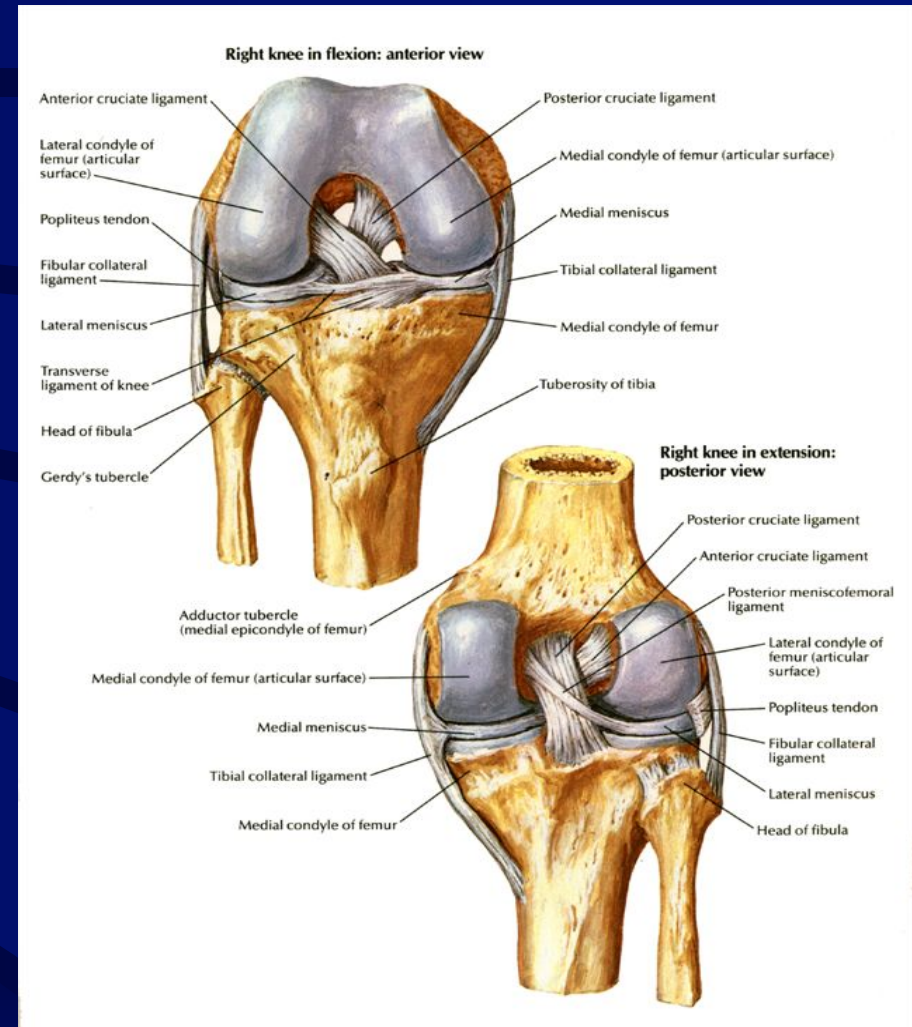


# Lateral Compartment

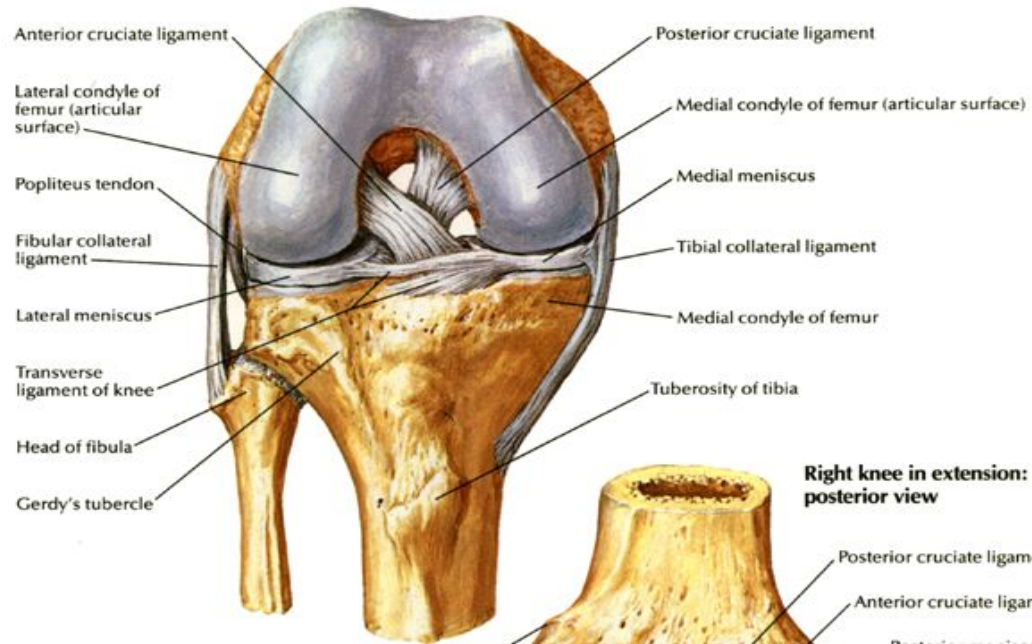


# ACL

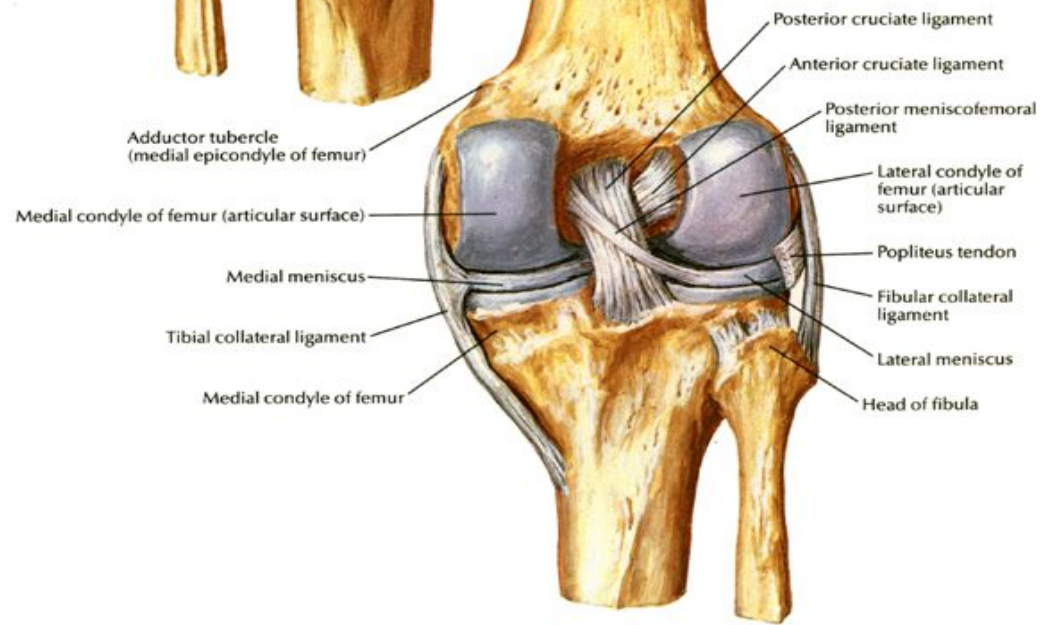
- Anteromedial Tibia to Posterolateral Notch
- Primary Restraint to Anterior Translation
- Bundles/Fiber Regions AM, PL
- Reciprocal tightening
- Isometry, Physiometry



