Surgical Treatment of Meniscal Injuries

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SLMANA AGM
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Lenox Hill Hospital
North Shore-LIJ Health System

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Disclosures

- No Financial Disclosures to Report

Learning Objectives

- Describe functions, anatomy, and blood supply to the meniscus
- Describe what diagnostic studies can be done by any physician to aid in diagnosis of the Meniscal injury
- Describe how to implement non operative measures of treating meniscal injuries
- Describe the various surgical options of treating meniscal injuries

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Mechanism of Injury

- Pivoting/twisting – most commonly seen in acute meniscal tears in younger athletic patients
- Unable to recall injury – degenerative tears in older patients

Presentation

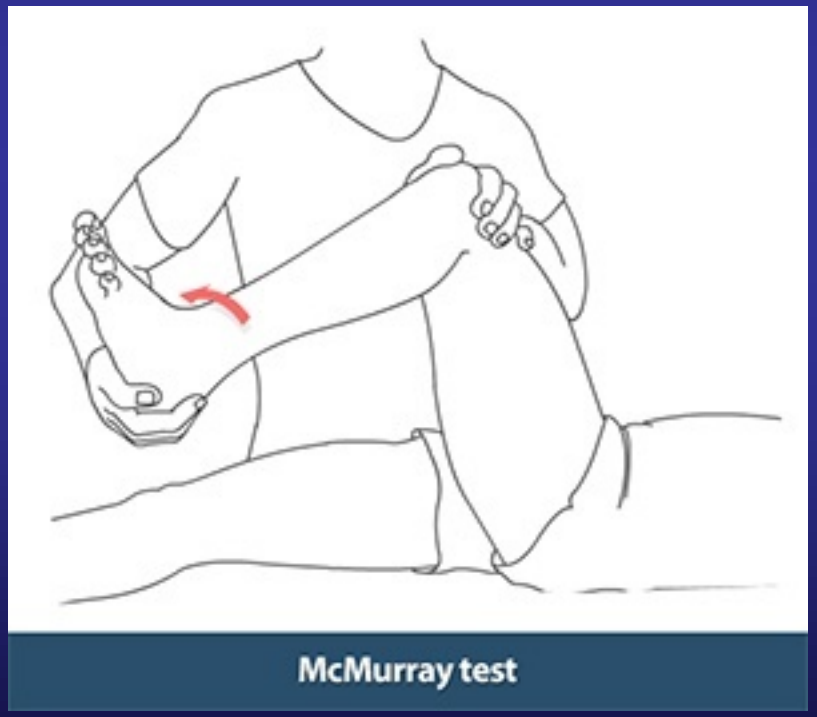
- Knee pain
- Clicking
- Locking
- Swelling/effusion

Differential Diagnosis

- ACL/PCL tear
- Contusions
- Medial Plica Syndrome
- MCL sprain
- Pes Anserine bursitis
- LS Spine radiculitis

Physical Exam

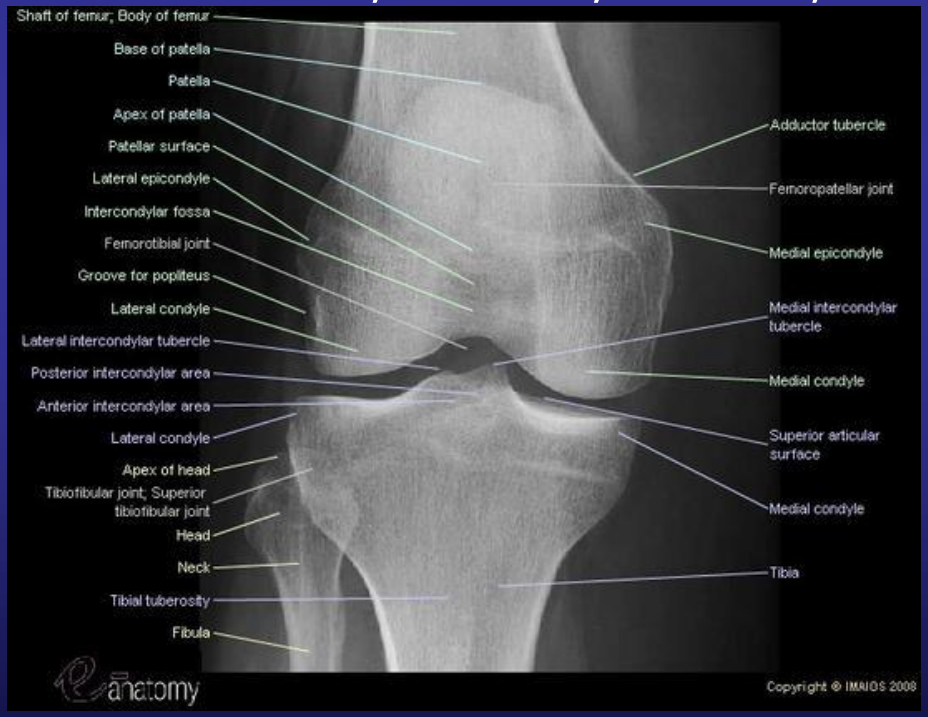
- Observation of effusion
- ROM
- Joint line pain
- McMurray test
- Steinman test



