Orthopaedic Injuries Below the Belt: It's Going TIBIA OK!

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Disclosures

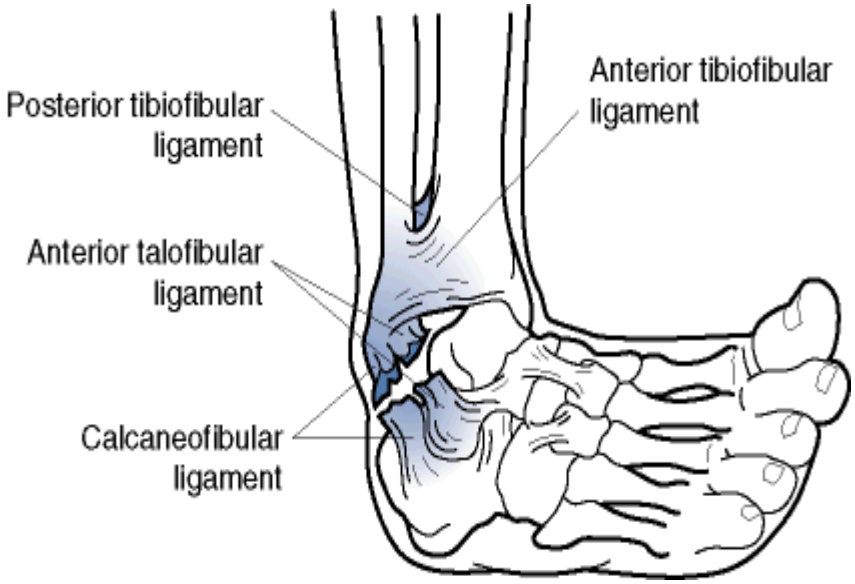
- No Financial Disclosures

History: Subjective Complaints

- Age/ Occupation/ Hand Dominance/ Sports
- Mechanism of Injury (MOI)
- Previous injury or surgery on affected body part
- Provocative or Alleviating movements
- Location, rating (0-10), quality of pain
- Night pain
- Paresthesia

Ankle Sprains

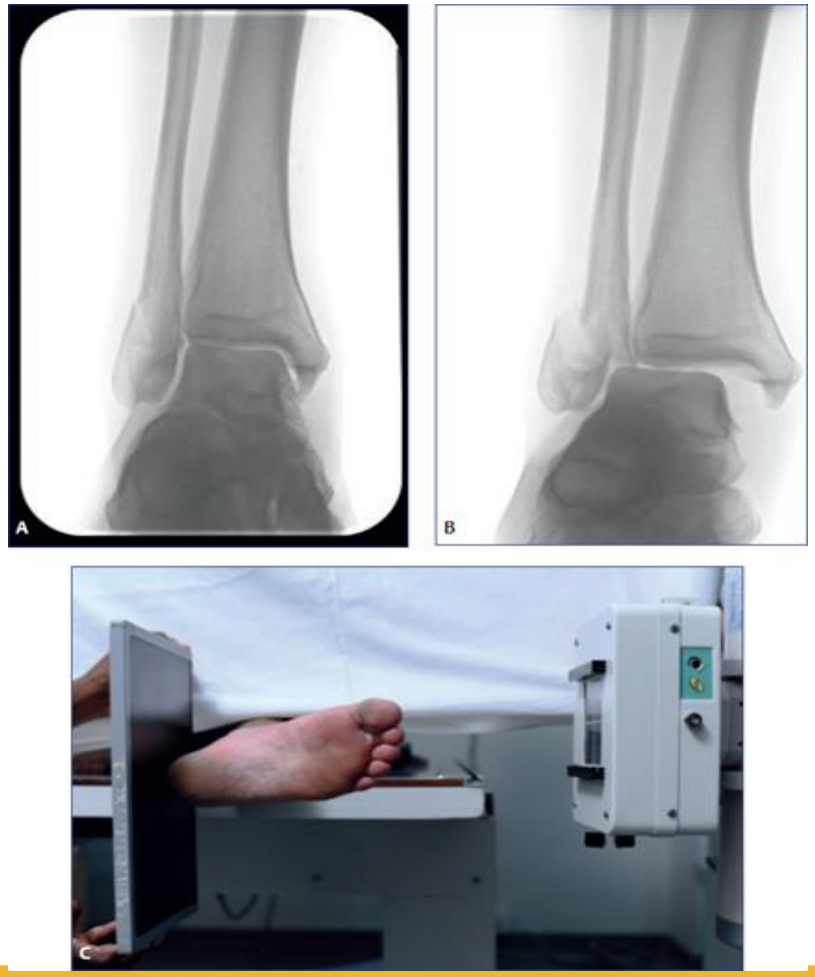
- Lateral Ankle Sprain (90%)
  - Anterior Talofibular ligament is most commonly injured
  - X-ray to rule out fracture/ avulsion
  - MRI is not typically necessary
  - Short period of immobilization along with physical therapy



Ankle Sprains

- Syndesmosis Injury
  - "High Ankle Sprain"
  - Involves tib/fib ligament
  - MOI: Twisting/ rotational
  - Pain above the ankle
  - May be associated with a fracture
  - Deltoid tenderness???

Gravity Stress View

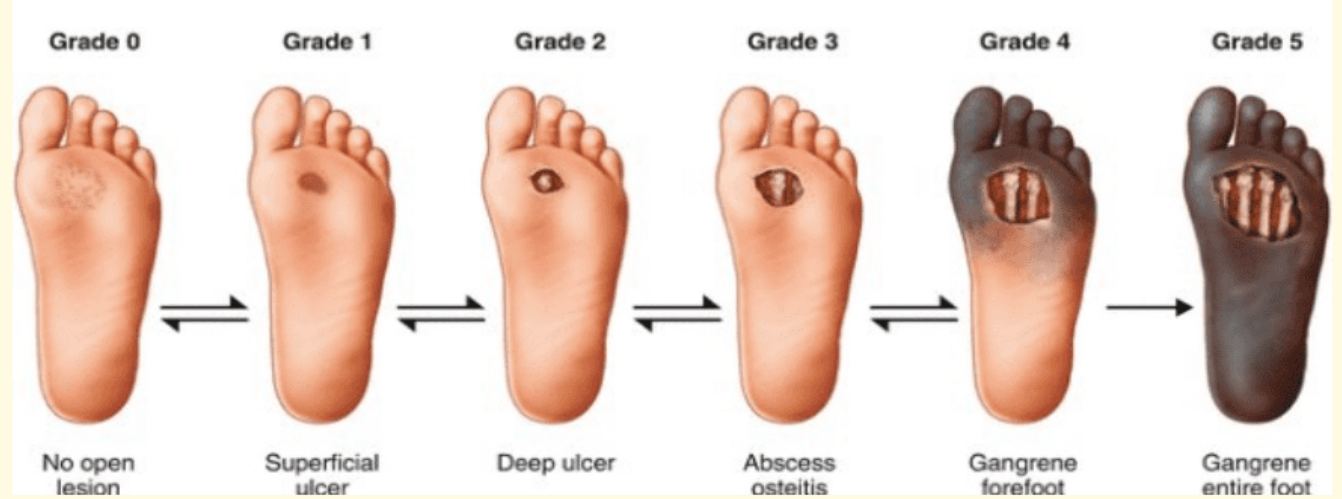


- Consider a gravity stress view with any Deltoid ligament tenderness or Distal Fibula Fractures to assess for ankle instability
- Medial clear space widening may indicate the need for surgical fixation

Plantar Fasciitis

- Subjective: heel pain with walking; most severe with initial steps out of bed
- X-ray may reveal a calcaneal bone spur
- Treatment: NSAIDs, Ice massage, stretching, night splint in neutral position
- Injections may increase risk of fascia rupture

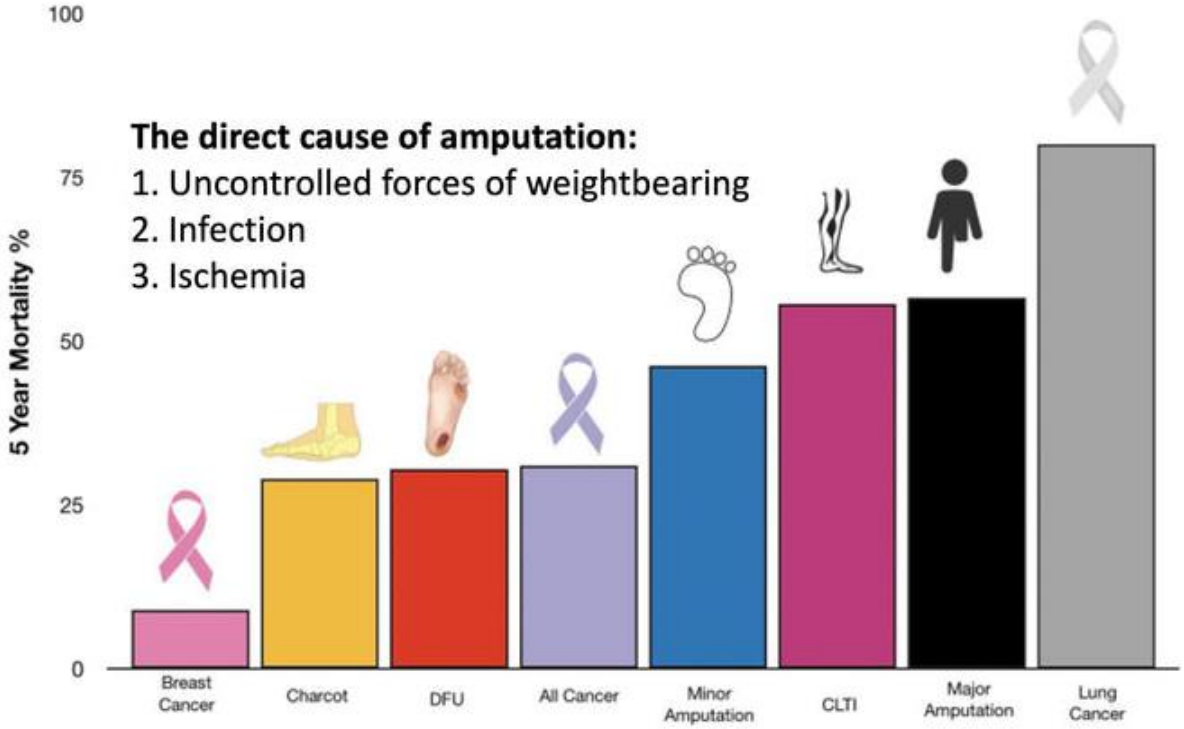
Diabetic Foot Infections



- Aseptic Culture
- Imaging (x-ray/ MRI), Probe-to-bone
- CRP, ESR
- 1-2 weeks for soft tissue; if improving but slowly can extend to 3-4 weeks
- 6 weeks for OM; can shorten if debrided without source control
- Consider the Pathogens
  - Mild infections: Staph, Strep
  - Moderate/ Severe: Gram negative, PsA if wet environment
    - Possible Anaerobes

Diabetic Foot Infections

HIGHER MORTALITY RATE THAN SOME FORMS OF CANCER



Mortality following amputation ranges from 13 to 40% in 1 year, 35–65% in 3 years, and 39–80% in 5 years, being worse than most malignancies

Achilles Tendon Rupture

- Largest tendon in body
- Watershed region approx. 4 cm proximal to insertion on calcaneus; most likely area to rupture
- Patient may report an audible “pop”
- “Felt like I was kicked”

- History
  - Injections?
  - Pre-existing Disease?
  - Age? Typically in 40s
  - Antibiotics: Quinolones?
- Physical Exam
  - Swelling/ Ecchymosis
  - Contour
  - Thompson Test

Achilles Tendon Rupture

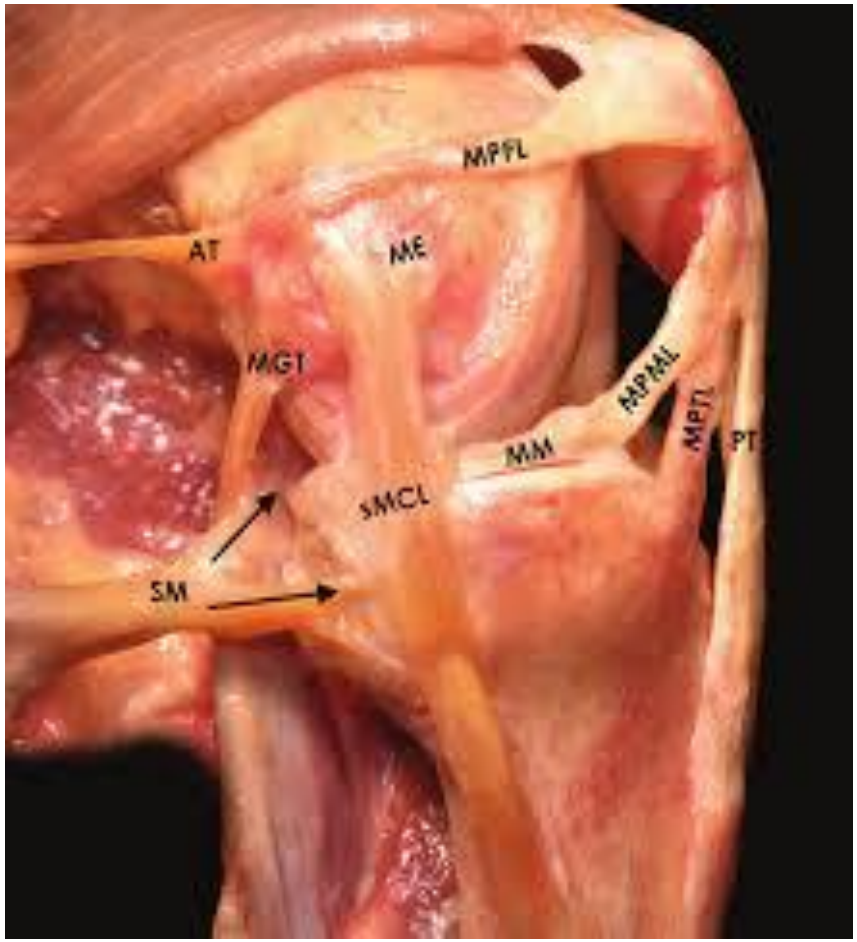
- Always splint injury in plantarflexion and non-weight bearing
- MRI only if necessary; don’t delay treatment
- Op vs Non-Op tx
  - Infection risk?
  - Rate of re-rupture?
  - Timing?