**Right knee in flexion: anterior view**

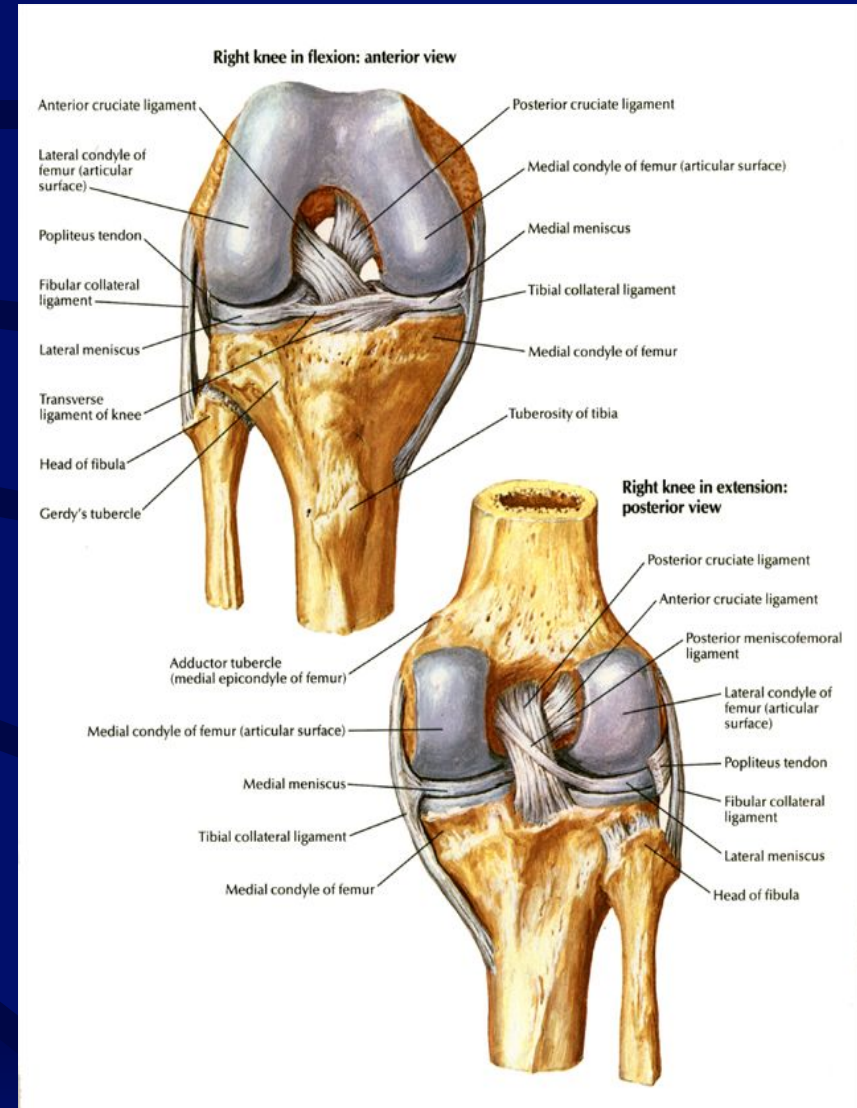


**Right knee in extension: posterior view**

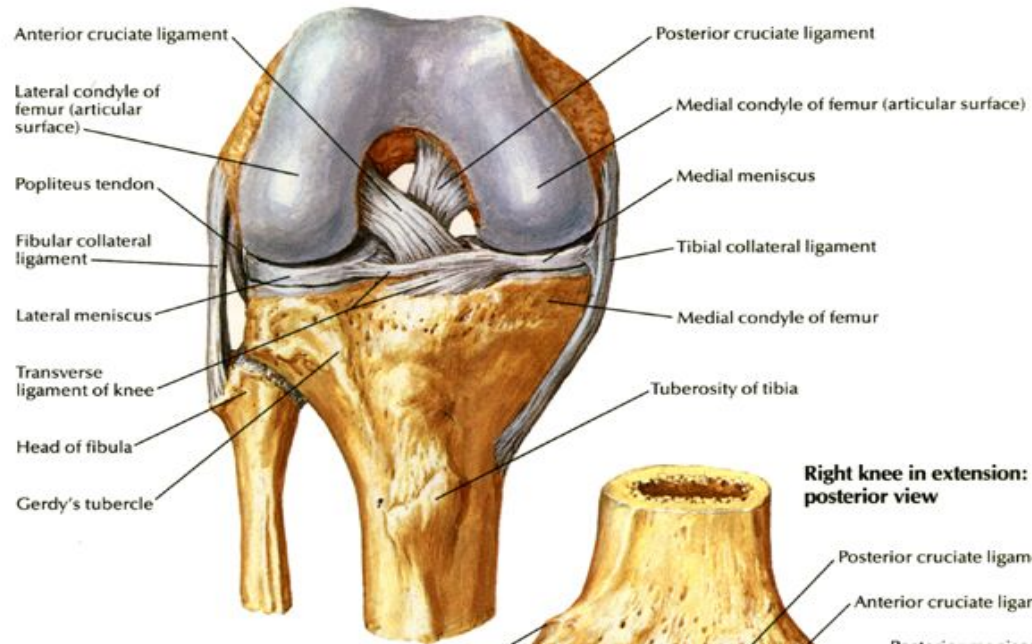


# PCL

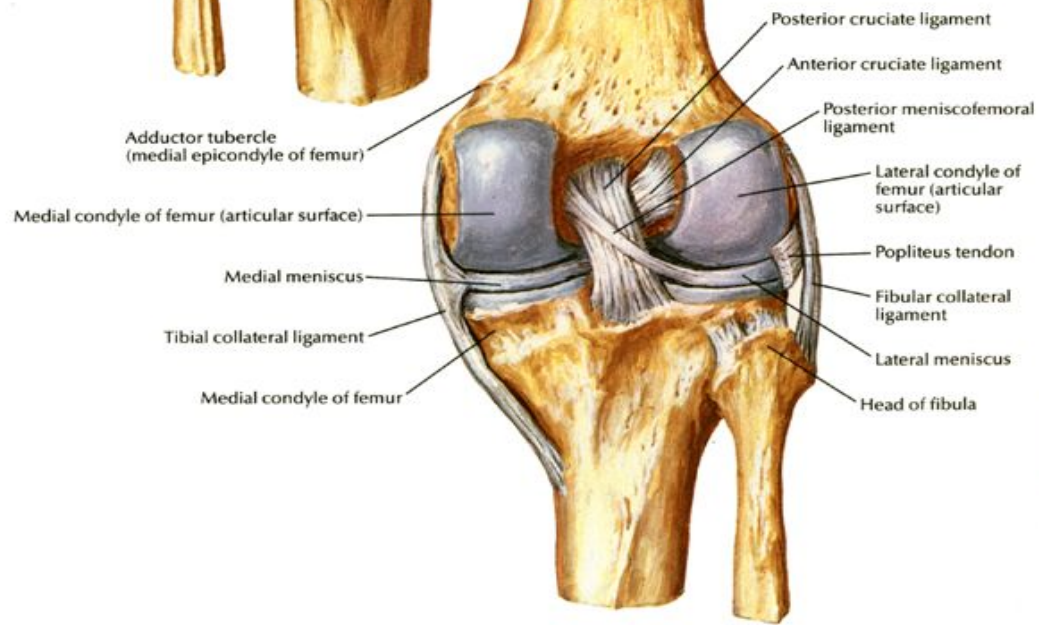
- Anterolateral Femur to *posterior* tibia
- Primary restraint to posterior translation
- Intimate with ACL
- Better blood supply and synovial sheath
- Bundles AL, PM
- Much broader origin



**Right knee in flexion: anterior view**



**Right knee in extension: posterior view**





# Normal PCL and ACL



# Posterolateral Corner

- Popliteus
- Arcuate Complex
- LCL/fibular collateral
- Lateral Head of Gastrocnemius
- Restraint to ER at 30 degrees

# Collaterals

- MCL 2 components
- Deep portion intimate with MM
- LCL
- Varus/Valgus at 30 degrees

St. Mary's MRI Center  
S... .. F RIGHT KNEE  
ID: 223-86-2568  
06 MAY 99 12:42  
16650 D

W:1042  
L:483  
Z:100  
P: +0.0 cm  
+0.0 cm



R

SE.  
TE: 16.0  
TR: 650  
FOV: 17.0  
THCK: 4.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
00:04:09  
NSA: 2  
SAR: 0.07