McMurray test

Diagnostic Tests

- Plain X-Rays
  - AP, Lateral, Tunnel, Merchant views



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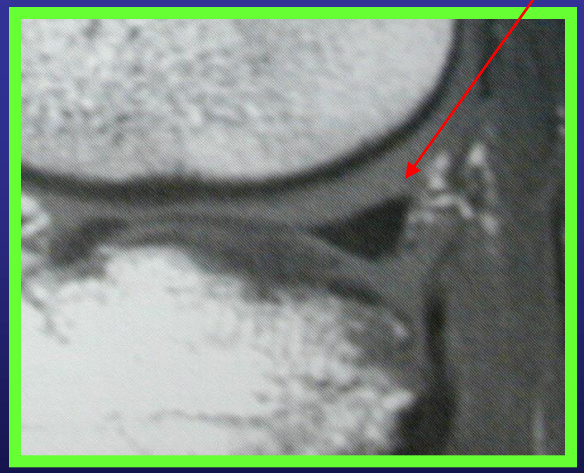
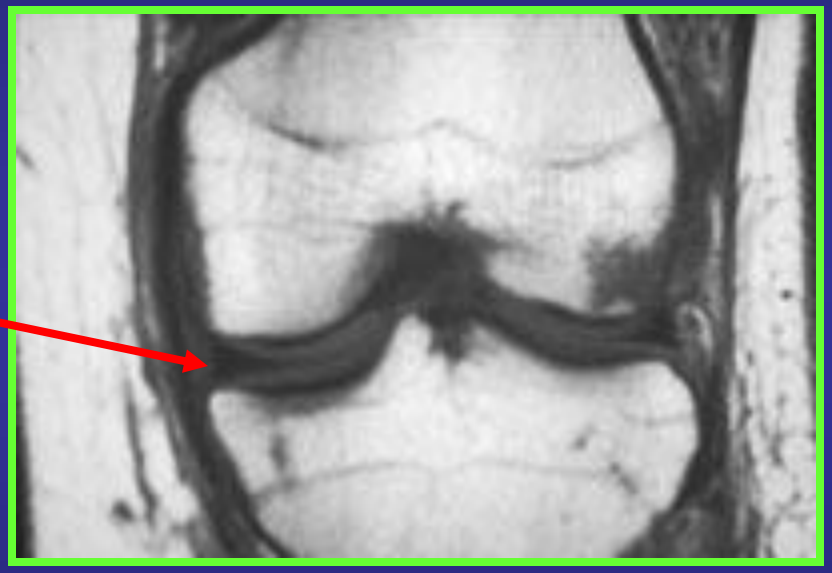
Knee MRI
Meniscus

- Uniform Low Signal is Normal
  - T1, T2, and T2*
-
- Triangular in cross-section



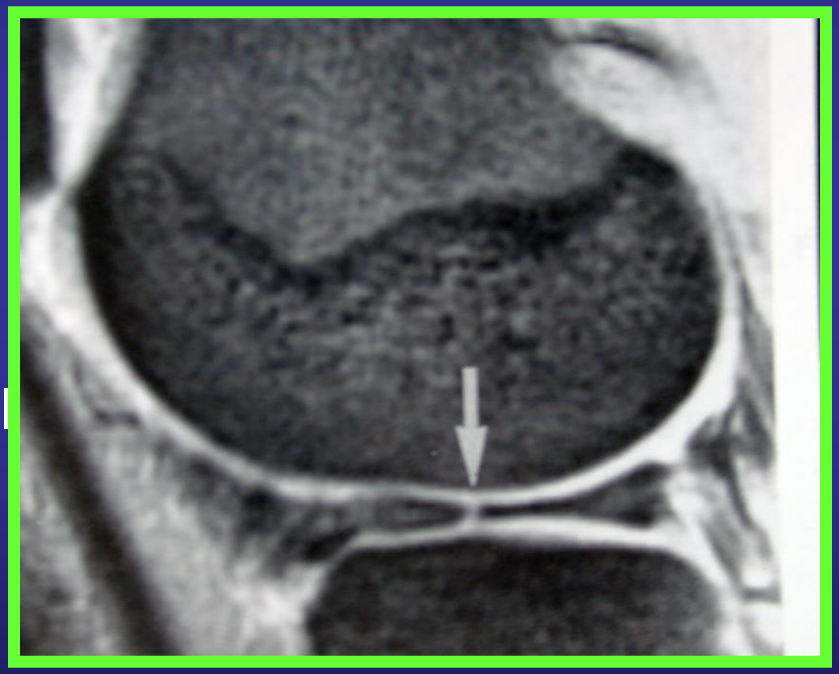
Sagittal



Coronal

Knee MRI
Meniscal Tears: Diagnostic Accuracy

- Verified with arthroscopy
  Meniscal Tear Diagnosis:
  - MRI sensitivity 80 –100%
  - MRI accuracy 88-92%
  - MRI negative predictive val
    - Approaches 100%



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Mink et al. Radiology 1987

Fischer et al. JBJS-A 1991.

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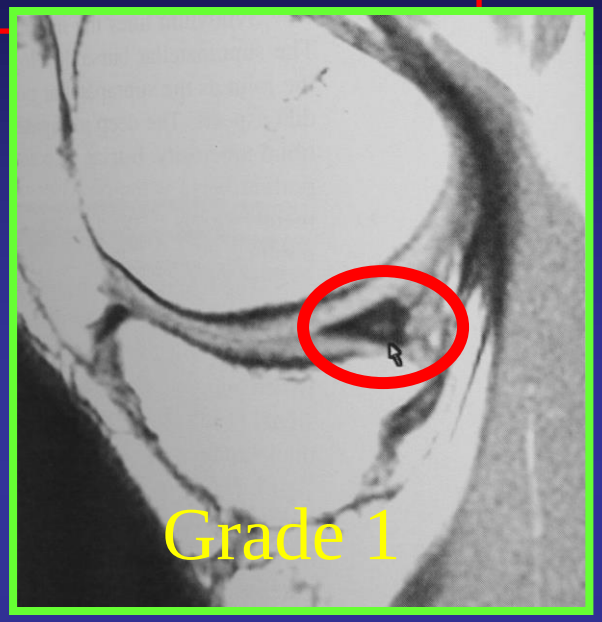
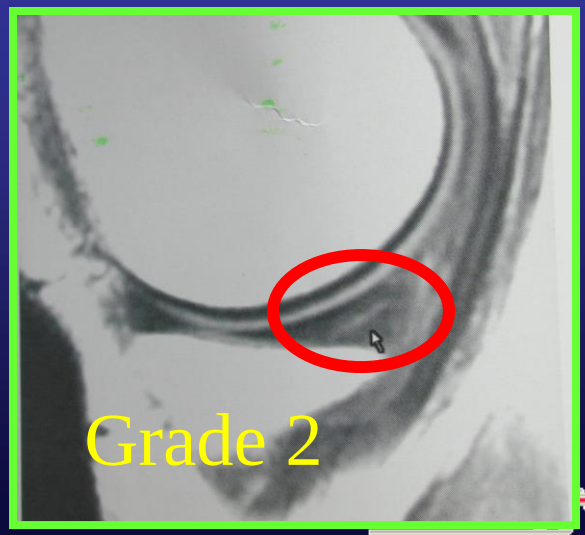
Knee MRI
Meniscal Tears: Grading System