Patella Dislocation/Subluxation

- **General:**
  - Occurs female = male
  - More in adolescents
  - Patella typically dislocates laterally
  - Sports & extreme activities
  - One or more medial restraints must fail
  - Not usually a work-related activity
  - Present acutely dislocated in flexed position
  - Very painful
  - Spontaneous reduction

Patella Dislocation/Subluxation

- Medial Patellofemoral ligament (MPFL)
  - Major medial support for patella in preventing dislocation/subluxation
  - Ruptures from femoral side usually (patellar side less common)
  - Look for associated avulsion fracture at medial patellar border



Amis AA[1] **Anatomy and biomechanics of the medial patellofemoral ligament.** Knee. 2003 Sep;10(3):215-20.

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Patella Dislocation/Subluxation

- Associated factors contribute to dislocation/subluxation
  - Shallow Femoral trochlea (vs. Hypoplastic lateral femoral condyle)
  - Increased Femoral anti-version and/or Tibial torsion
  - Lateral tracking Patella
  - Tight lateral retinaculum
  - Patella Alta
  - Hypermobile patella (hyper- ligament laxity)
  - Increased Q angle
  - Poor dynamic stabilizers

Patella Dislocation/Subluxation

- Osteochondral (OCD) Injury Patella
  - Most common problem with lateral patellar dislocation
  - Lateral facet patella common site OCD
  - Can occur at time initial dislocation or with reduction
  - Initial x-ray important to document OCD presence

Patella Dislocation/Subluxation

Physical Examination

- Inspection:
  - obvious deformity laterally displaced patella – dislocated
  - Subluxed – no deformity
  - Joint effusion – high probability hemarthrosis
- Palpation:
  - medial sided tenderness (over MPFL)
  - medial knee pain - ? Retinaculum injury
  - Apprehension Sign
    - Pain with passive lateral patella translation

Patella Dislocation/Subluxation

Physical Examination

- Range-of-Motion (ROM) & strength
  - Limited 2nd to patella deformity – dislocation
  - Limited 2nd to pain
  - ? Mechanical blocks think OCD (X-ray)
- Neuro & Vascular
- Orthopaedic Tests
  - Apprehension Sign- sensation of patella dislocating with lateral translation
  - NO laxity usually
  - J Sign: assess mal-tracking of the patella

Patella Dislocation/Subluxation

- Radiographs - Acute
  - AP & Lateral- initial
    - Look at patella position in trochlea and to identify bony injury related to acute
    - Look at patella height: calculate Patella Alta
  - Sunrise/Merchant/Tangential view
    - Look at patella position (pre & post reduction)
      - Maybe difficult to obtain 2nd to pain & patient cooperation
    - Post-reduction
      - Look for patella centered in femoral trochlea
      - Look for bony avulsion injury medial border patella

Patella Dislocation

- Sunrise or Merchant view of knee
- Lateral patella dislocation is most common

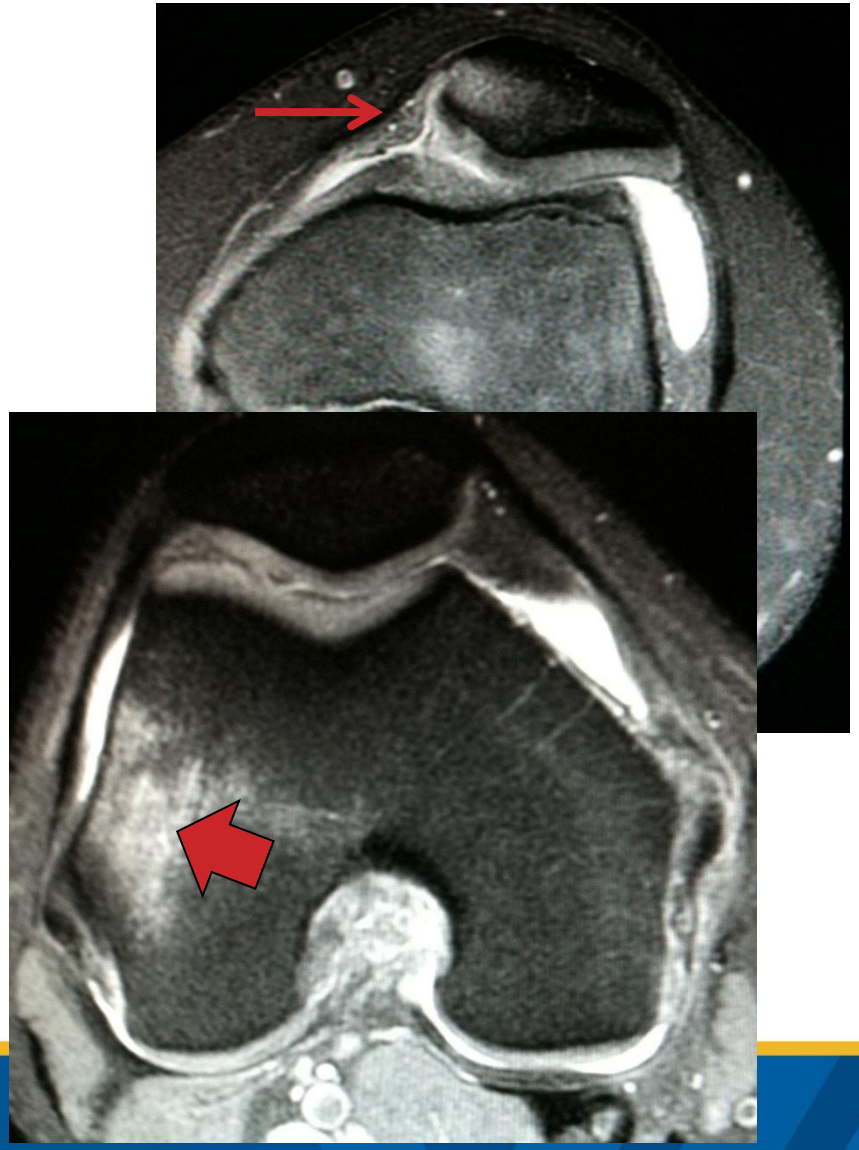
Patella Dislocation/Subluxation

- Radiographs - Acute
  - MRI:
    - Provider preference
    - Rupture MPFL (patella vs. femur)
    - Shows acute bone inflammation
    - Look for corresponding injury to medial border patella and lateral edge femoral condyle
    - Identify articular cartilage injuries to the patella

Patella Dislocation/Subluxation

Radiographs

- MRI
  - Contusion pattern
    - Lateral patella facet
    - Lateral Femoral condyle
  - Rupture MPFL
  - Rupture medial retinaculum



Patella Dislocation/Subluxation

- Non-Operative Treatment: Acute injury
  - Unreduced patella dislocation
    - Flex hip, applying medial force on lateral edge of patella while passively extending knee
    - May spontaneously reduce with EMS or during x-rays
    - May need to inject local anesthetic knee to reduce pain to help facilitate reduction maneuver

Patella Dislocation/Subluxation

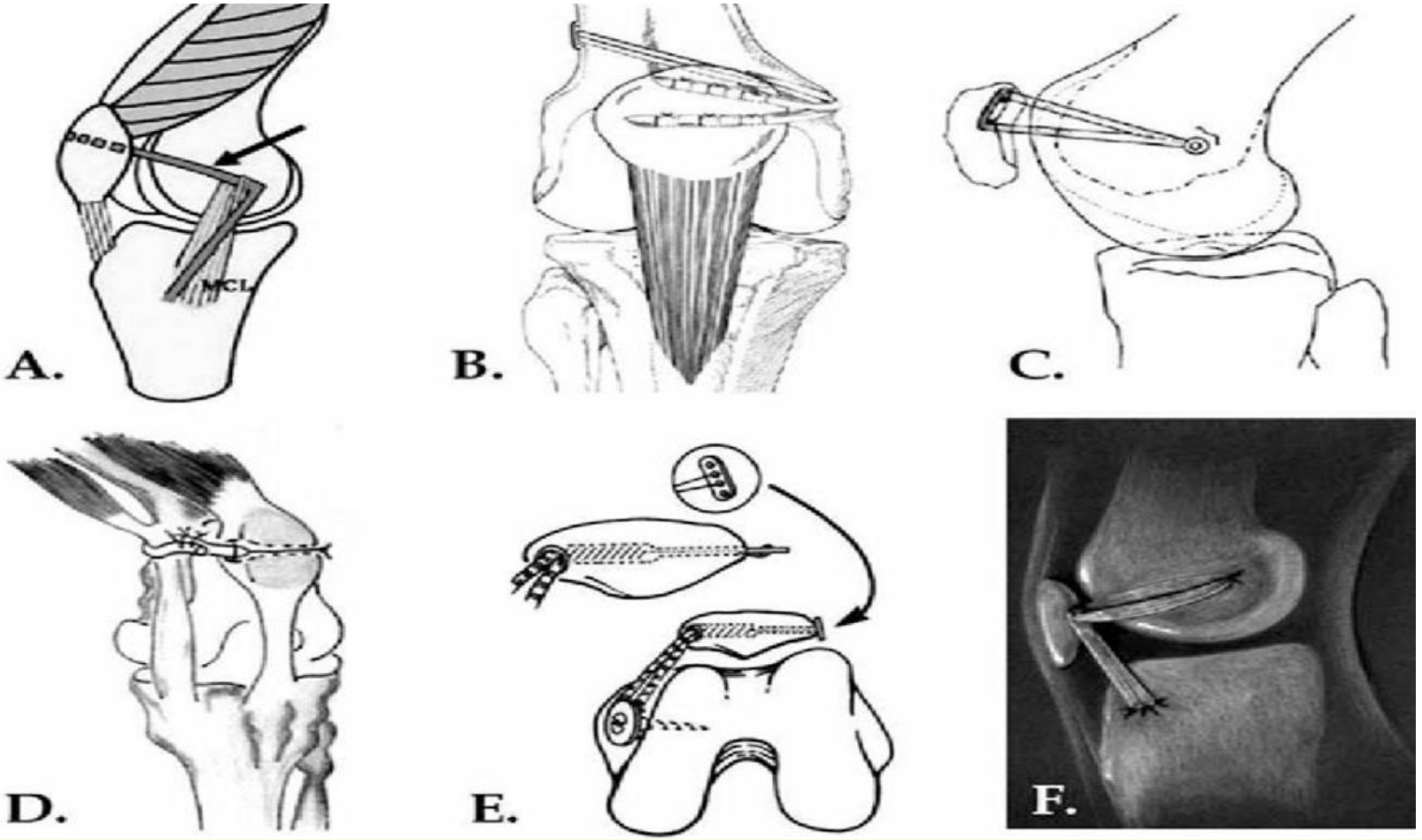
- Non-Operative Treatment: Acute injury
  - Reduced patella dislocation
    - 1st episode: treat non-op with immobilizer
    - Immobilize 4-6 weeks
    - Begin quad strengthen 2-4 weeks
    - X-ray shows bony injury needs:
      - MRI for further delineation MPFL injury
      - Surgeon preference on surgical correction
    - 50% have recurrent dislocations

Patella Dislocation/Subluxation

- Operative Treatment: Acute injury
  - MRI shows:
    - Rupture MPFL & bone injury OR
    - OCD lesion medial facet patella and lateral edge LFC
    - Need Arthroscopy to evaluate and repair
  - Surgical procedure
    - Arthroscopy
    - Debride or repair OCD lesions
    - Perform LRR as needed/indicated
    - Repair MPFL (& redundant medial joint capsule)
    - Post–op: same as acute injury

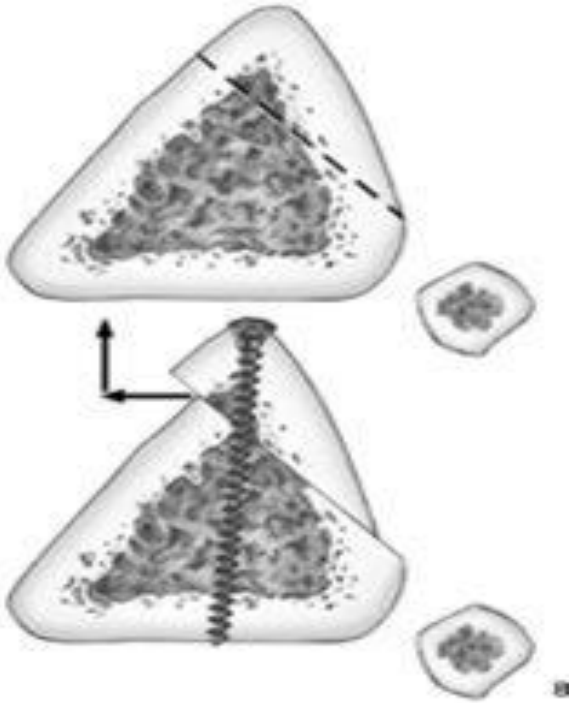
Patella Dislocation/ Subluxation

Techniques for MPFL Reconstruction



Patella Dislocation/ Subluxation

A Tibial Tubercle Osteotomy brings the tibial tubercle anterior and medial to help correct alignment (decrease TT-TG distance) and unload the patella facets (Fulkerson Osteotomy)



Anterior Knee Pain

- Patella Tendonitis
- Patellofemoral Syndrome
- Pes Anserine Bursitis
- Remember to evaluate hip mechanics/ strength; muscle imbalances
- Avoid Open Kinetic Chain leg extension

Pre-Patellar Bursitis

- Inflammation of pre & infra-patella bursa
- Localized to anterior knee
- Usually extra-articular involvement
- Inflammatory-Hemorrhagic-Septic
- Mechanism
  - Direct blow to anterior knee
  - Repetitive minor trauma
  - Skin injuries