F

74.8 R  
16.4 A  
30.2 H  
ECHO: 1/1  
SLICE: 10/18

St. Mary's MRI Center

YR F RIGHT KNEE

ID: 223-86-2568  
06 MAY 99 12:42  
16850 D

W: 1063  
L: 443  
Z: 100  
P: -0.0 cm  
+0.0 cm



R

F

SE.  
TE: 16.0  
TR: 650  
FOV: 17.0  
THCK: 4.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
00:04:09  
NSA: 2  
SAR: 0.07

74.8 R  
1.4 A  
30.2 H  
ECHO: 1/1  
SLICE: 7/18

# Anatomy

- Patellofemoral joint
- Medial Patellofemoral Ligament
- Retinaculum



# Assessment

- History not MRI most important
- Mechanism
- Locking, Catching, Giving Way
- Swelling?
- Plain Films



# Assessment

- Inspection
  - Effusion
  - Ecchymosis
  - Attitude

# Assessment

- ROM
- NV Check
- Joint Line Tenderness
- Stability

# ACL

- Lachman “Gold Standard” watch medial tibia
- Anterior Drawer
- Pivot Shift (lateral tibia)
- Pivot Glide

# PCL

- Posterior Drawer (Knee at 90)
- Quads Active
- Godfrey Test (Sag Sign)
- Reverse Pivot Shift
- Pivot Jerk
- Grades

# Posterior Drawer



# Posterolateral Corner

- Posterolateral Drawer
- External Rotation Recurvatum
- External Rotation at 30 and 90
- Prone ER at 90 and 30