- Most common → 3 grades

1) non-articular, globular signal increase
   - Intrasubstance
   - Early mucinous degeneration
   - Not Clinically Significant
     - Found in asymptomatic knees

2) Horizontal, Linear intrasubstance tear
   - Does not involve articular surface
   - Mucinous degeneration
   - May be precursor to Grade 3 tear
   - Found in asymptomatic

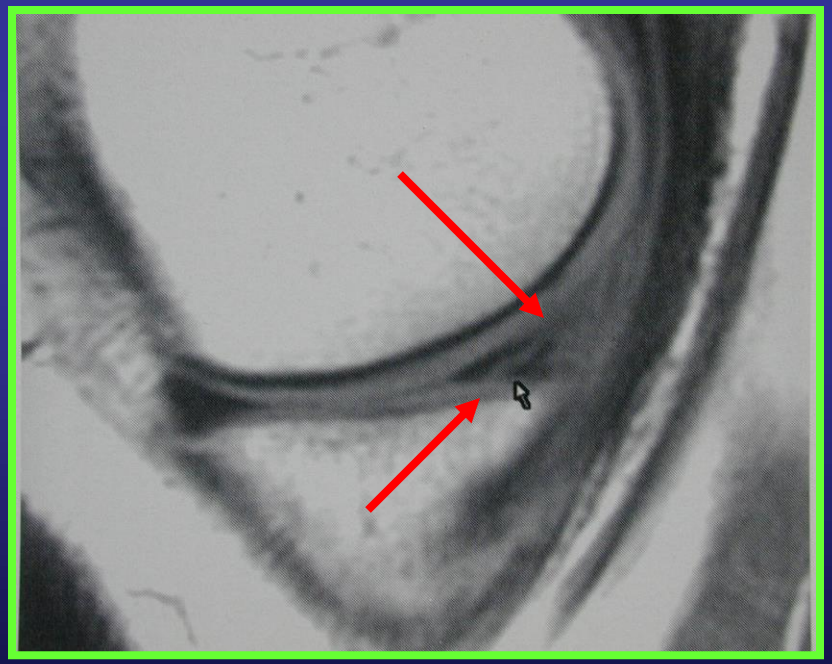




Knee MRI
Meniscal Tears: Grading System

- Grade 3
  - Clearly involves one or both surfaces

- Considered clinically significant tear



Functions Of The Meniscus

- Load transmission
- Mechanical stability
- Shock absorbtion
- Proprioception
- Lubrication

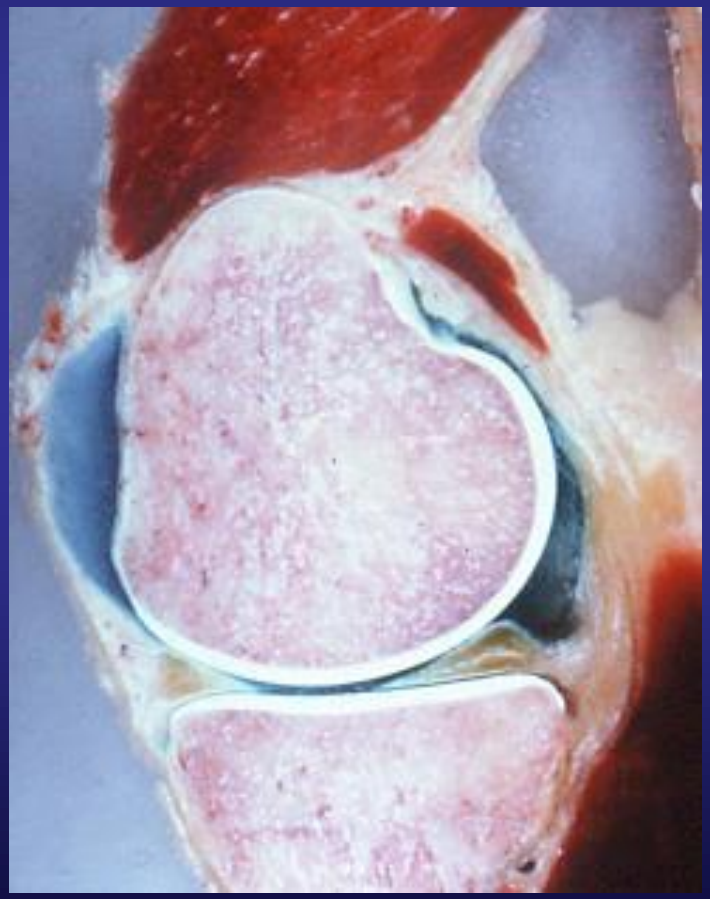


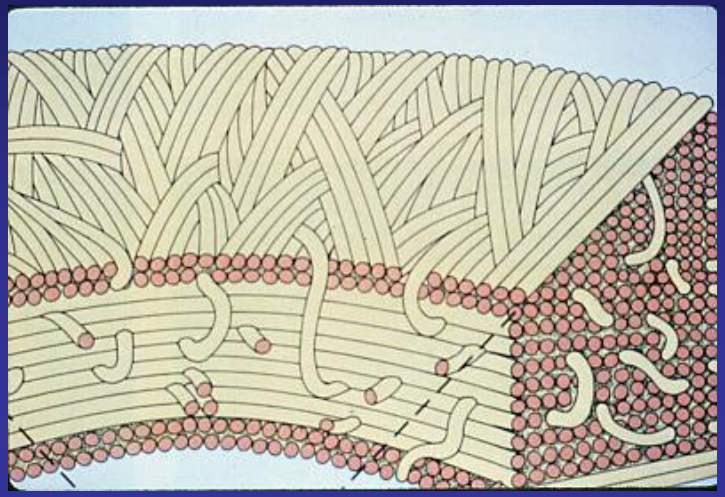
Photo courtesy of Jo Hannafin MD PhD

Contact Pressure Studies

- Loss of medial meniscus
  - 100% increase in contact stress
- Loss of lateral meniscus
  - 300% increase in contact stress
- Development of OA
  - Fairbank, "Knee joint changes after meniscectomy" JBJS Br 1948