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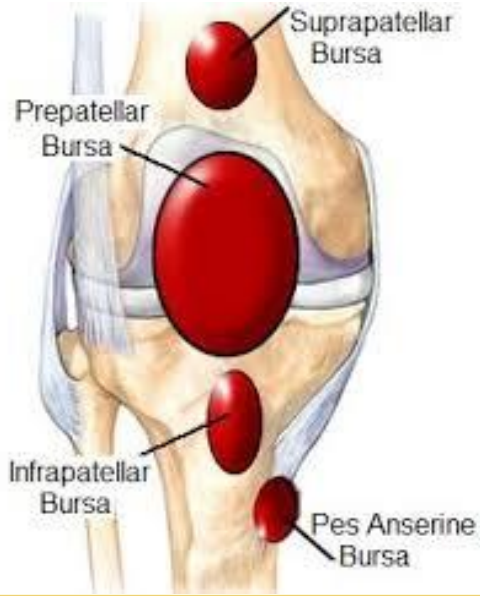
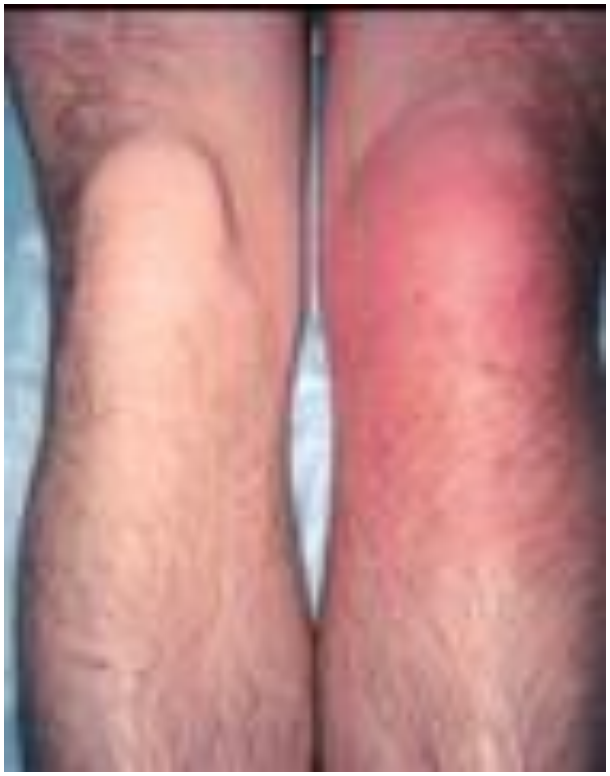


Pre-Patellar Bursitis

Signs & Symptoms

- Swelling
  - Localized to anterior knee
  - Focal swelling
- Redness
  - pre-patella more common
- Warmth
- Pain
  - Palpation vs. Motion
- Skin Wounds
  - Bacterial infection
  - Associated medical conditions



Pre-Patellar Bursitis

- Differential Diagnosis
  - Patella fracture
  - Contusion
  - Intra-articular injury
  - Infection: skin vs. abscess vs. bursitis
- Physical Exam
  - Focused knee exam
  - Pay attention to suspicion for infection
  - Aspirated fluid
- Radiographs

Pre-Patellar Bursitis

- Treatment
  - Change behavior
  - Ice
  - NSAIDS
  - Protective/compression padding
  - Consider immobilization – decrease spread of infection
  - Infection
    - Aspiration
    - Incision & Drainage (I&D)
    - CBC w/ diff, ESR, CRP, culture fluid/wound
    - Antibiotics: pay attention to MRSA

Pre-Patellar Bursitis

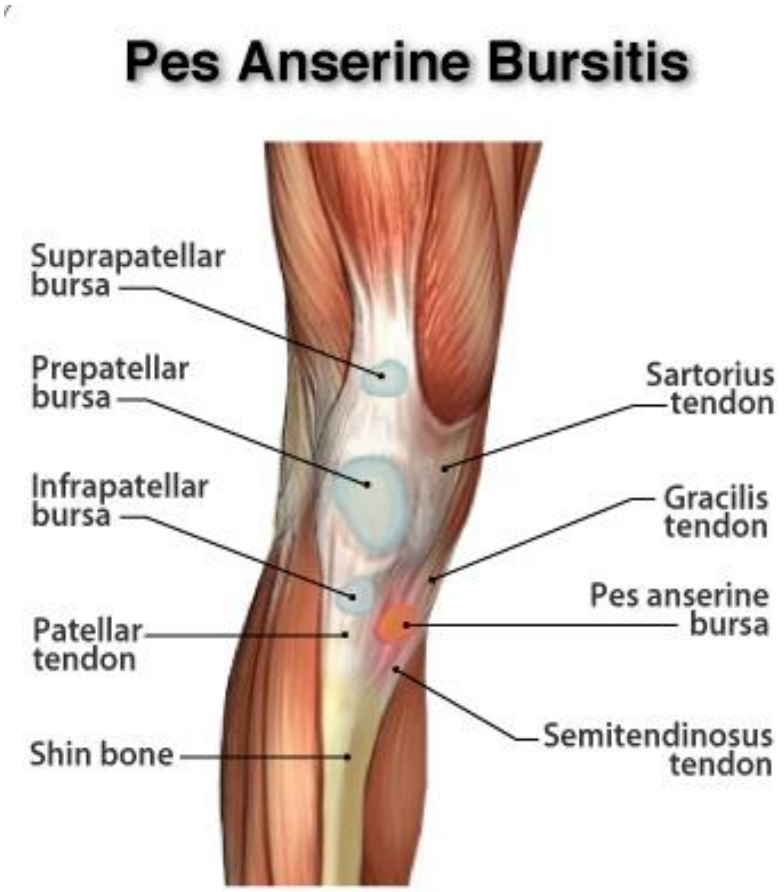
- Infection
  - Send aspirate or wound culture
    - Gram stain, cell count, crystals culture,(fungal & AFB)
  - Copious Saline lavage
  - Incise and Drain: cotton wick
    - Remove 2-3 days
  - Appropriate Wound care
  - Antibiotic coverage
  - Recurrent infection – surgical I&D

Pes Anserine Bursitis

- Inflammation of pes anserine bursa
- Localized to medial knee & tibia
- Predisposing Factors
  - Osteoarthritis
  - Obesity
  - Women > Men
  - Over activity
  - Poor Flexibility

Pes Anserine Bursitis

- Signs & Symptoms
  - Medial knee / hamstring pain
  - Swelling Sartorius, Gracilis, SemiTendinosus
  - Decreased Hamstring flexibility
  - Associated knee effusion



Pes Anserine Bursitis

- Differential Diagnosis
  - Medial Meniscus tear
  - Medial Collateral Ligament (MCL) injury
  - Synovitis
  - Hamstring strain
  - Osteoarthritis

Pes Anserine Bursitis

- Treatment
  - Modify activity
  - Increase flexibility (tight hamstrings & quads)
  - NSAIDS
  - Ice
  - Corticosteroid injection
  - Home Exercise Program (HEP) vs. Physical Therapy (PT)

Osgood-Schlatter Disease

- General
  - Occurs 11-15 age group (rapid growth)
  - Boys > Girls
  - Overuse problem – increased demand on immature skeleton
  - Caused by tight Hamstrings limit knee extension and increasing pull of Quad/Patellar tendon on Tibial tubercle
  - Small area heterotopic ossification seen 2nd to microtrauma a the Tibial apophysis
- Clinical Symptoms
  - Swelling Tibial tubercle area
  - Pain with ambulation, stair-climbing, jumping & running
  - Pain with palpation
  - Limited ROM knee 2nd to tight Hamstrings

Osgood-Schlatter Disease

- Physical Examination
  - General Knee exam
  - Pay specific attention to age group, flexibility and location pain
  - Tender palpate tibial tubercle
  - Pain with AROM & resistive AROM knee extension
- Differential Diagnosis
  - Jumper's Knee
  - Avulsion fracture tibial physis
  - Sinding-Larsen-Johansen Disease – connective tissue disorder

Osgood-Schlatter Disease

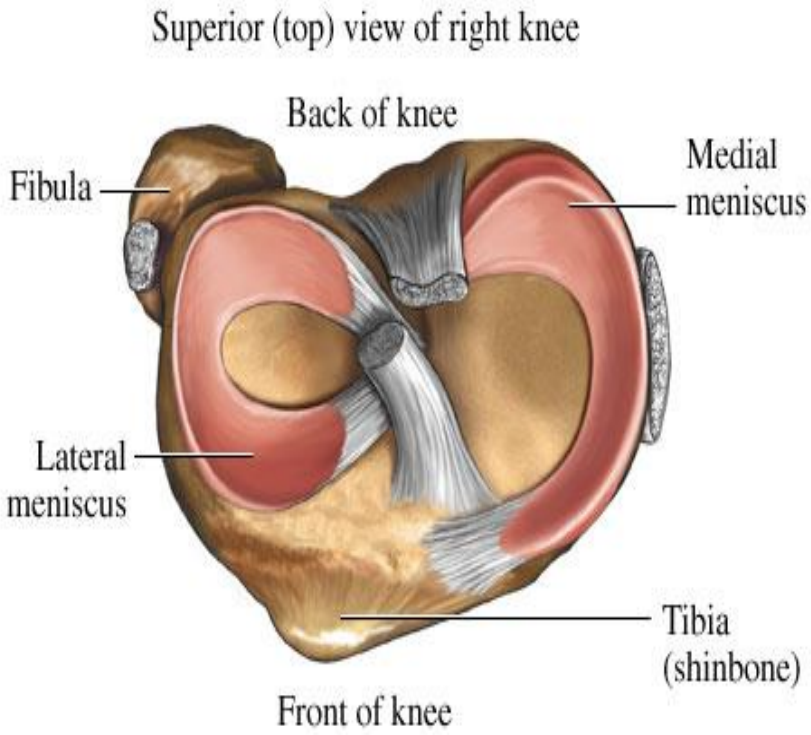
- Radiographs:
  - AP, Lateral, Sunrise
  - AP - Normal
  - Lateral
    - Bony changes noted at tibial tubercle
    - May need comparison view contralateral knee
  - Sunrise – check patella position in trochlea

Osgood-Schlatter Disease

- Treatment:
  - Symptomatic care
  - ICE
  - NSAIDS
  - Knee pad or sleeve: decrease pain from contact pressure
  - Immobilize for recalcitrant symptoms or poor patient compliance
  - Change activity up to 2-3 months
    - May need longer for more severe cases
  - Surgery to correction for rupture/bony fracture - rare

Meniscus Tears

- Cartilage that provides “shock absorption” and secondary knee restraints
- MOI: squatting and twisting movements
- Patients may report catching/ locking of knee, delayed knee effusion
- Medial Meniscus Tears are most common

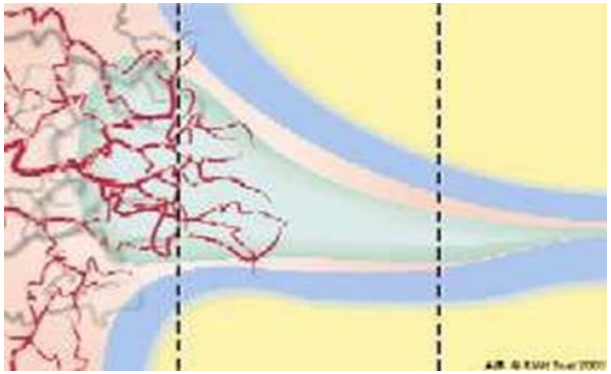


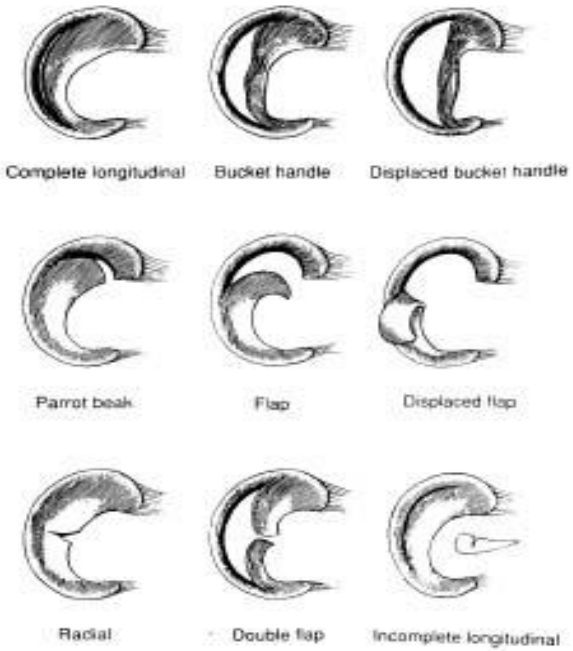
Meniscus Pathology

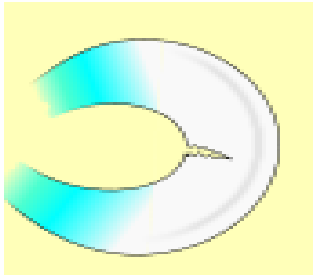
- Types of Meniscus Tears
  - Vertical Longitudinal Tear
    - Bucket-handle tear (3 times more common in medial meniscus)
    - Typically involves posterior portion of meniscus
  - Radial Tear
    - Most common in medial aspect of lateral meniscus; may be associated with a meniscal cyst
  - Horizontal Cleavage Tear
  - Flap Tear
  - Oblique Tear
    - Full thickness tear running obliquely from the inner edge of the meniscus into the body of the meniscus

Meniscus Pathology

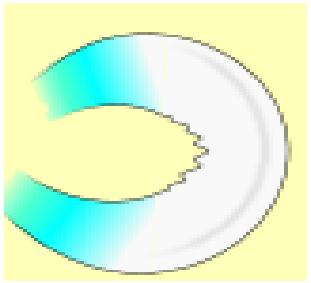
- MENSICAL ZONES
- Red – Red
  - Vascular zone in the peripheral 1/3 with best chance of healing
- Red – White
  - Middle 1/3 with intermediate healing potential
- White – White
  - Inner 1/3 avascular zone



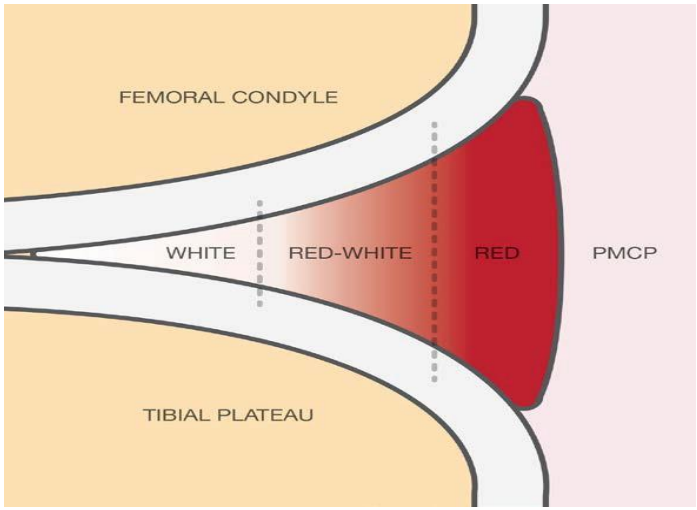




Radial Tear



Degenerative Tear



Meniscus Tears

- Start with wt. bearing x-ray of knee
- Exam: joint line tenderness, McMurray's, + effusion, dec ROM
- MRI is indicated for mechanical symptoms
- Op vs Non-op Tx
  - Repair vs Debridement