# Collaterals

- Test at 30
- Palpate LCL in figure 4

# Menisci

- Joint Line Tenderness
- MacMurray's
- Duck Walk
- Squat

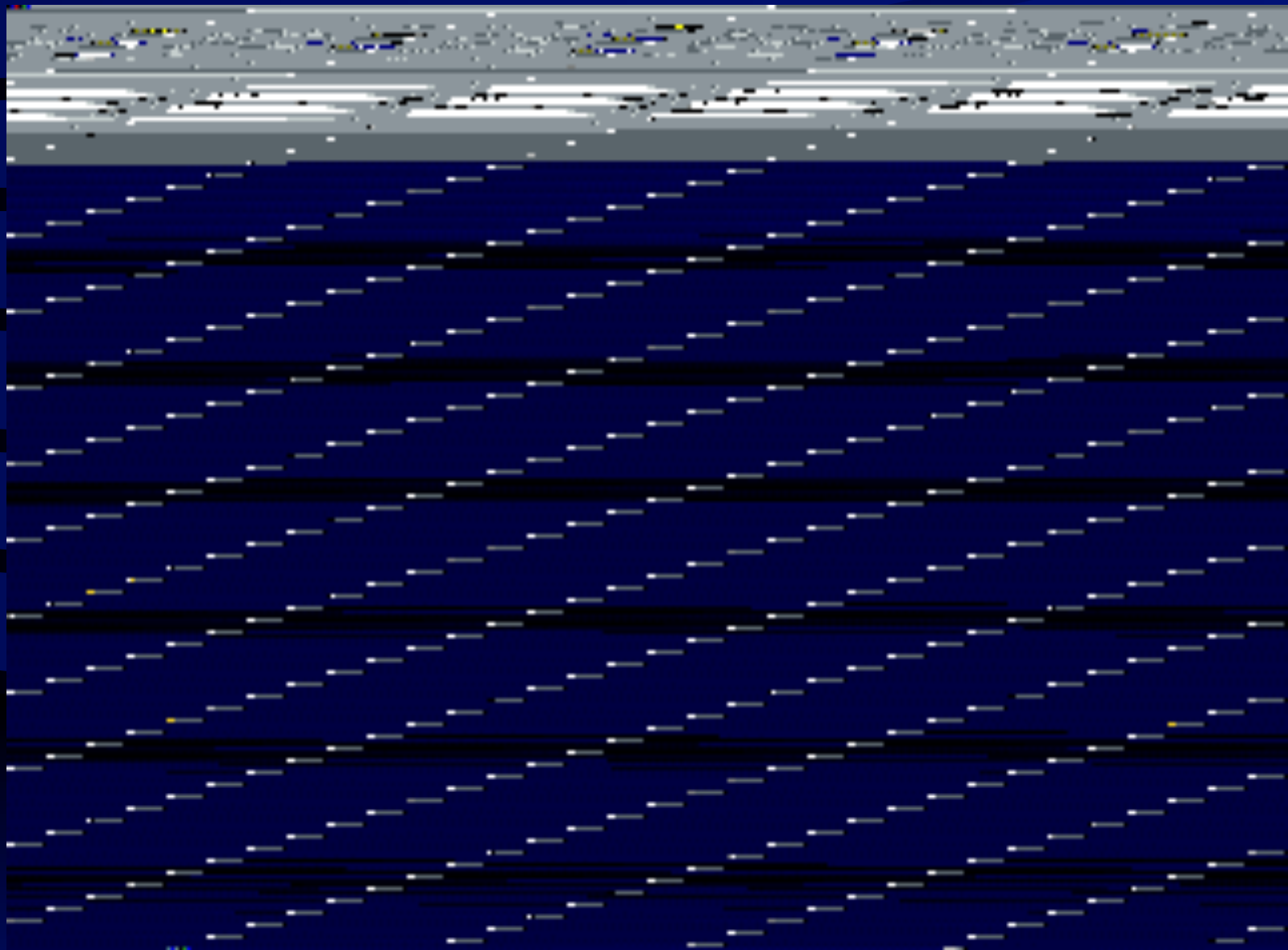


# Patellofemoral Joint

- Patellar Glide
- Patellar Inhibition
- Patellar Tracking

# Don't Miss Obvious

- Extensor Rupture
- Fracture
- Knee Dislocation
- Physeal Fracture



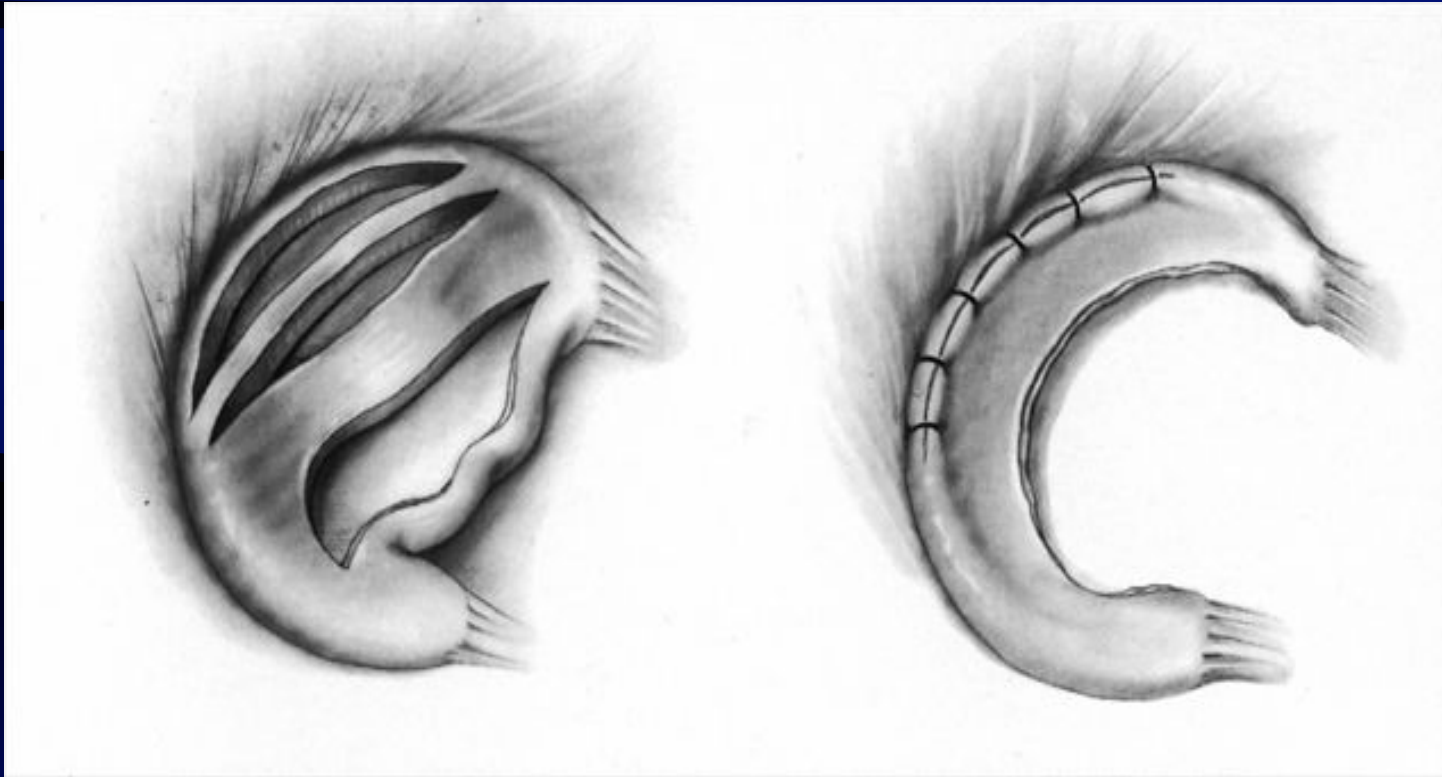
# Arthroscopy

- Systematic
- Standard Portals
- Pump

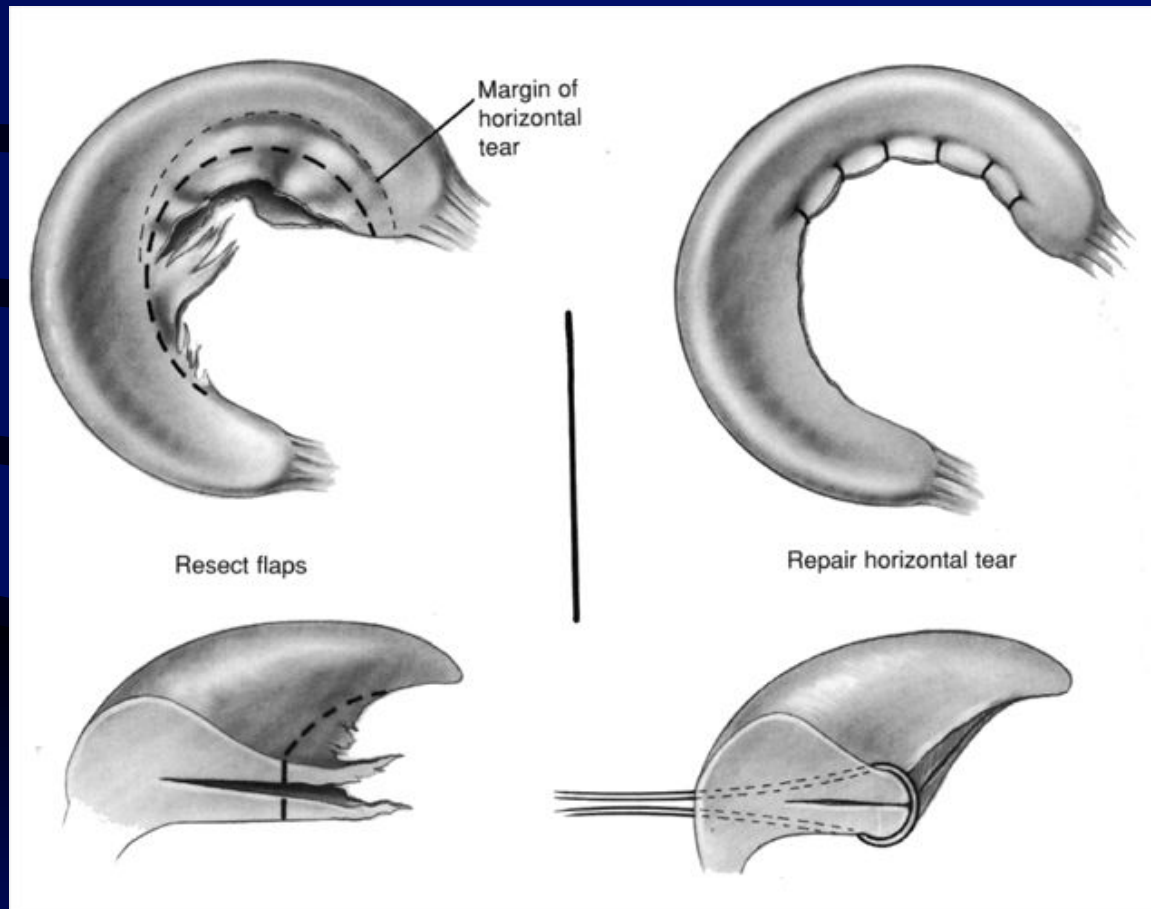
# Meniscus

- Zones
- Tear Types
- Biomechanics
- Meniscectomy, Repair, Replacement

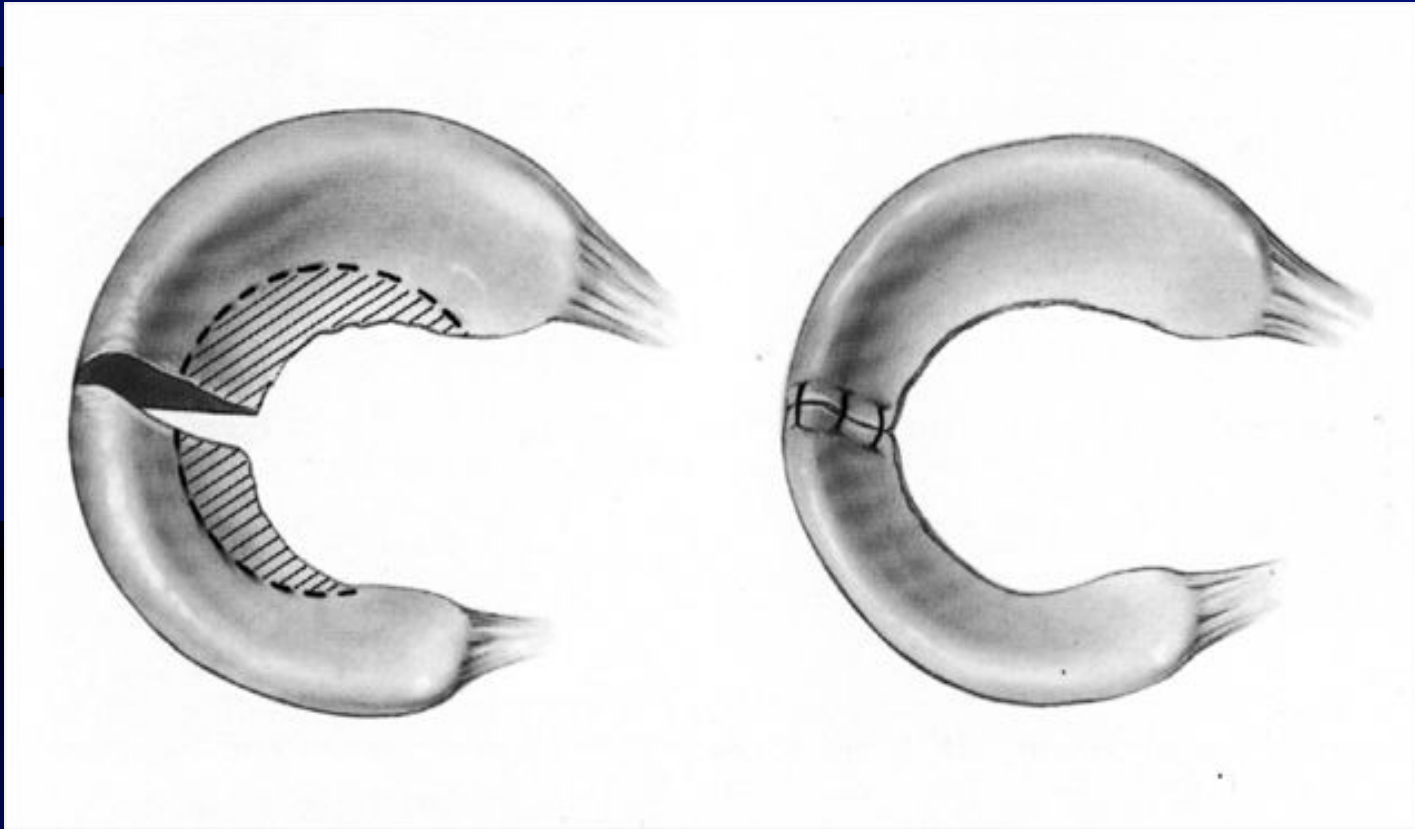
# Bucket Handle Tear



# Horizontal Tear

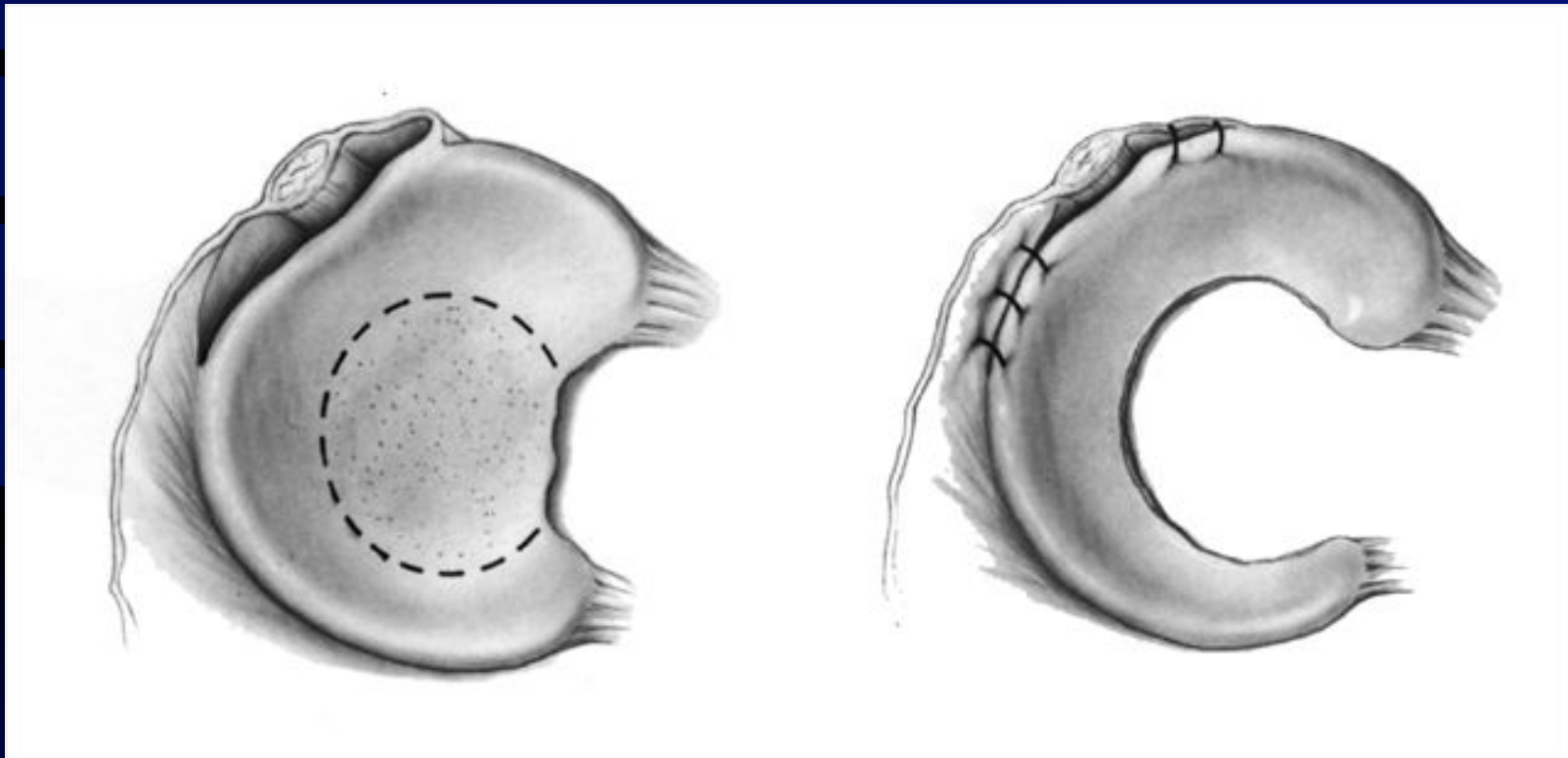


# Radial Tear





# Discoid Meniscus



# ACL

- Non contact
- Gives way
- Immediate swelling
- Bloody effusion

# ACL

- Why fix it? (meniscus and djd, lifestyle)
- Endoscopic one incision
- Tension at 30 or full extension
- Allo or autograft
- Hamstrings, Achilles, BTB, Fascia Lata
- Fixation
- Return to sports 6 months

# ACL Basic Science

- Native ACL 2700 newtons
- ACL graft completely replaced
- 30-50% strength of native ACL after incorporation

# ACL Complications

- Tunnel Placement
- Loss of fixation
- Loss of motion
- Patellofemoral pain
- Surgeon Dependent