Microscopic Anatomy

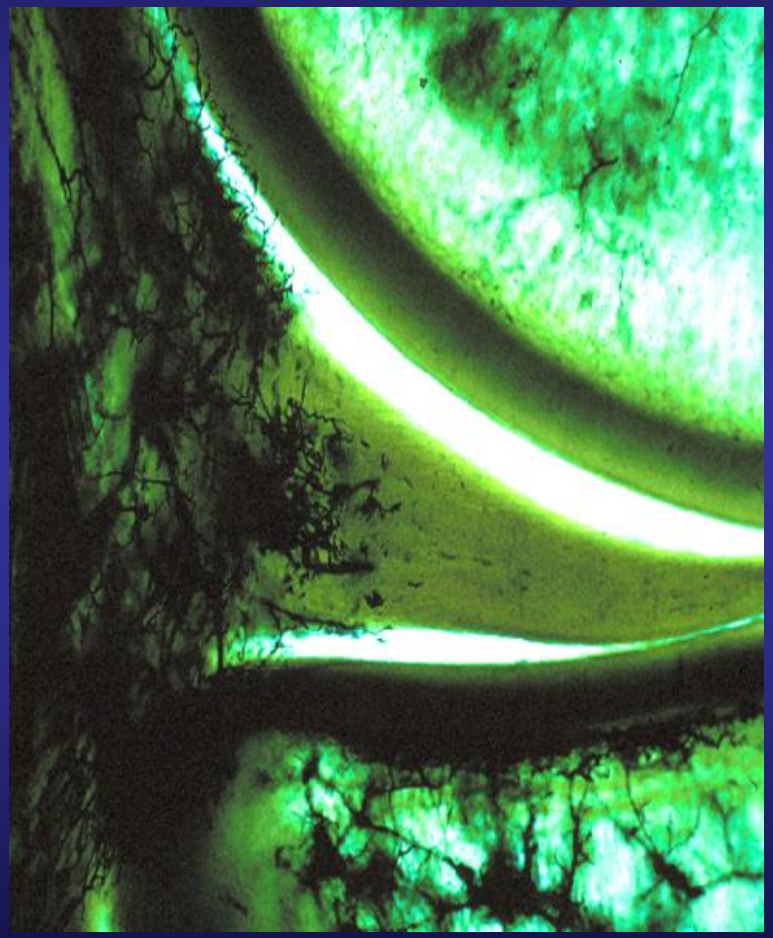
- Collagen fibers
  - strength
  - compressive forces create circumferential stresses at the horn attachments
- Proteoglycan
  - compressive properties
  - lubrication
- Fibrochondrocytes
  - matrix synthesis



Vascular Supply

Arnoczky, Warren – The microvasculature of the human meniscus, AJSM 1982

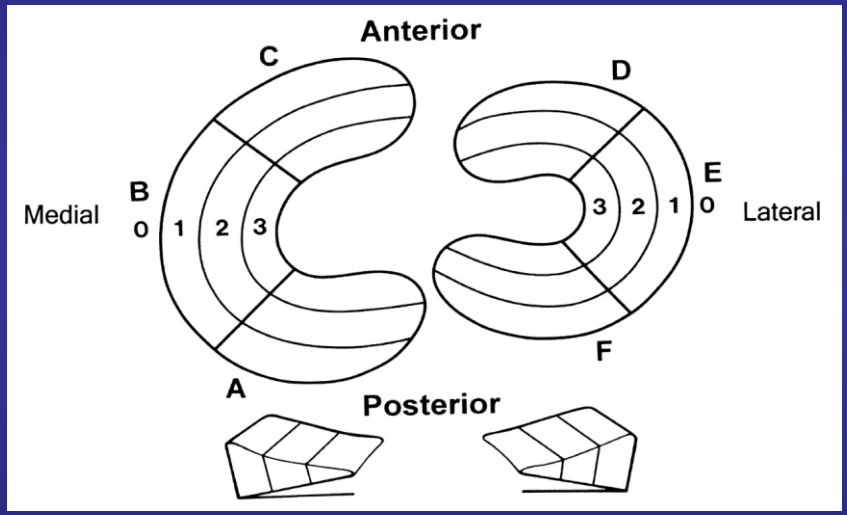
- Meniscal blood supply arises from the medial and lateral geniculate arteries
- Circumferential plexus
- Radial branches supply the outer 30%
- Vascular zones influence healing potential



Vascular Anatomy

Cooper et al. Clin Sports Med, 1990

- Red - red zone:
  - bleeding promotes fibrovascular scar formation
  - migration of cells in response to cytokines
- Red - white zone:
  - synovial abrasion, vascular access channels, and fibrin clot can be used to improve healing
  - less predictable result
- White - white zone
  - injury does not stimulate a healing response
  - poor prognosis for healing