Meniscus Tears

- Bucket Handle Meniscus Tear
- “Double PCL Sign”
- Lacks full knee extension on physical exam
- Make patient non-wt. bearing, STAT MRI and refer to Orthopaedics

Anterior Cruciate Ligament (ACL) Tear

- MOI: twisting, change of direction, hyperextension, deceleration
- Contact vs Non-contact
- Patient may hear or feel a “pop” in the knee
- Sensation of instability
- Immediate swelling

Anterior Cruciate Ligament (ACL) Tear

- History
  - Non-contact:
    - fixed foot, rotation and valgus stress (?)
    - Jumping
  - Contact:
    - Fixed foot & external valgus force (rotation ?)
- Symptoms
  - Sudden “pop”; Unable to continue playing
  - Deep seated internal pain
  - Knee effusion < 24 hrs – highly suspicious
  - May describe a “shift” or “wobble” in knee (unstable)

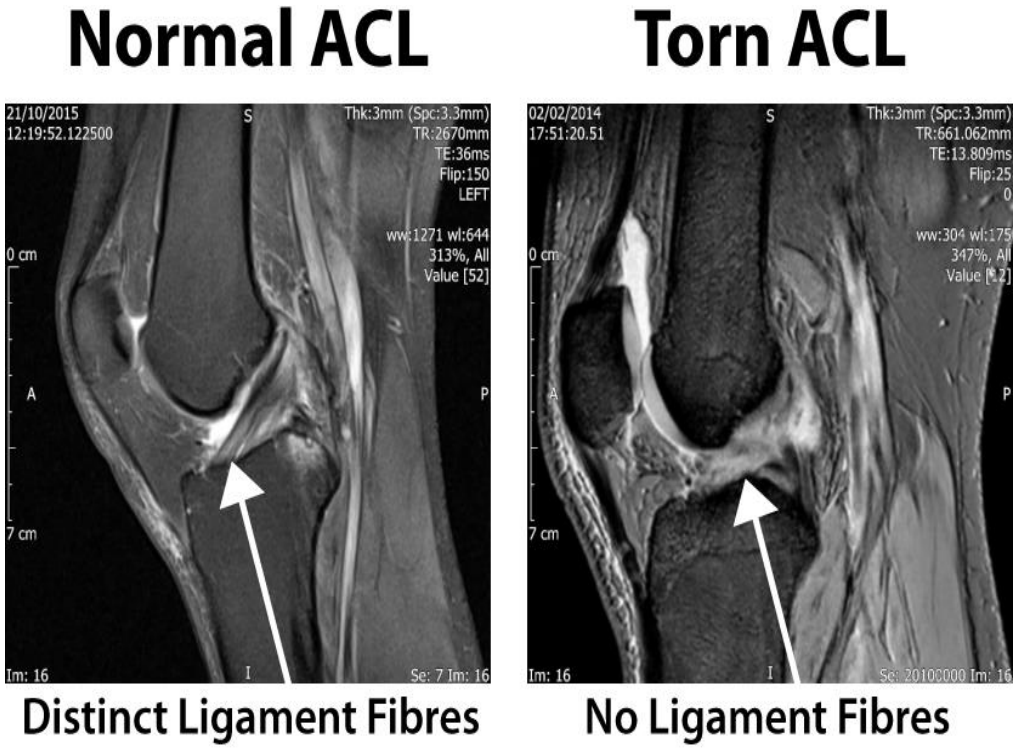
Anterior Cruciate Ligament (ACL) Tear

- Physical examination
  - Joint effusion: hemarthrosis
  - Toe touch gait
    - Knee bend & avoid knee extension
    - Increase use gastroc and increase pain 2nd to altered
    - Joint effusion contributes
  - Limited AROM 2nd pain & effusion
  - Tests: + Lachman, Anterior Drawer
  - MCL Laxity
    - Laxity 0 degrees concern for associated ACL injury
    - MCL and meniscus injuries commonly associated with ACL tear- “Terrible Triad”

Anterior Cruciate Ligament (ACL) Tear

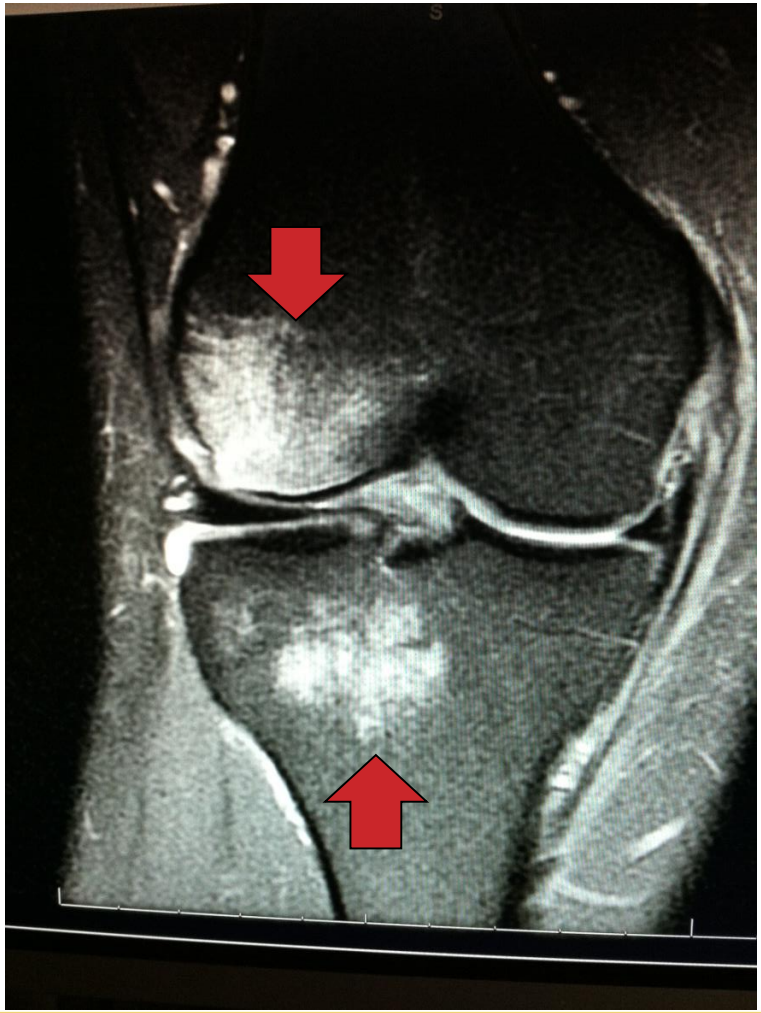
Segond Fracture

MRI

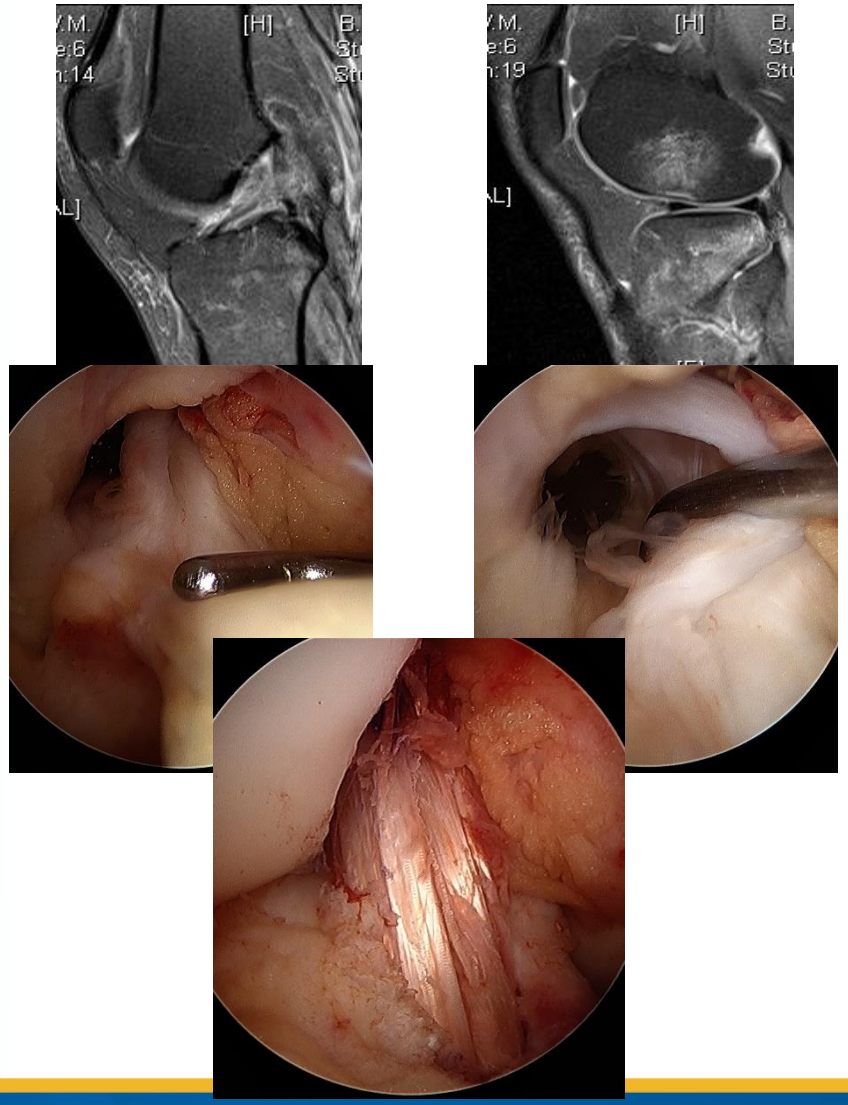


Anterior Cruciate Ligament (ACL) Tear

Pivot Shift Contusion pattern- Lateral Femoral Condyle and Lateral Tibia



Anterior Cruciate Ligament (ACL) Tear



- Exam: + effusion, dec ROM, + Lachman's test, + anterior drawer
- May have concurrent meniscus tear
- ACL Reconstruction recommended for symptoms of instability
- Non-op: bracing/ PT

Posterior Cruciate Ligament (PCL) Tear

- Primary action: limit posterior translation tibia on femur
- Secondary action limit varus & valgus stress & external rotation
- Injury Mechanism:
  - Direct blow tibia forcing PCL posterior (most common)
  - Dashboard injury results combined ligament injury
  - Hyperflexion (non-contact MOI)
- Chronic PCL injury
  - Leads to instability
  - Patellofemoral issues
  - Early medial compartment OA
- Symptoms
  - Sudden pop with deep seated pain and knee effusion
- Exam
  - Posterior Sag Sign/ Quad Activation and Posterior Drawer

Posterior Cruciate Ligament (PCL) Tear

Normal PCL

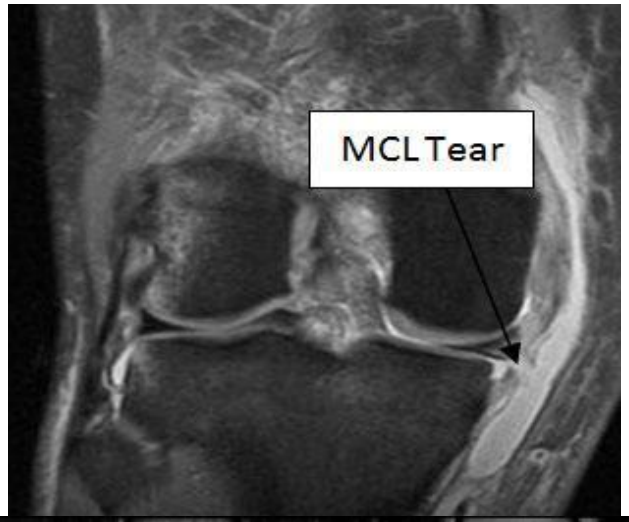
PCL TEAR

Medial Collateral Ligament (MCL)

- MOI: valgus force directed at the lateral aspect of knee
- Exam: TTP over MCL, laxity with valgus stress; check at 0 and 30 degrees of flexion
- Tx: short course of immobilization, PT, gradual return to play

Medial Collateral Ligament (MCL)

- MRI
  - Modality of choice to see soft-tissue structures
  - MCL best visualized on coronal series
  - Bone bruising to the lateral femoral condyle and tibial plateau may be seen in up to 45% of MCL injuries



Lateral Collateral Ligament (LCL)

- General:
  - Aka: *Fibular collateral ligament*
  - Rare to have an isolated LCL injury
    - Contralateral leg helps to prevent a varus stress mechanism to knee
  - Associated with Posterolateral corner injuries
  - May have a concomitant Common Peroneal Nerve injury
    - Look for associated foot drop- inability to actively dorsiflex ankle
  - Mechanism of Injury
    - MVA & sports injury – most common
      - Direct blow to medial aspect of wt-bearing leg
      - Forced varus thrust and external rotation leg
  - Physical Exam
    - Tender to palpation over lateral joint line
    - + Varus Stress with instability at 0 (ACL/LCL) and 30 (LCL)
    - Assess Dial Test to rule out Posterolateral Corner Injury

Lateral Collateral Ligament (LCL)

- Radiographs
  - X-ray
    - AP, Lateral, Tunnel, Patellofemoral view
  - MRI
    - Modality of choice
    - See soft-tissue structures
    - Best seen on Coronal view

Normal LCL

LCL Tear

Knee Dislocation

- Mechanism of injury- may present with a vague history, particularly in obese patients
- Physical Exam changes:
  - Unable to move knee
  - Multiple Ligament injury - **Skin is not a stabilizer**
  - Drop Foot- Common Peroneal Nerve Injury
  - Dorsal foot sensory changes
  - Asymmetric pulse assessments- be sure to check ABI/ Doppler