# PCL

- Dashboard Injury
- Blow to anteromedial tibia
- Hyperflexion
- Usually combined with PL corner

# PCL

- Many techniques (2 bundle femur)
- Indications - symptoms of functional instability
- Tension at 90 degrees

# Posterolateral

- Primary Repair (early)
- Split Biceps (Clancy)
- Semitendinosus figure 8
- Hughston Imbrication



# Chondral Defects

- Chondroplasty
- Microfracture (Steadman)
- Osteochondral Transplant (Hair plugs)
- Carticel

# Meniscus Repair

- Inside-out, Outside-in, All-inside
- Fibrin Clot
- Arrows, Darts, Screws
- Heal faster with ACL

# Meniscal Allograft

- Patients with early disease (Grade I-II)
- Technically challenging
- Expensive
- Patients must undergo change in lifestyle



# Meniscus Rehab

- Meniscectomy: none
- Repair: WBAT in full extension 6 weeks

# ACL Rehab

- Hinged Knee Brace
- WBAT in full extension
- Crutches

# ACL Rehab

- Decrease swelling
- Full extension
- Quad Control
- Patellar Mobilization

# ACL Rehab

- Closed chain
- Co-Contraction



# ACL

- Cycling
- Stairmaster
- Straight ahead Jogging
- Return to cutting sports 6-9 months
- (Jerry Rice 3 months = Patella Fracture)

# Braces

- No evidence of increased proprioception
- Can't protect ligament
- Patients expect them