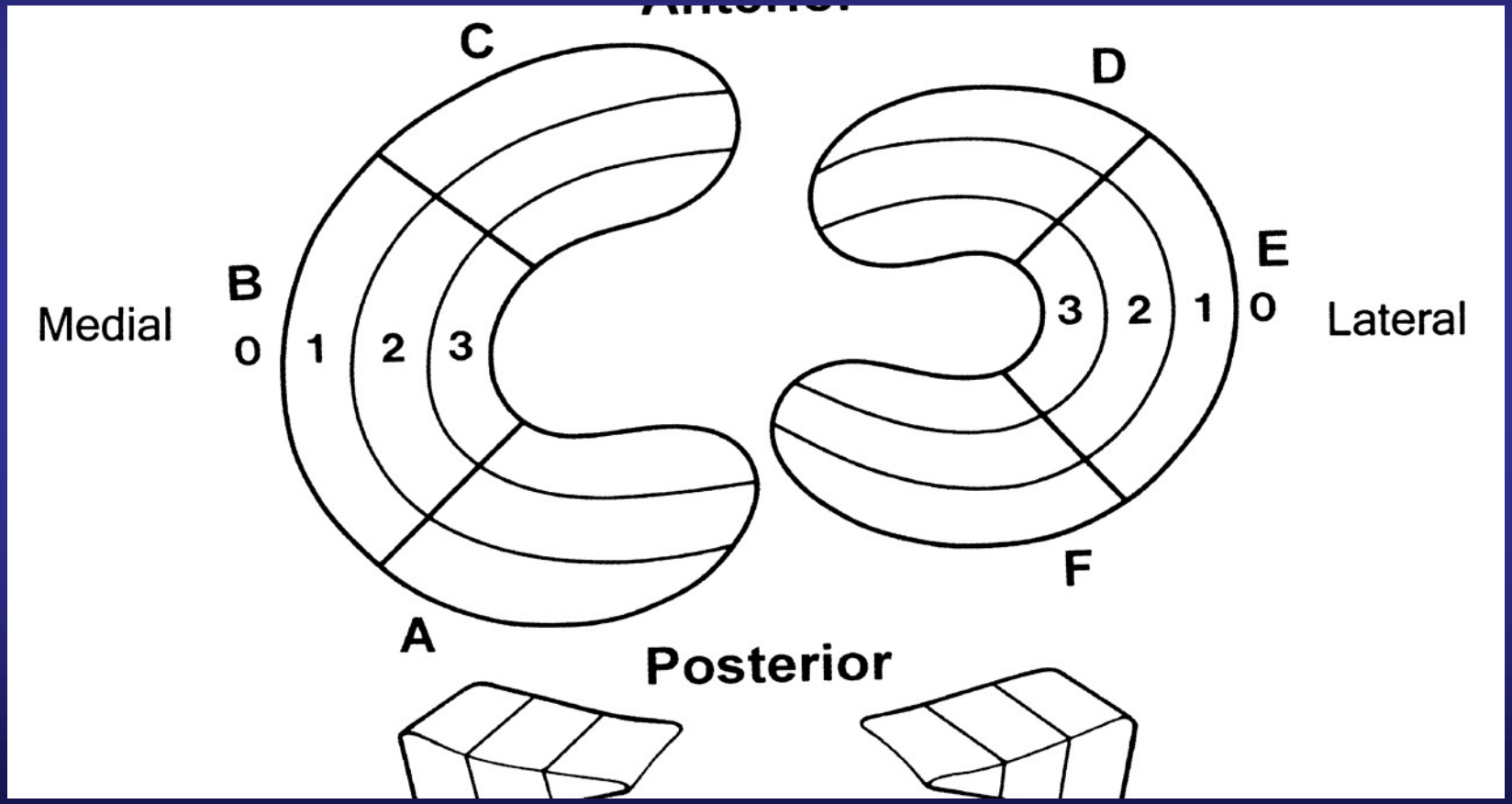
Treatment Options

- Non operative treatment
- Meniscal resection
- Meniscal repair
  - Outside in
  - Inside out
  - All inside
  - Root repair
- Meniscus Allograft Transplantation
- Synthetic meniscal replacement

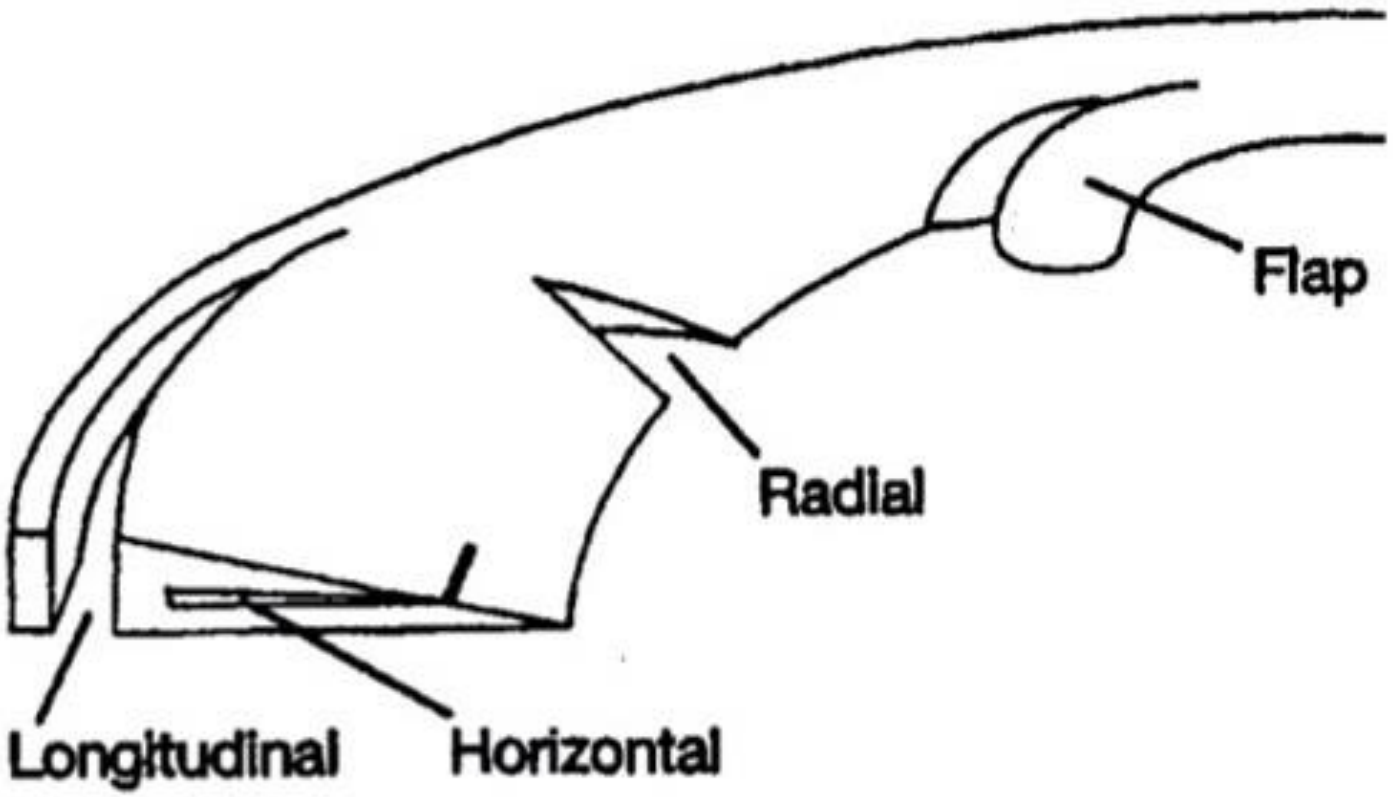
Factors Influencing Treatment

- Location of tear
- Pattern of tear
- Patient age
- Age of meniscal tear
- Types of pathology