Knee Dislocation

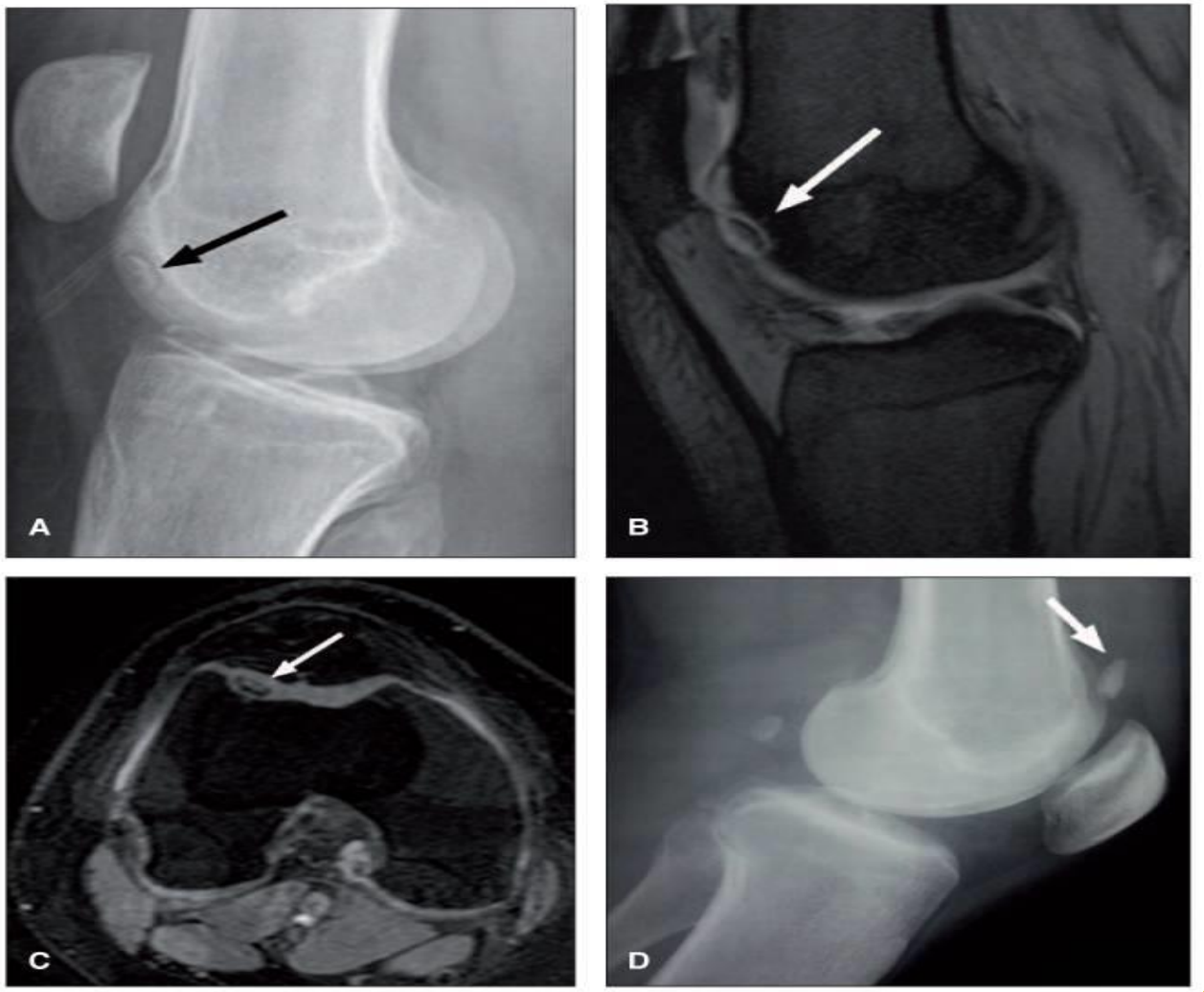
AP view

Cross Table Lateral view

Osteochondral Injury

- Articular surface injury involving hyaline articular cartilage and/or subchondral bone
  - Repetitive stress to knee causes disruption to bone & blood supply; Trauma
  - Weakness in articular cartilage & shear forces gradually dissects articular cartilage from subchondral bone
- Clinical presentation & symptoms variable
  - Juvenile (most commonly ages 9-17)
  - adult (worst long-term outcomes- leads to DJD)
- Knee (most common)
  - 70% knee lesions medial femoral condyle(MFC)
    - Posterolateral
  - Complete detachment = loose body

Osteochondral Injury



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Knee Osteoarthritis

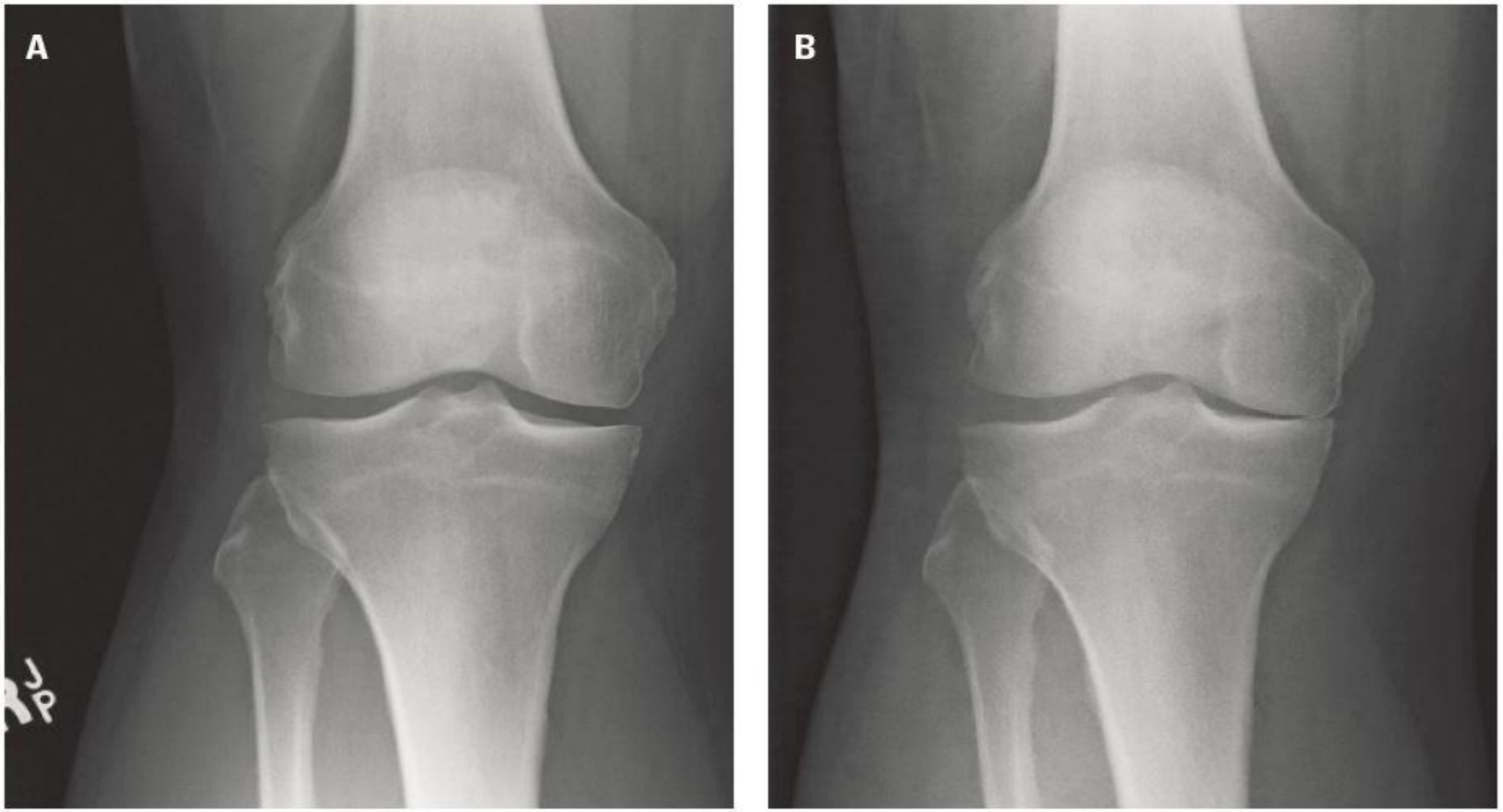


Figure. Two anteroposterior radiographs of the same knee. The non-weight-bearing radiograph (A) shows minimal medial joint space loss, while the weight-bearing radiograph (B) reveals significant loss.

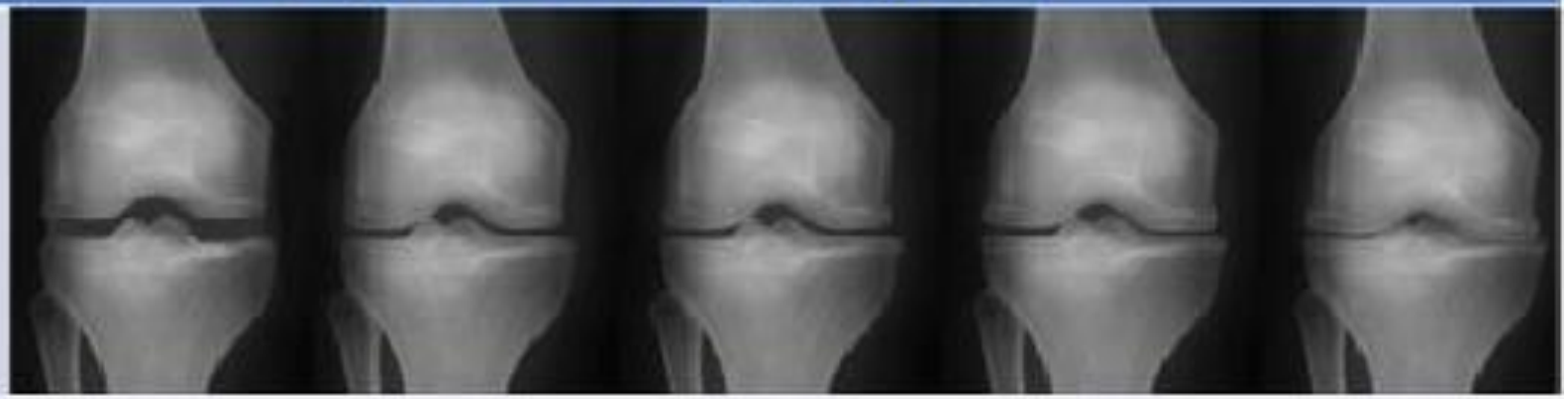
Knee Osteoarthritis

- Most common form arthritis
  - Knee most often involved
  - Can affect other joints
  - Advanced age > younger age
  - Men=Women
  - Immobility stiffness
- Non-inflammatory arthritis
  - Primary: native defect
  - Secondary: due to trauma, infection
  - Chondrocytes unable to repair following injury

Knee Osteoarthritis

- Progression of osteoarthritis
  - Deterioration hyaline articular cartilage
    - Leads to loss of cartilage on bearing surface
  - Osteophyte development
  - Osteochondral junction breakdown
    - Interface between hyaline cartilage and bone surface lost
  - Cartilage breakdown
  - Subchondral microfractures
  - Subchondral cyst formation
  - 2nd to increased pressure of synovial fluid over production

Knee Osteoarthritis

Kellgren–Lawrence grading scale					
X-Ray					
OA Grade	Grade 0 (Normal)	Grade 1 (Doubtful)	Grade 2 (Mild)	Grade 3 (Moderate)	Grade 4 (Severe)
JSN	No radiographic features of OA are present	Doubtful	Possible	Definite	Marked
Osteophytes		Possible	Definite	Multiple	Large

Knee Osteoarthritis

- WT. BEARING X-RAYS!!
- Non-Op Treatment: PT, NSAIDs, Weight Loss, Corticosteroid Injection, Viscosupplementation
- Operative Tx: Partial vs Total Knee Arthroplasty
  - BMI < 45
  - HbA1C < 7
  - Ideally > 60 years old

Risk Factors for Post-op Infections

- Modifiable
  - Tobacco abuse
  - Obesity/ Metabolic Syndrome (1.5x)
  - A1C > 7
  - Malnutrition (Albumin < 3.5)
  - Poor Oral Health
  - Vit D Deficiency
  - Iron Deficiency Anemia (1.75-2.5x)
- Non-modifiable
  - Prior Surgery (2.4x)
  - Auto-immune disease (1.5x)
  - Age
  - Male Gender (1.5-2x)

(Alamanda & Springer, 2018); (Walocha et al., 2023); (Seok et al., 2022)

Antibiotic Medications

- Dental Antibiotic Prophylaxis
  - 1. Amoxicillin 2 grams
  - 2. Ampicillin 2 gm IV/ IM
  - 3. Ceftriaxone 1 gm IV/ IM
  - 4. Cephalexin 2 gm
  - 5. Clindamycin 600 mg
  - 6. Azithromycin 500 mg

  - Take 1 hour prior to dental work

Septic Arthritis

- Most common joints:
  - Knee
  - Hip
  - Ankle
  - Wrist
  - Shoulder
  - Elbow
- Monoarthritis

- Exam: erythematous, swollen joint; pain with passive ROM
- Cartilage destruction begins as early as 3 days

- Arthrocentesis- avoid traversing area of inflammation or skin lesion

Septic Arthritis

RheumTutor.com

Synovial Fluid Analysis

	NORMAL	Non-Inflammatory	Inflammatory	Septic	Hemorrhagic
Clarity	Transparent	Transparent	Translucent	Opaque	Bloody
Colour	Clear	Yellow	Yellow	Dirty/Yellow	Red
Viscosity	High	High	Low	Variable	Variable
WBC/mm3	<200	200-2,000	2000-10,000 (up to 100,000)	>80,000	200-2,000
PMNs %	<25%	<25%	>50%	>75%	50-75%

Depending on the clinical scenario, synovial fluid is analysed for:

- Cell count and differential
- Crystals
- Culture and sensitivity (if septic arthritis suspected)
- Cytology (if malignancy suspected)

Lyme Arthritis

- Lyme Disease
  - Tick born illness caused by infection with bacteria Borrelia burgdorferi (transmitted through deer ticks)
  - Prophylaxis
    - Doxycycline 200 mg within 72 hours of tick removal
  - Early Localized Lyme disease
    - Doxycycline 100 mg for 10-21 days
  - Late Lyme disease (Lyme Arthritis)
    - Doxycycline for 28 days
  - Refractory cases may require IV antibiotics (Ceftriaxone)

Gout vs Pseudogout

Gout

- Patients tend to be over 40
- Small joints
- Severe joint pain and swelling
- Soft tissue swelling on radiographs
- Uric acid crystals
- Negatively birefringent needle shaped crystals
- Rest, NSAIDs, Allopurinol