# Braces

- Cti
- Donjoy Defiance
- Playmaker
- Townsend
- Richards
- Breg

# Extensor Realignment

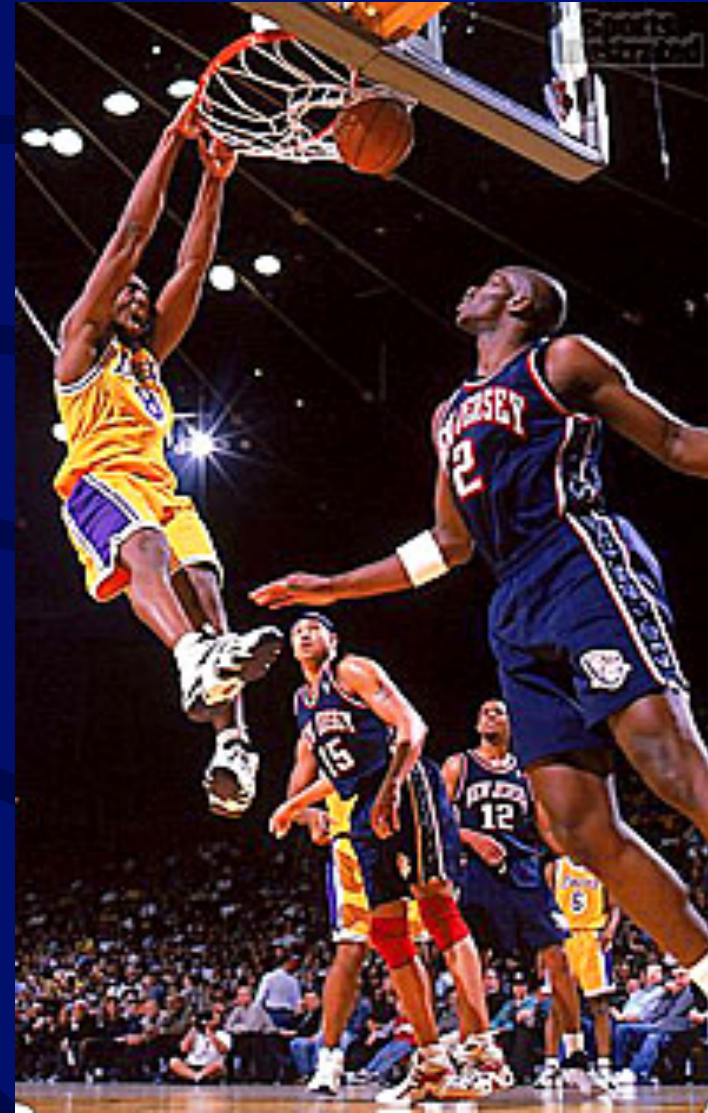
- Very Controversial
- Lateral Release
- Proximal Imbrication (Insall)
- Maquet
- Elmslie-Trillat
- Hauser
- Roux-Goldthwait
- Fulkerson

# Fulkerson

- Anteromedialization
- Complications

# Case Study

- 23 y.o. male playing basketball
- Varus injury
- Fibular head fracture
- Peroneal nerve palsy



St. Mary's MRI Center  
) 43M RIGHT

ID: 227-80-1699  
23 OCT 98 17:48  
14125 F

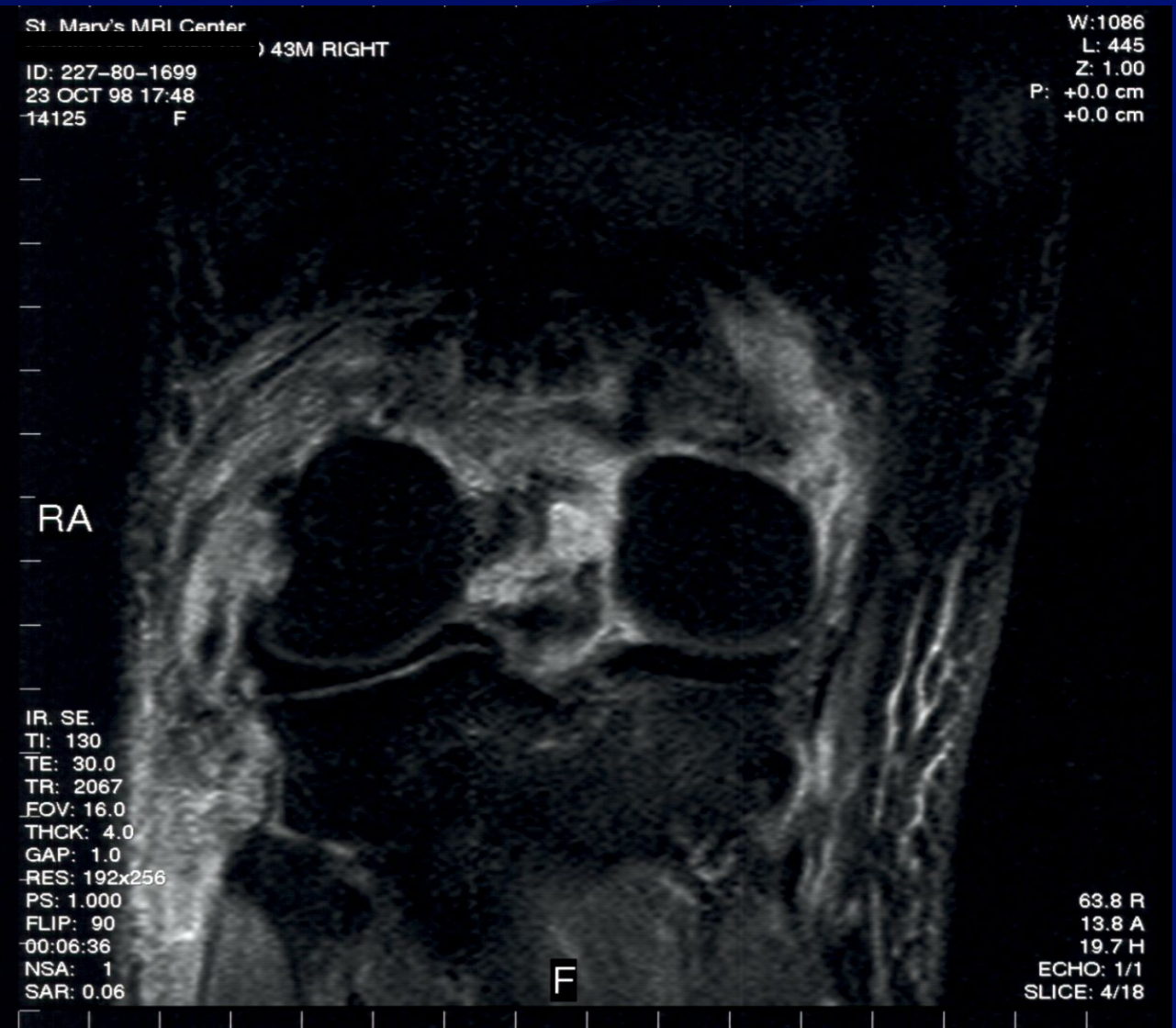
W:1086  
L: 445  
Z: 1.00  
P: +0.0 cm  
+0.0 cm

RA

IR. SE.  
TI: 130  
TE: 30.0  
TR: 2067  
FOV: 16.0  
THICK: 4.0  
GAP: 1.0  
RES: 192x256  
PS: 1,000  
FLIP: 90  
00:06:36  
NSA: 1  
SAR: 0.06