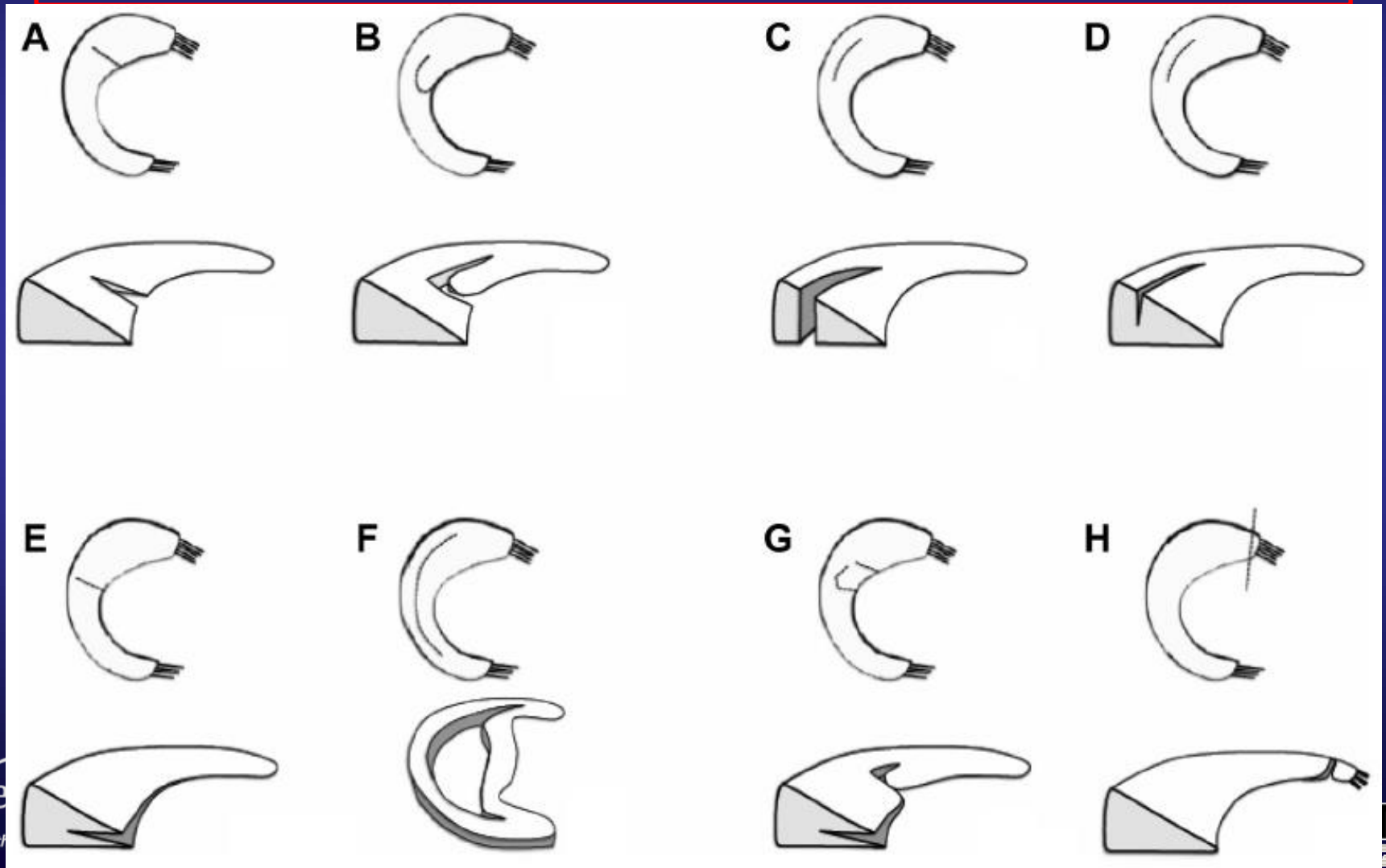
Location & Size of Tear



Tear Patterns

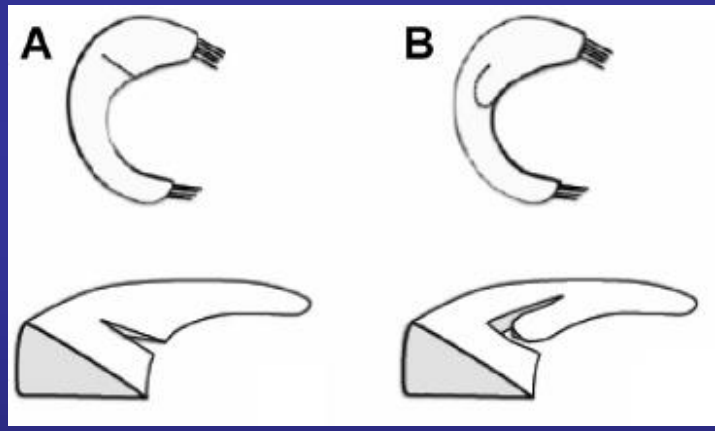


Tear Patterns



Radial & Oblique Tears

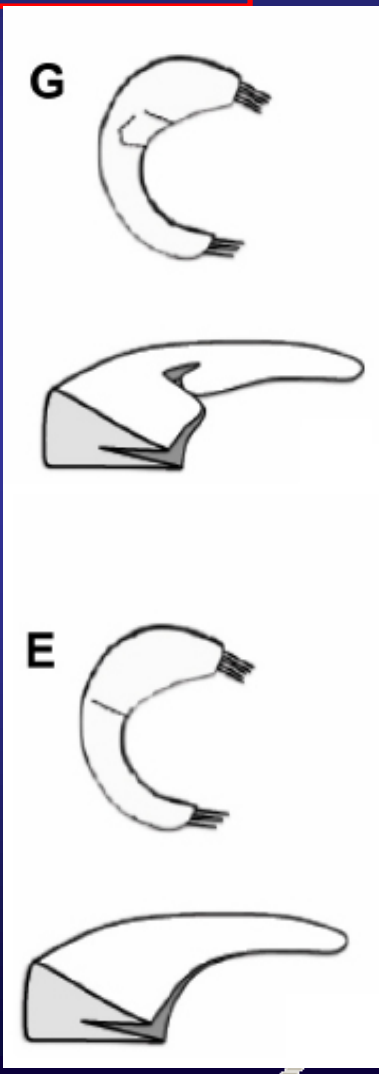
- Disrupts circumferential fibers
- Biomechanically act as total meniscus deficiency
- Poor ability to heal