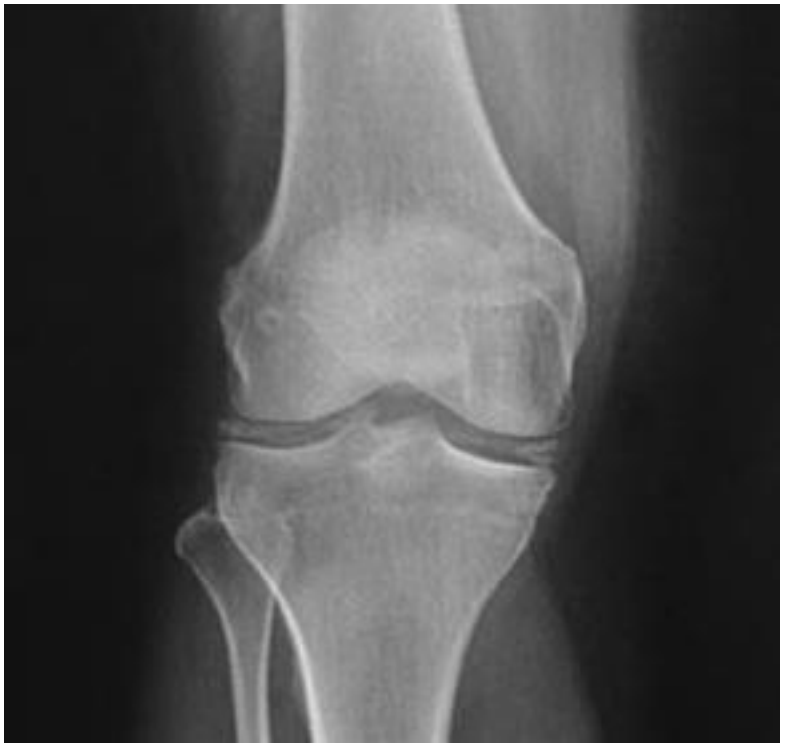
Pseudogout

- Elderly population
- Large joints (most commonly in knee)
- Moderate joint pain and swelling
- Chondrocalcinosis
- Calcium Pyrophosphate Dihydrate crystals
- Positively birefringent Rhomboid- shaped crystals
- Rest, NSAIDs, joint aspiration

Gout vs Pseudogout

Gout

Pseudogout

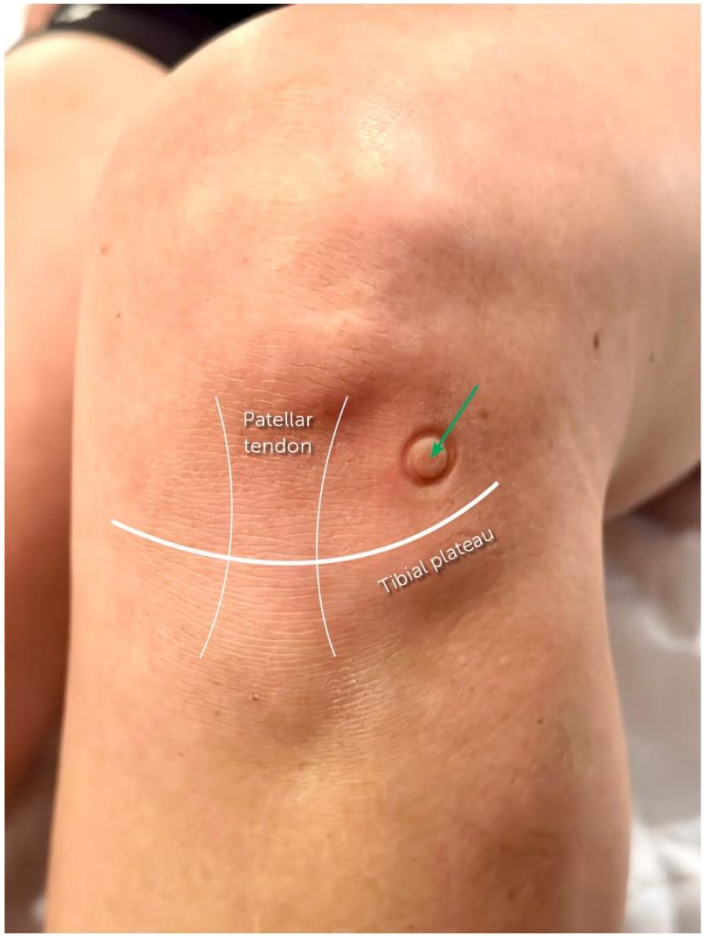


Injections

- Corticosteroid Injections
  - Methylprednisolone (Depo-Medrol)/ Triamcinolone (Kenalog)/ Betamethasone (Celestone)/ Dexamethasone
  - Typically buffered with Lidocaine/ Marcaine to reduce injection site pain, provide immediate pain relief and dilute the steroid to distribute it throughout joint
  - Limit joint injections to every 3-4 months
  - Avoid repetitive injections around tendons
  - Side effects: Patients may experience a steroid flare for 24-48 hours, elevated blood sugars, skin atrophy and bleaching of skin pigment at injection site
  - Repetitive doses may increase chondrotoxicity

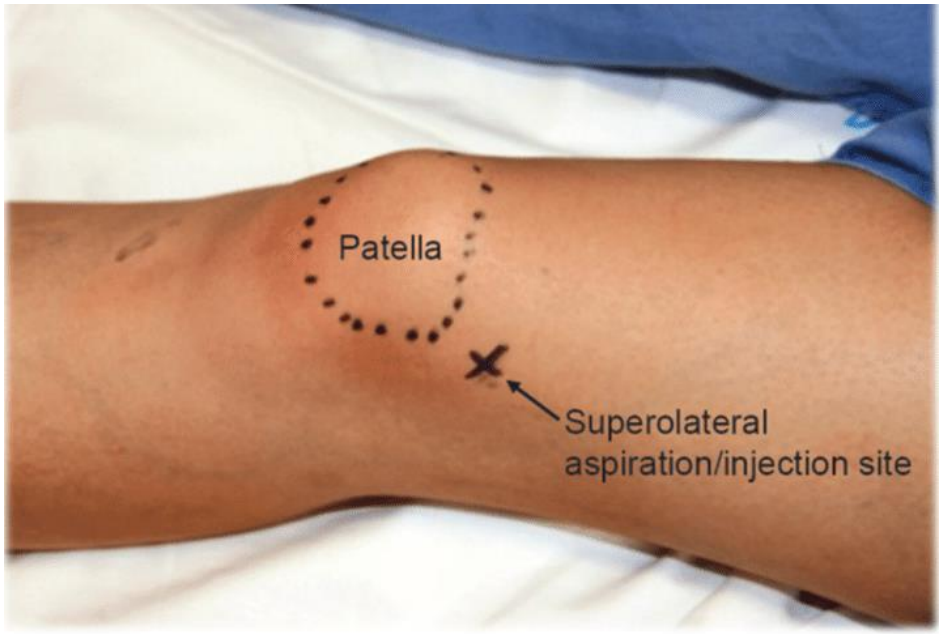
Injections

- Seated Technique- Anterior Approach
  - Knee flexed to 90 degrees
  - Palpate the lateral joint line and inferior-lateral aspect of patella
  - Dimple or window in lateral joint space
  - 21/22 guage 1.5 inch needle aimed 45 degrees medially
  - Avoid injecting into fat pad (may feel resistance and may be painful)
  - Redirect needle if you feel bone



Injections

- Supine Technique- Superolateral Approach
  - Palpate superior and lateral border of patella
  - Measure 1 cm superior to patella and 1 cm lateral
  - Places you under the quadriceps tendon
  - Aim towards/ under superior pole of patella
  - Utilize this approach for any knee aspiration
  - Redirect needle if you feel bone of the distal femur



Injections

- Hyaluronic Acid Injections (HA)
  - Hyaluronic acid is a naturally occurring substance found in the synovial fluid surrounding joints. (Molecular weight for normal human synovial fluid is equal to 6000-7000 kDa)
  - HA acts as a lubricant to enable bones to move smoothly and provides shock absorption for the joint
  - Joints with osteoarthritis have a lower concentration of Hyaluronic acid
  - May be effective in early stages of arthritis but more research is needed to support
  - Does NOT reverse arthritic changes or grow cartilage

Hyaluronic Acid (HA) Injections

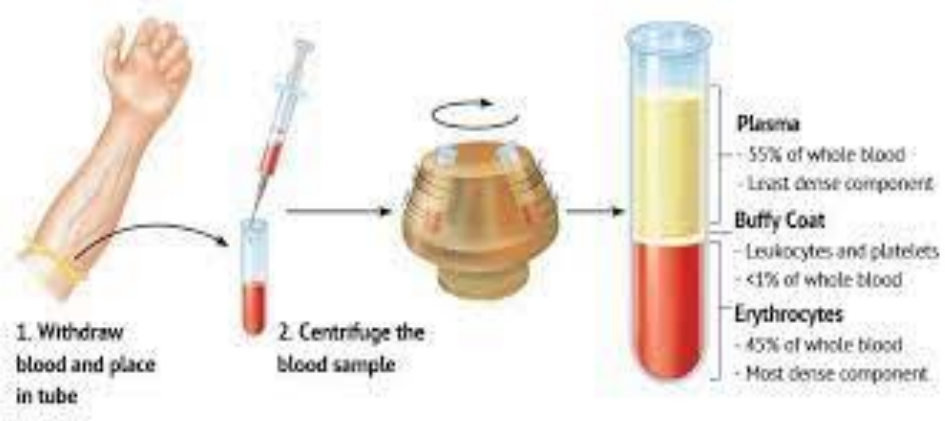
Brand Name Manufacturer	Generic Content	Molecular Weight (kDa)	Dosage
Hyalgan (Fidia Pharma)	1% sodium hyaluronate	500–730	20 mg weekly (five injections)
Synvisc (Sanofi)	0.8% hylan G-F 20	6000	16 mg weekly (three injections)
Synvisc-One (Sanofi)	0.8% hylan G-F 20	6000	48 mg one-time injection
Supartz (Bioventus)	1% sodium hyaluronate	620–1170	10 mg weekly (five injections)
Euflexxa (Ferring B.V.)	1% sodium hyaluronate	2400–3600	20 mg weekly (three injections)
Gel-One (Zimmer)	1% cross-linked hyaluronate	Not disclosed	30 mg one-time injection
Orthovisc (DePuy Synthes)	1.5% sodium hyaluronate	1000–2900	30 mg weekly (three to four injections)
Monovisc (Anika/Pendopharm)	2.2% cross-linked hyaluronan (proprietary cross-linking agent)	1000–2900	88 mg one-time injection
GenVisc 850 (Adant) (OrthogenRx)	1% sodium hyaluronate	620–1170	25 mg weekly (five injections)
Hymovis (Fidia Pharma)	0.8% hexadecylamide derivative of hyaluronan	500–730	24 mg weekly (two injections)
Gelsyn-3 (Gel-Syn) (Bioventus LLC)	0.84% sodium hyaluronate	1100	16.8 mg weekly (three injections)
Durolane (Bioventus LLC)	non-animal stabilized hyaluronic acid	Not disclosed	60 mg one-time injection

Injections

- Platelet Rich Plasma (PRP)
  - Minimally invasive method of obtaining a natural concentration of autologous growth factors by centrifugation of autologous blood to separate and extract the plasma and buffy coat portion of the blood, which contain high concentration of platelets
  - Platelets are the 1st cell type to arrive at tissue injuries and are particularly active in the early inflammatory phase of tissue healing through degranulation and production of growth factors to enhance tissue repair
  - Concentration of platelets (growth hormone) can be 5-10 times greater in PRP preparations
  - NOT covered by most insurance plans, including Medicare

Platelet Rich Plasma (PRP)

- Conditions to Treat:
  - Chronic tendon injuries (lateral epicondylitis)
  - Acute Ligament (UCL) and Muscle (Hamstring) Injuries
  - Surgery Adjunct (RTC, Meniscus, ACL)
  - Knee Arthritis
  - Fracture Healing
- Leukocyte-Rich vs Leukocyte-Poor

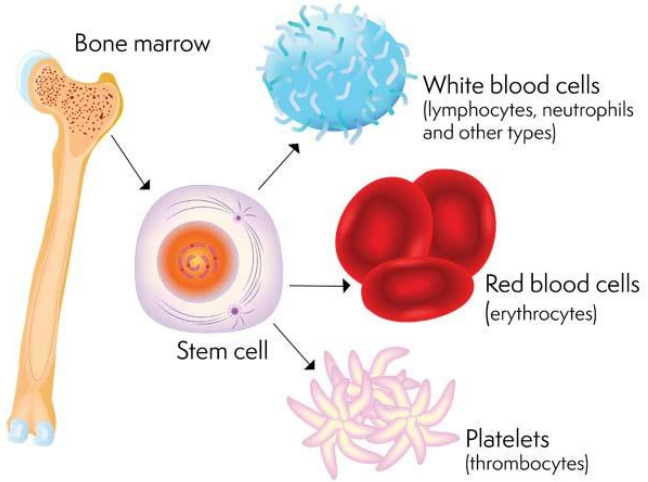


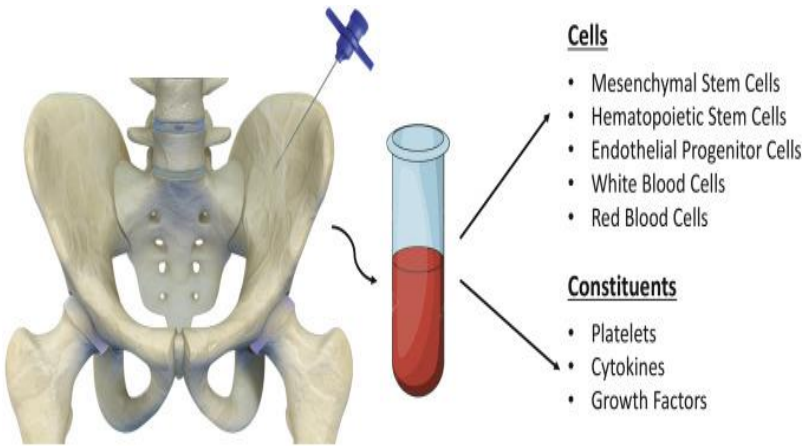
Injections

- Stem Cell Therapy
  - Autologous stem cells have the natural ability to accelerate healing and promote regeneration after an injury
  - Mesenchymal stem cells (MSC) are specific cells to the musculoskeletal system which are able to differentiate into different tissue types such as ligament, tendon, muscle and even bone
  - May be used to treat bone fractures, soft tissue injuries and osteoarthritis
  - More research is evolving; still considered experimental

Stem Cell Therapy

- Bone Marrow-Derived Stem Cells (BMAC)
  - Gathered by aspirating bone marrow from the back of a patient's pelvis
  - Machine is used to isolate the platelets and stem cells from the blood products (bone marrow aspirate) and injected into the injured area





Quadriceps Contusion

- The Quadriceps muscle group extends the lower leg.
- A contusion results from a direct blow to the Quad muscles
- Common athletic injury in any contact sport.
- Contusions are referred to as mild, moderate or severe
- Severity is determined by the amount of knee ROM lost
  - mild > 90 degrees
  - moderate 45-90 degrees
  - severe < 45 degrees
- Untreated quadriceps contusion can result in Myositis Ossificans
  - Calcification of the muscle tissue 2nd to trauma, intramuscular hemorrhage