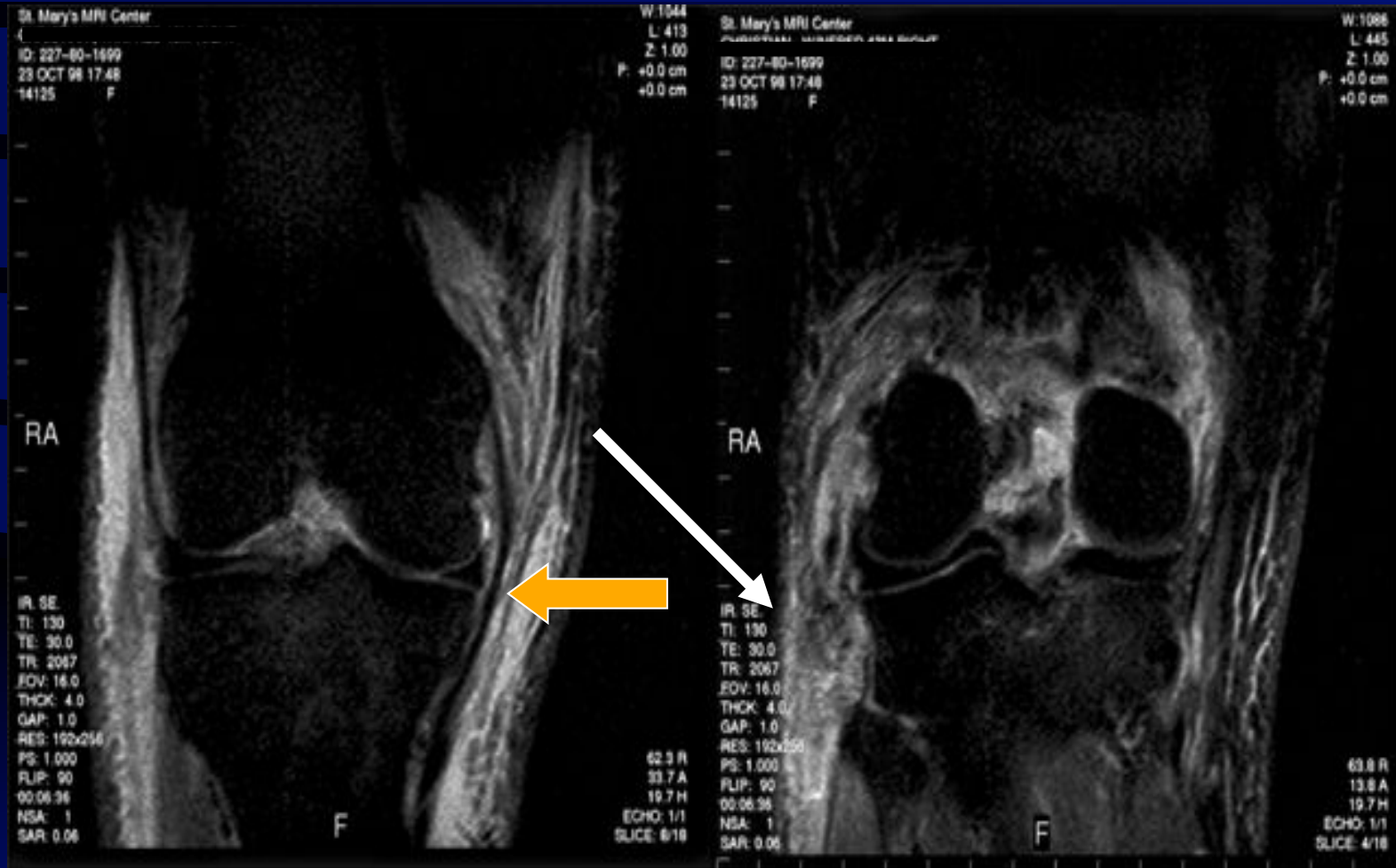
F

63.8 R  
13.8 A  
19.7 H  
ECHO: 1/1  
SLICE: 4/18



# MCL

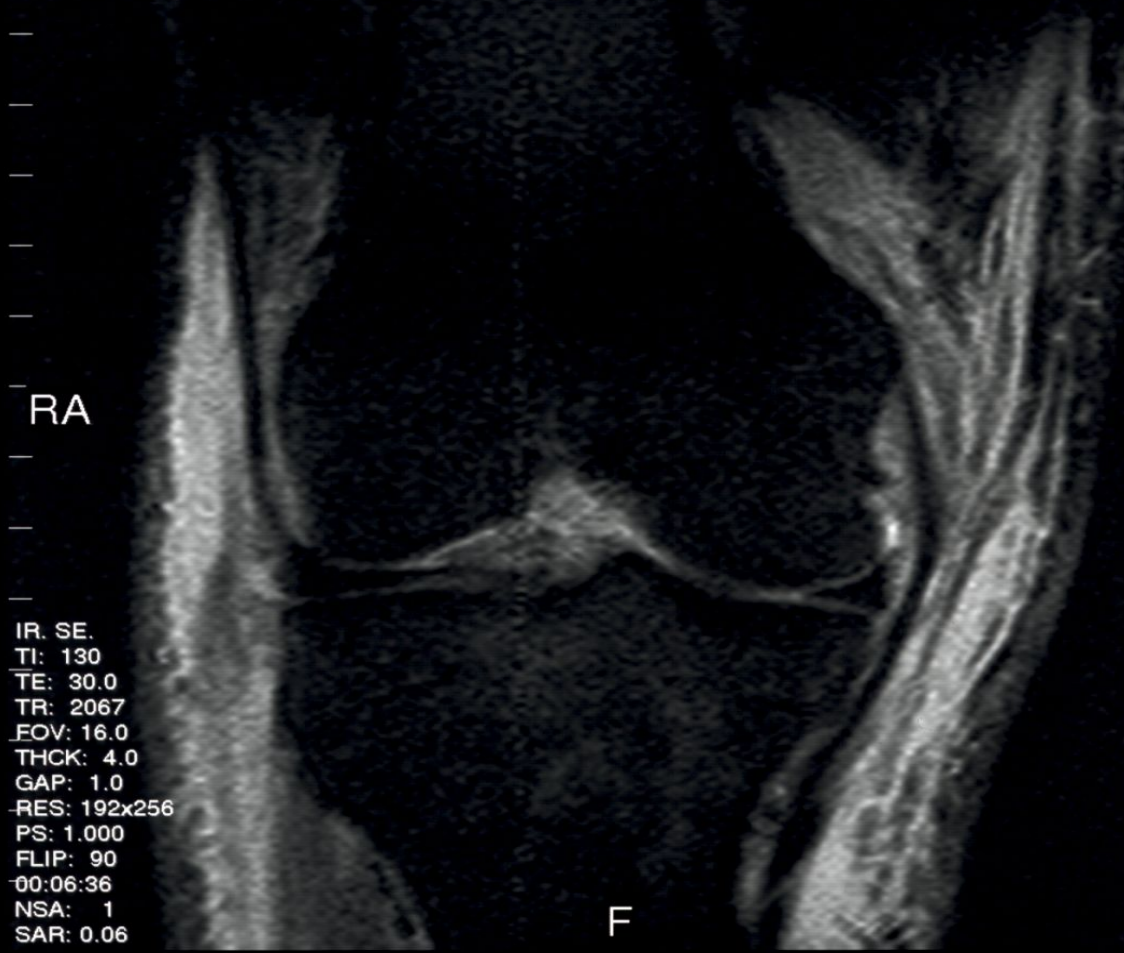
# PLC





St. Mary's MRI Center  
ID: 227-80-1699  
23 OCT 98 17:48  
14125 F

W:1044  
L: 413  
Z: 1.00  
P: +0.0 cm  
+0.0 cm



IR, SE.  
TI: 130  
TE: 30.0  
TR: 2067  
FOV: 16.0  
THICK: 4.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
00:06:36  
NSA: 1  
SAR: 0.06

62.3 R  
33.7 A  
19.7 H  
ECHO: 1/1  
SLICE: 8/18

St. Mary's MRI Center  
ID: 227-80-1699  
23 OCT 98 17:55  
14125 G

W: 922  
L: 385  
Z: 1.00  
P: +0.0 cm  
+0.0 cm

AL

SE:  
TE: 80.0  
TR: 2500  
FOV: 15.0  
THICK: 3.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
DD: 08:00  
NSA: 1  
SAR: 0.09