- Still consider repairing in young patients
  - ACL recon
  - Fibrin clot augmentation

Horizontal Cleavage & Complex Tears

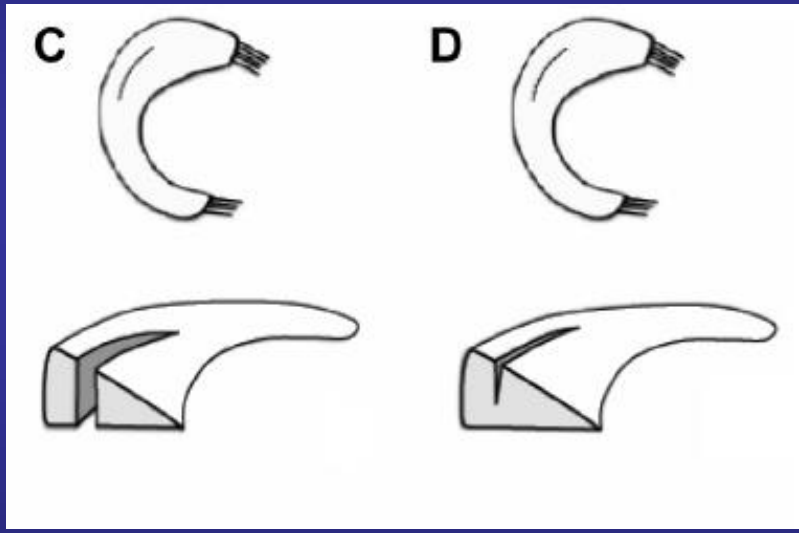
- Mechanism – shear
- Usually degenerative
- Tend to cross multiple planes
- In avascular zone
- Poor results with repair
  - Bierdert, Knee surg sport traumatol arthrosc, 2000
  - 40 patients, 4 groups (non op, resect, repair with vascular channels, and repair with fibrin clot
  - 2 yr f/u outcome with exam, xray and mri – resection did best
- Usually resect



Longitudinal Tears

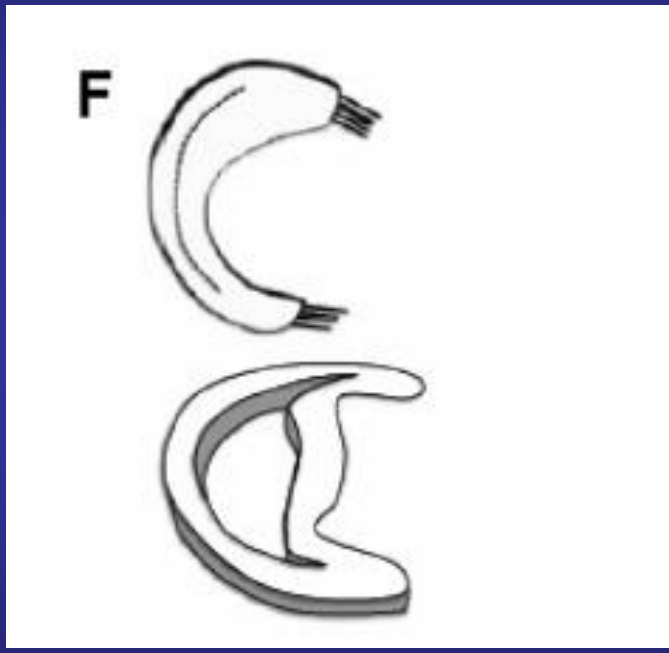
- Mechanism is compressive force
- Does not disrupt circumferential fibers
- Thus amenable to repair
- Resect if in avascular zone

- Most all inside implants are designed for this type of tear



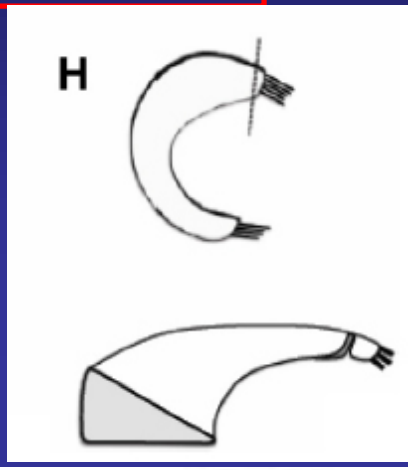
Bucket Handle Tears

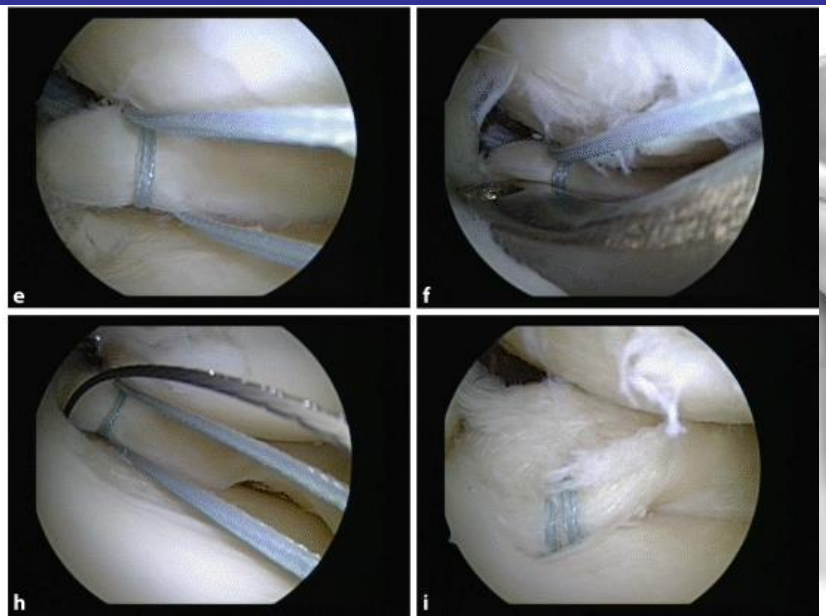
- A subset of longitudinal tears with displacement of the fragment into the notch
- Can result in a locked knee
- Acute repair is important
- Good results with repair