Quadriceps Contusion

- Physical Examination
  - Inspection: skin bruising/swelling & gait changes
  - Palpation: Quad muscle tender
    - Look for defect 2nd to rupture quad muscle
  - ROM: Alteration in AROM & gait
    - mild > 90 degrees
    - moderate 45-90 degrees
    - severe < 45 degrees
  - Strength: diminished 2nd to pain & swelling
  - Neuro/Vascular: no usual changes
  - Ortho Tests

Quadriceps Contusion

- Radiographic Exam
  - AP & Lateral Femur
    - Usually no abnormalities
    - Calcification seen later changes
    2nd to Myositis Ossificans
    - Acute Fx not likely
  - MRI or Ultra-sound
    - Soft –tissue injury
- Treatment
  - Recognize injury acutely; RICE and avoid heat
  - Start gentle ROM; Crutches to minimize pain
  - Follow closely for 24-48 hours to monitor for compartment syndrome

Quadriceps Contusion

- Myositis Ossificans
  - Occurs in 20% of large hematomas associated with contusions/ strains
  - Proliferation of bone at the site of hematoma
  - Bone formation is diagnosed on x-ray 3-4 weeks after initial trauma
  - May be treated with Extracorporeal Shock-Wave Therapy (ESWT)

Quadriceps Tendon Rupture

- General
  - Quadriceps Tendon Tear: Tissues injured
    - Quadriceps muscle & tendon
    - Retinaculum (medial & lateral)
    - Patellofemoral ligament
- Involves either Quad or Patellar tendon
  - PARTIAL OR COMPLETE
  - Complete rupture rare in young population
  - Patellar tendon involved <40 yrs age
  - Quad tendon involved > 40 yrs age

Quadriceps Tendon Rupture

- Quad Tendon Injury
  - Occurs most in 60-70 yrs of age range
  - Occurs 2nd to poor circulation to quad tendon
  - Men > Women
  - Partial vs. complete tear
  - Transverse tear usual injury: near patellar
    - May extend into Quad muscle or ligament structures depending on amount knee flexion at the time of injury
  - Increased pain with acute injury
- Risk Factors
  - RA, Steroids, DM, Renal Disease, Gout, Hypothyroidism, Fluoroquinolones

Quadriceps Tendon Rupture

- Clinical Presentation
  - Pain
  - Quad tendon palpable defect
  - Swelling/bruising
  - Hemarthrosis
  - Loss of ROM/altered gait – complete tear
  - Lack of isometric quad strength – complete tear
    - Inability to perform a straight leg raise
  - Partial Tear
    - Weak terminal knee extension vs. isometric quad contraction
    - MRI helps to delineate extent of injury

Quadriceps Tendon Rupture

- **Acute Injury**
  - Recognize injury
  - Assess orthopaedic trauma
  - Focused Orthopaedic exam
    - Quad set
    - Terminal knee extension
    - Ligamentous instability
    - Neurovascular integrity

Quadriceps Tendon Rupture

Acute Injury

- Radiographs: 2 view knee (femur)
  - Minimizes distraction of patella and identifies any fracture
  - Sunrise, Merchant, Tangential views may be pain prohibited
  - MRI: quantify suspected partial ruptures of tendon

Quadriceps Tendon Rupture

- **Acute Injury**
  - Immediate Treatment
    - ICE
    - Knee Aspiration: pain control
    - Knee Immobilizer
      - Wear all times
      - Ok to Weight-bear as tolerated: Negative fractures
      - Remove Daily
        - skin care
        - protected bathing (consider age and patient abilities)
    - Assisted Ambulation
      - Crutches vs. Walker vs. Wheel-chair
    - Pain management
    - Prompt follow up for reassessment
      - Continued conservative treatment in brace
      - Surgical consideration and repair

Quadriceps Tendon Rupture

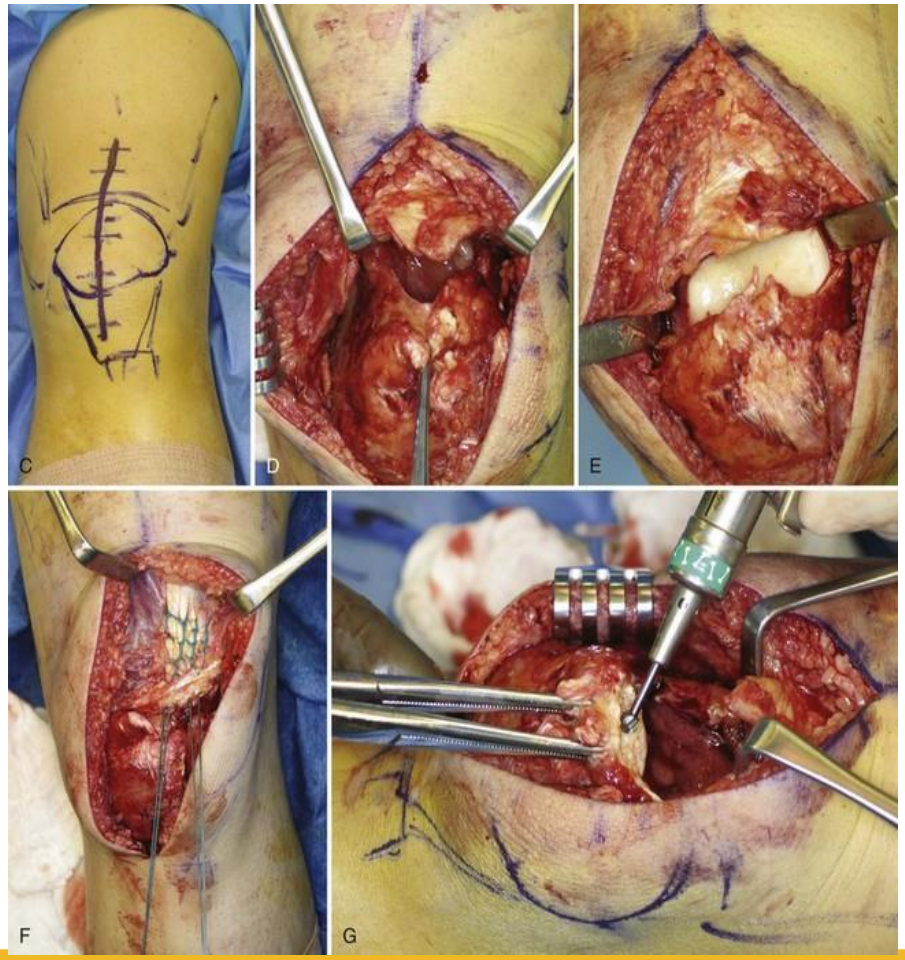
- Treatment: Operative vs. No-Operative
  - Partial Tear
    - May heal with prolonged immobilization
    - Need MRI to confirm extent of injury
    - Usually 8-12 weeks for full recovery
    - Begin ROM EX depending on amount of healing noted and based on associated factors
    - Usually started protected ROM ex at 6 weeks
    - Big concerns for elderly with Activities of Daily Living (ADL)

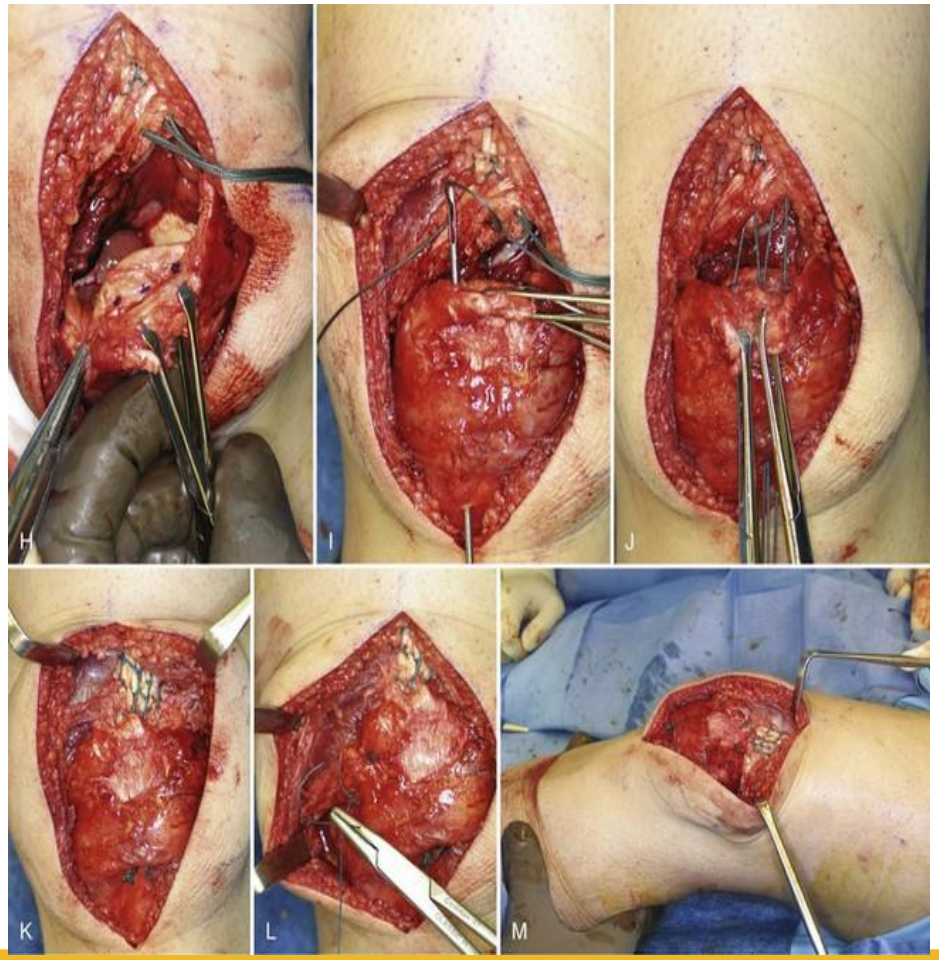
Quadriceps Tendon Rupture

- Treatment: Operative vs. No-Operative
  - Complete Tear
    - Surgical reapproximation of tissue
    - Plan surgery <48 hrs post injury
    - Integrity of repair related to quality of native tissue
    - May have to secure tendon into patella
    - Must balance forces pulling on patella
    - Brace in Full Extension
    - Pain and Edema control
    - Usually 8-12 weeks for full recovery
    - Begin ROM EX depending on amount of healing noted and based on associated factors
    - Residual limits with strength and ROM – older population

Quadriceps Tendon Rupture

Surgical Repair of Quadriceps Tendon





Patellar Tendon Rupture

- General
  - Occurs <40 age group primarily
  - Knee flexed position & excessive force applied
  - Inferior pole patella most common spot for rupture
- Clinical Symptoms:
  - Pain
  - Patella tendon defect or abnormal position of patella
  - Swelling/bruising
  - Hemarthrosis
  - Loss of ROM/altered gait – complete vs. partial tear
  - Lack of isometric quad strength – complete tear
  - Partial Tear
    - Retinaculum minimally injured
    - Weak terminal knee extension vs. isometric quad contraction
    - MRI helps to delineate extent of injury

Patellar Tendon Rupture

- Physical Exam
  - General Knee Physical Exam
  - Defect at patella tendon or abnormal Patella position
  - Lack of terminal extension
  - Inability to perform a Straight Leg Raise (SLR)
  - Partial tear may allow for some isometric Quad contractions and very weak terminal knee extension
  - Patella appears normal position with partial tear
  - No ligament laxity
  - Neurovascular exam intact
  - Hemarthrosis maybe present

Patellar Tendon Rupture

Radiographs

- Anterior-posterior (AP) & Lateral Views
  - High riding patella on lateral view
  - May show bony avulsion injury
  - Patella usually above Blumensaat's line
  - Check for patella alta by Insall or Blackbourne methods

Patellar Tendon Rupture

- **Acute Injury**
  - Immediate Treatment
    - ICE
    - Knee Aspiration: pain control
    - Knee Immobilizer
      - Wear all times
      - Ok to Weight-bear as tolerated: Negative fractures
      - Remove Daily
        - skin care
        - protected bathing (consider age and patient abilities)

Patellar Tendon Rupture

Treatment – Partial Tear

- May heal with prolonged immobilization 2nd to minimal damage to retinaculum
- Big concerns for elderly with Activities of Daily Living (ADL) & associated factors
- Need MRI to confirm extent of injury
- Usually 8-12 weeks for full recovery
- Immobilize for 4-6 weeks in full extension
- Usually started protected ROM ex at 6 weeks
- Begin ROM EX depending on amount of healing noted and based on associated factors
- May have residual lag in extension and extension strength

Patellar Tendon Rupture

- Treatment – Complete Tear
  - Goal to repair damaged tendon and associated structures
  - Reapproximate wound edges
  - Trough and/or drill holes in patella to accept tissue
  - Variety of materials and methods to repair tendon
    - Suture
    - Suture anchors
    - Fiberwire
  - Repair retinaculum and joint capsule
  - Evaluate patellar alignment after repair to ensure balanced movement

Hip Pointer

- Common injury in football and hockey
- Deep bruise to the Iliac Crest of the pelvis
- Treat with NSAIDs, Ice and possible injection
- Pad the area well
- Early ROM exercises to avoid stiffness

Coxa Saltans “Jumping/Snapping Hip”

Internal Coxa Saltans

- Psoas tendonitis – snapping of psoas against iliacus muscle
  - Often others can hear this from across the room
- Usually results from core and pelvic muscle imbalance/weakness
- Action of the psoas is to flex the hip, but when core muscles weak, acts a secondary lumbopelvic stabilizer and gets ore from overuse

Treatment – Physical therapy, possible diagnostic and therapeutic psoas tendon sheath injection

- Tend to not do psoas releases anymore

Coxa Saltans “Jumping/Snapping Hip”