75.8 R  
24.9 A  
21.1 H  
ECHO: 2/2  
SLICE: 9/21

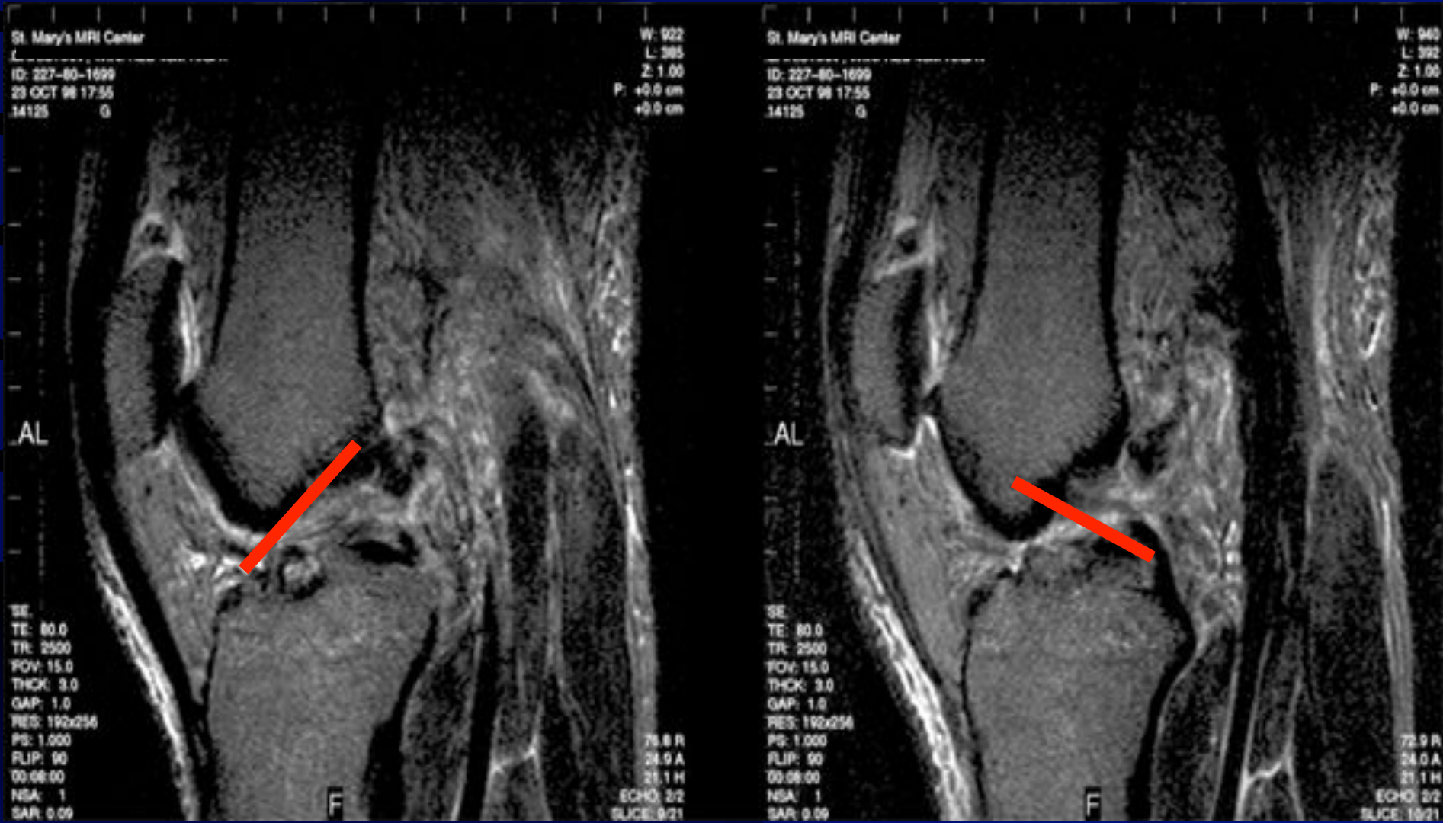
St. Mary's MRI Center  
ID: 227-80-1699  
23 OCT 98 17:55  
14125 G

W: 940  
L: 392  
Z: 1.00  
P: +0.0 cm  
+0.0 cm

AL

SE:  
TE: 80.0  
TR: 2500  
FOV: 15.0  
THICK: 3.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
DD: 08:00  
NSA: 1  
SAR: 0.09

72.9 R  
24.0 A  
21.1 H  
ECHO: 2/2  
SLICE: 10/21



# Normal PCL and ACL



St. Mary's MRI Center  
ID: 227-80-1699  
23 OCT 98 17:55  
14125 G

W: 940  
L: 392  
Z: 1.00  
P: +0.0 cm  
+0.0 cm

AL

SE  
TE: 80.0  
TR: 2500  
FOV: 15.0  
THICK: 3.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
00:08:00  
NSA: 1  
SAR: 0.09

69.0 R  
23.1 A  
21.1 H  
ECHO: 2/2  
SLICE: 11/21

F





St. Mary's MRI Center  
CHRISTIAN, WINFRED 43M RIGHT  
ID: 227-80-1699  
23 OCT 98 17:55  
14125 G

W: 940  
L: 392  
Z: 1.00  
P: +0.0 cm  
+0.0 cm

AL

SE.  
TE: 80.0  
TR: 2500  
FOV: 15.0  
THICK: 3.0  
GAP: 1.0  
RES: 192x256  
PS: 1.000  
FLIP: 90  
00:08:00  
NSA: 1  
SAR: 0.09

F

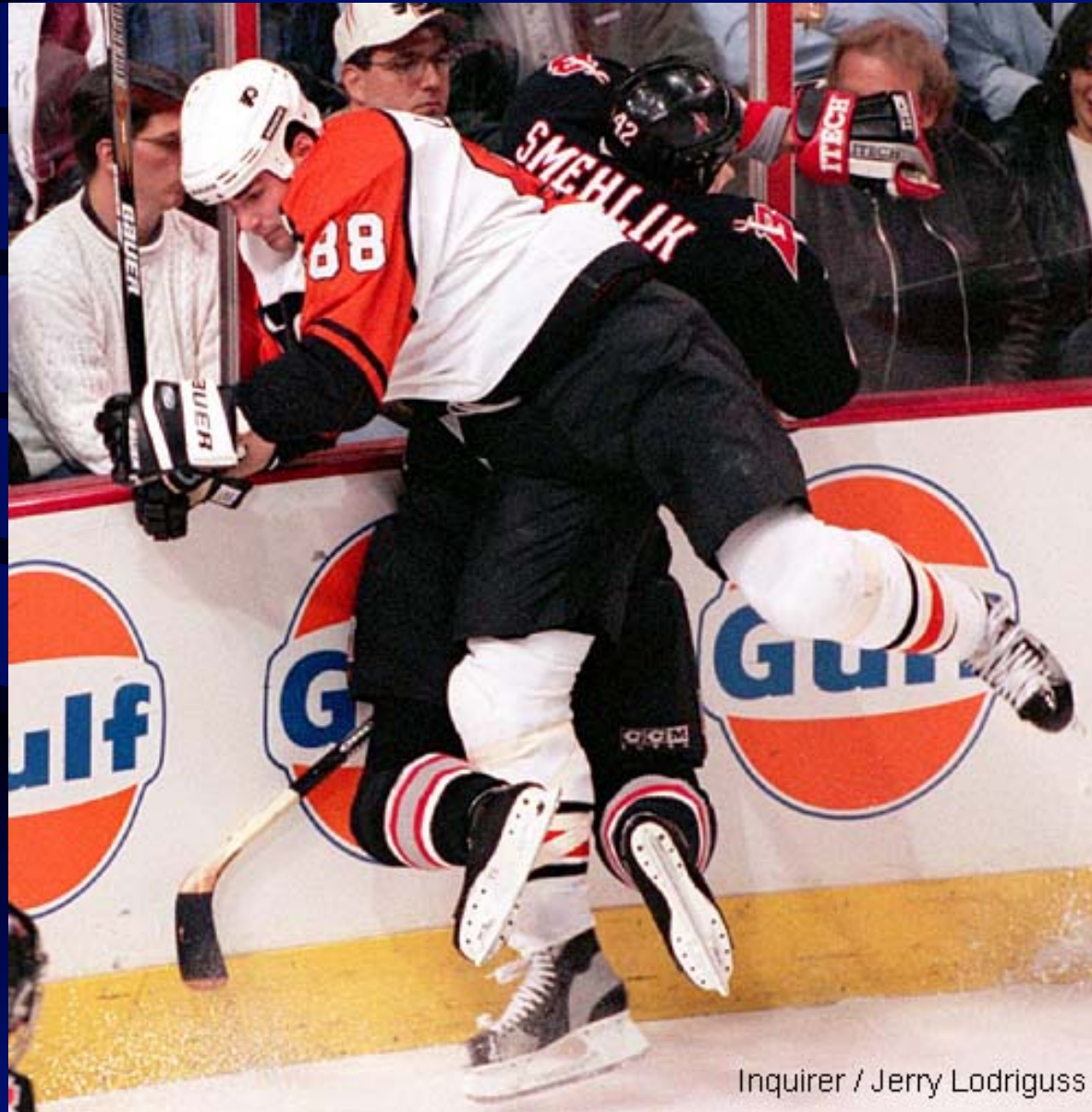
65.1 R  
22.2 A  
21.1 H  
ECHO: 2/2  
SLICE: 12/21



# The American Journal of Sports Medicine

The Official Publication of the American Orthopaedic Society for Sports Medicine

# Thank You



Inquirer / Jerry Lodriguss