Root Tears

- Similar to complete meniscal deficiency
- If articular cartilage is well maintained – root repair
- Resect if degenerative





Non Operative Care

- Period of Rest
- Ice
- NSAIDs
- PT
- Assess improvement
  - Especially degenerative tears (will do ok without op)

- Surgical management in those who fail non op

Operative Technique

Scope Insertion

- No insufflation with Saline
- Antero lateral portal
- Scope directed to pf compartment
- Establish visualization
  - Focus
  - Flush

- Begin diagnostic scope

Diagnostic Scope

- Systematic examination of all compartments
  - Begin at supra patellar pouch
  - PF compartment
    - Image and document articular cartilage of patella (lateral facet, apex, and medial facet)
    - Trochlea
  - Lateral gutter
    - Look for loose bodies and synovitis.
    - Extruded meniscal tears
    - Marginal osteophytes
  - Medial gutter
    - Medial plica

Diagnostic Scope

- Enter medial compartment
  - Apply valgus
  - Establish medial portal in valgus (even if pathology is in lateral compartment)
    - Trans illuminate skin
    - Spinal needle localization
    - Establish the portal
      - Skin incision
      - L shaped capsulotomy (KEY Move)
  - Assess articular cartilage
  - Assess and probe meniscus

Diagnostic Scope

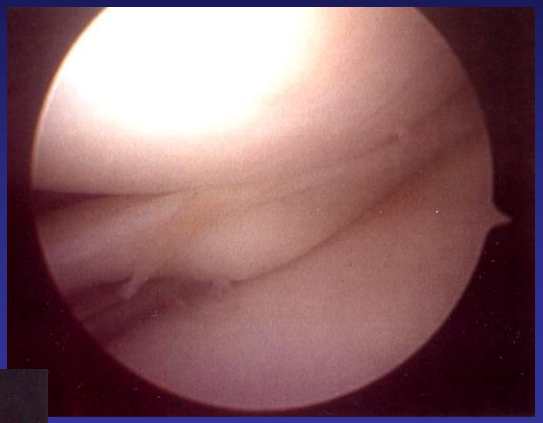
- Enter notch (leg at 90deg)
  - Assess ACL
  - Assess PCL
- Enter lateral compartment (varus or figure of 4)
  - Assess articular cartilage
  - Assess and probe meniscus
- If suspicious for loose bodies enter the posterior compartment through the notch

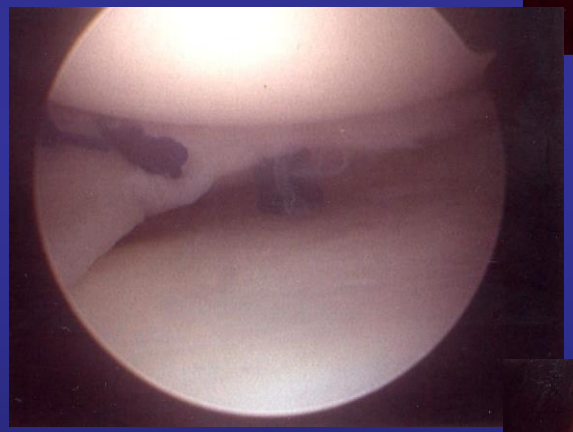
Meniscectomy

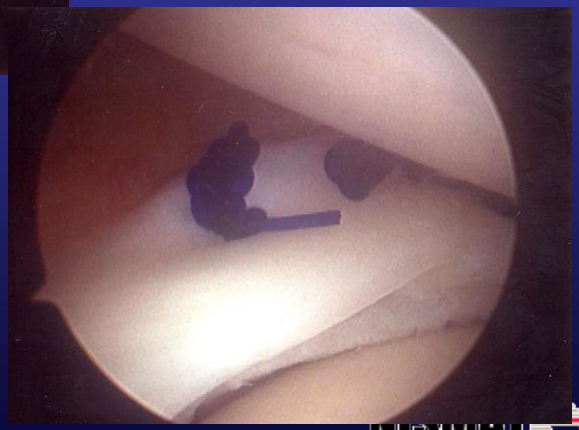
- Complex tears
  - Begin with shaver
  - Transition with biters
- Radial and oblique tears
  - Begin with biters
  - Smooth off and transition with shaver

Meniscal Repair

- Young patient
  - physiologic versus chronologic age
- Red-red
- Red-white in combination with ACL
- Lateral compartment

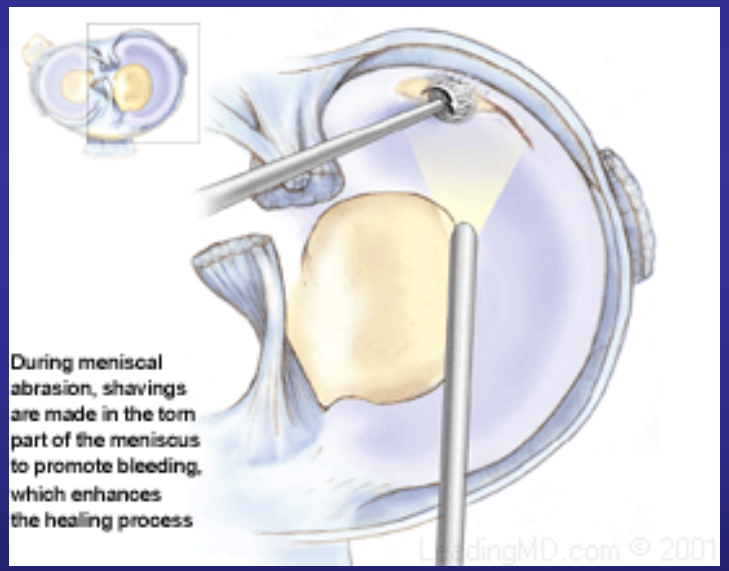






Steps to Success in Meniscal Repair

- Selection of an appropriate tear for repair
- Creation of vascular access
  - tear abrasion
  - rasps
- Tissue approximation
- Biological healing



Set Up The Repair

- Trim the meniscus
- Abrade the synovium above and below the meniscus
  - Use rasps
  - Use shaver in reverse without suction
- If accessible create vascular channels with trephination of meniscus and capsule

- After repair – limited notchplasty (in non ACL recon)