External Coxa Saltans

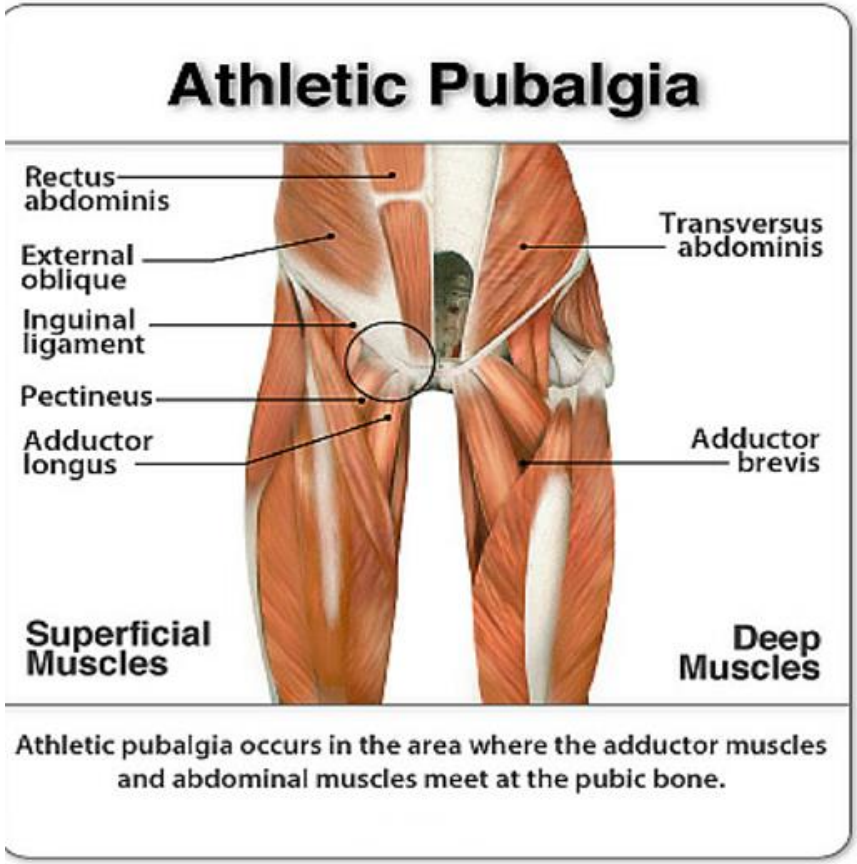
- IT band snapping over the greater trochanter
- Lateral hip pain

Treatment – Physiotherapy for stretching and strengthening

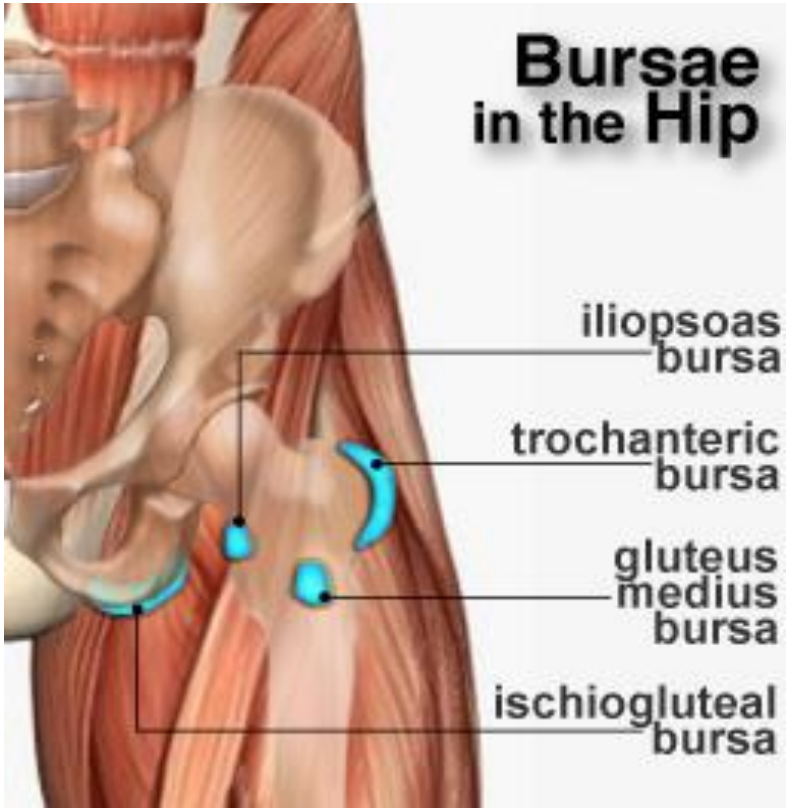
- Rarely, IT band surgical lengthening/release

Athletic Pubalgia – Sports Hernia

- Overuse injury to the abdominal wall as it inserts onto the pelvic brim
- Common in hockey, football, soccer and wresting
- Foot planted with associated twisting motion
- Pain may be reproduced on exam with resisted sit-up with resisted adduction or valsalva
- Tx: rest, PT, NSAID; may consider surgery if conservative tx fails



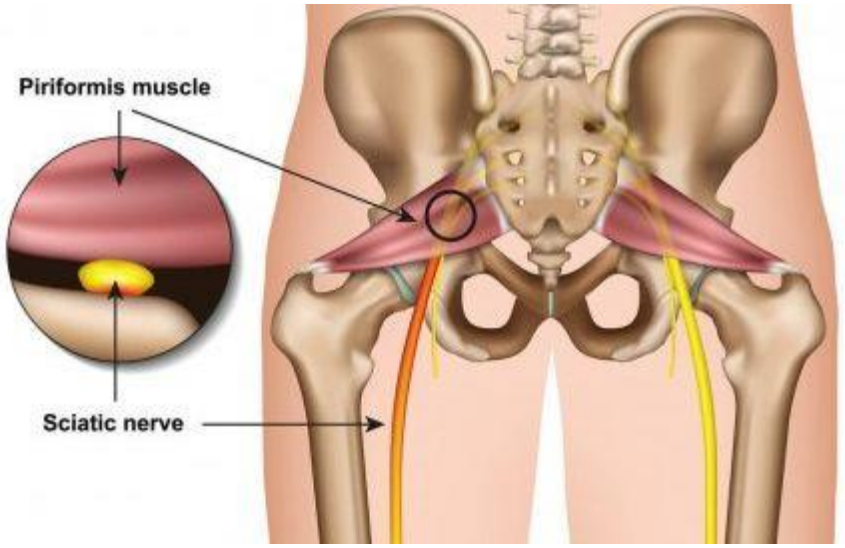
Greater Trochanteric Hip Bursitis



- Pain located directly over the greater trochanter and increases with hip flexion
- Normal x-rays and MRI
- 93% female
- Average age: 53
- Tx: NSAIDs and Physical Therapy (core stabilization and IT band stretching
- Corticosteroid injection for persistent symptoms

Piriformis Syndrome

- Patient present with buttock pain with/ without “Sciatica” symptoms
- FAIR: flexion abduction int. rot.
- To engage the piriformis, have the patient lie in lateral decubitus, stack ankles and clamshell knees open (externally rotate)
- May benefit from a focal steroid injection
- Refractory cases: surgical decompression of the sciatic nerve with partial piriformis release



Femoroacetabular Impingement (FAI)

Intra-articular Hip Pain

- Groin pain associated with impact activities and positions of increased hip flexion
- Patients may present with a “C” sign
- High association with labral tears in hip
  - Labral tears not always the problem (asymptomatic up to 69%)
- FAI: Cam/ Pincer/ Mixed (motion limiting disorder)
  - Pincer: “too much coverage”
    - Crossover sign- overlap of anterior and posterior acetabular wall
    - Similar pathologies: calcified labrum

Femoroacetabular Impingement (FAI)

Cam Lesion

Pincer Lesion

Pediatric Hip Pain

Septic Hip

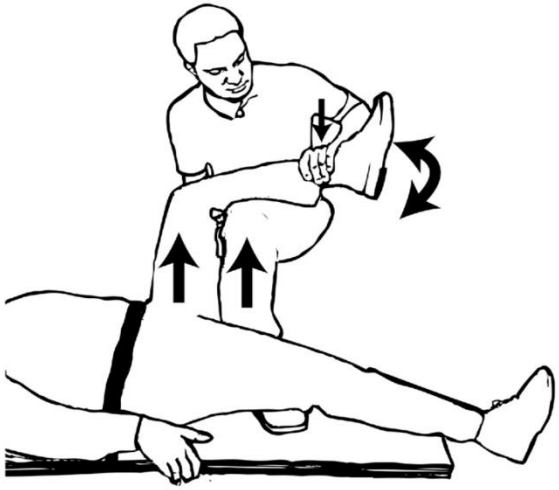
- Inability for a young child (typically < 2 yo) to bear weight or painful hip with motion and toxic appearing
- Positive infection markers
- Medical urgency/ emergency
- Refer to local ED with Peds Ortho on staff

Toxic (Transient) Synovitis

- Most common age is 4-5 years old
- May be transient symptoms after a viral illness
- Requires lab studies to rule-out septic hip
- Recommended work-up in the local ED

Hip Dislocation

- **Posterior**: flexion, traction, adduction and internal rotation
- **Anterior**: traction, abduction, lateralization, rotation
- Reduction palpable and permits improved ROM
- Immobilize with knee immobilizer and abduction pillow

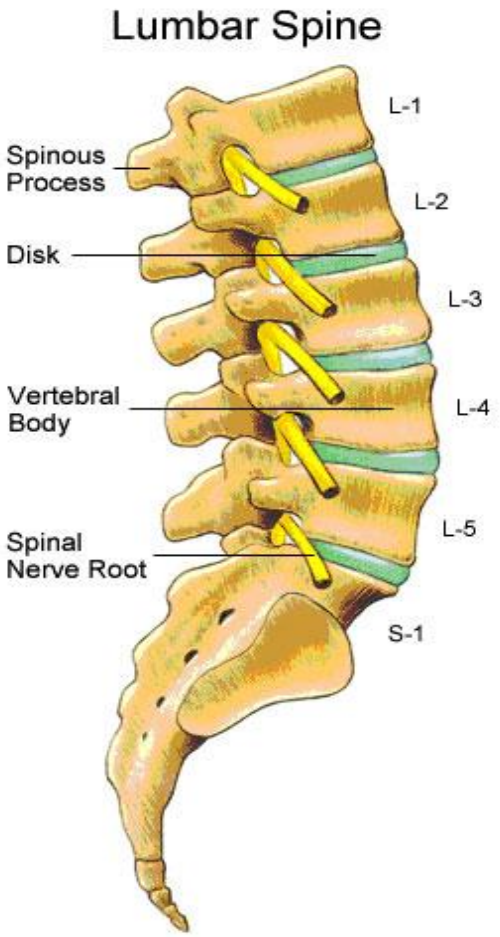


Hip Osteoarthritis

- Most often occurs in patients over 50
- Younger patients with AVN or h/o hip dysplasia
- Symptoms: pain in groin that radiates to thigh/ knee and decreased ROM
- Tx: Weight loss, NSAIDs, PT, Injections, Replacement Surgery

Lumbar Spine

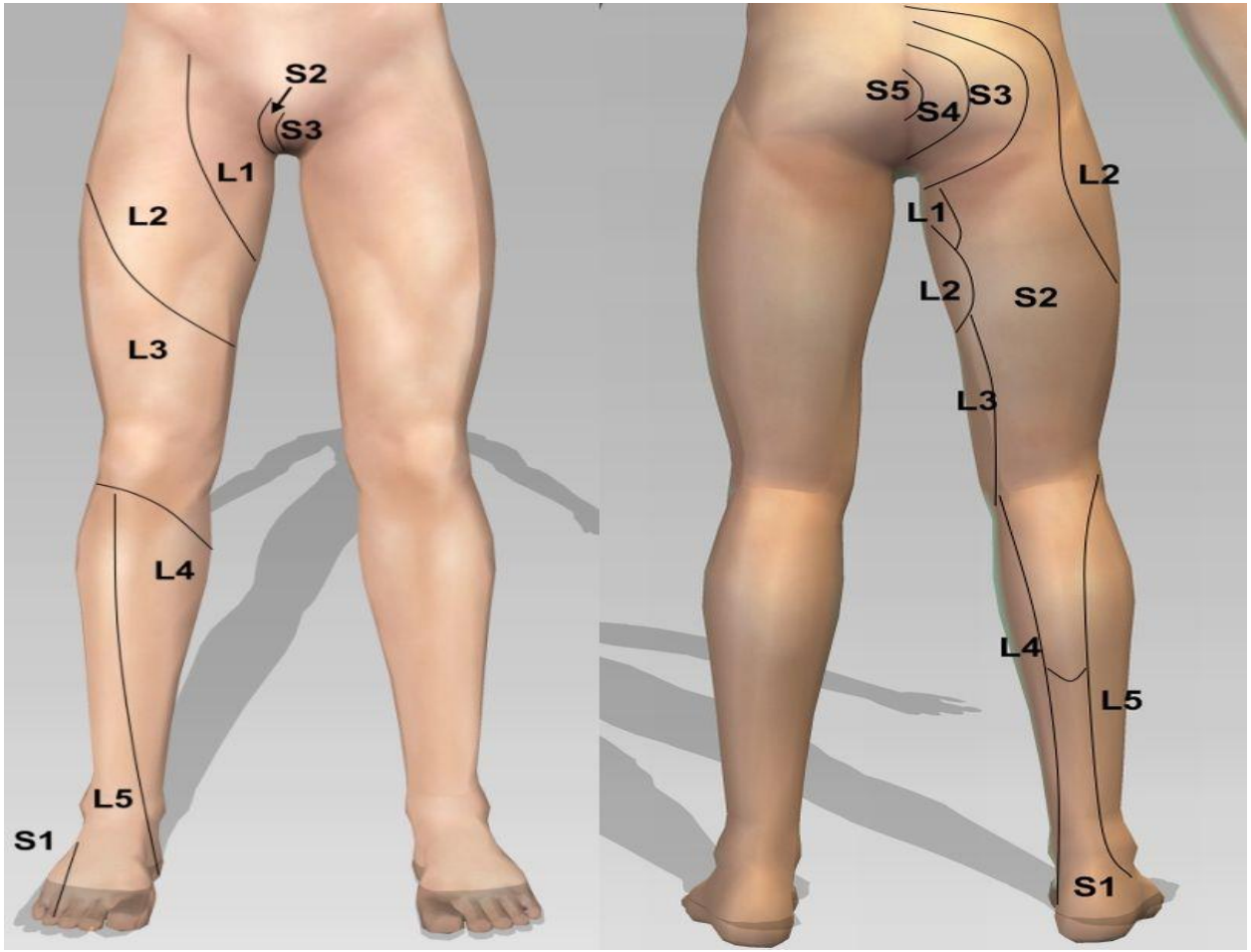
- 5 Lumbar Vertebrae
- 5 Lumbar Nerves
  - Lumbar nerve exits below the corresponding lumbar vertebrae
- Lordosis Curvature
- Examine gait, posture, strength, ROM, atrophy, clonus
- Upper vs Lower Motor Neuron Lesion



Lumbar Spine

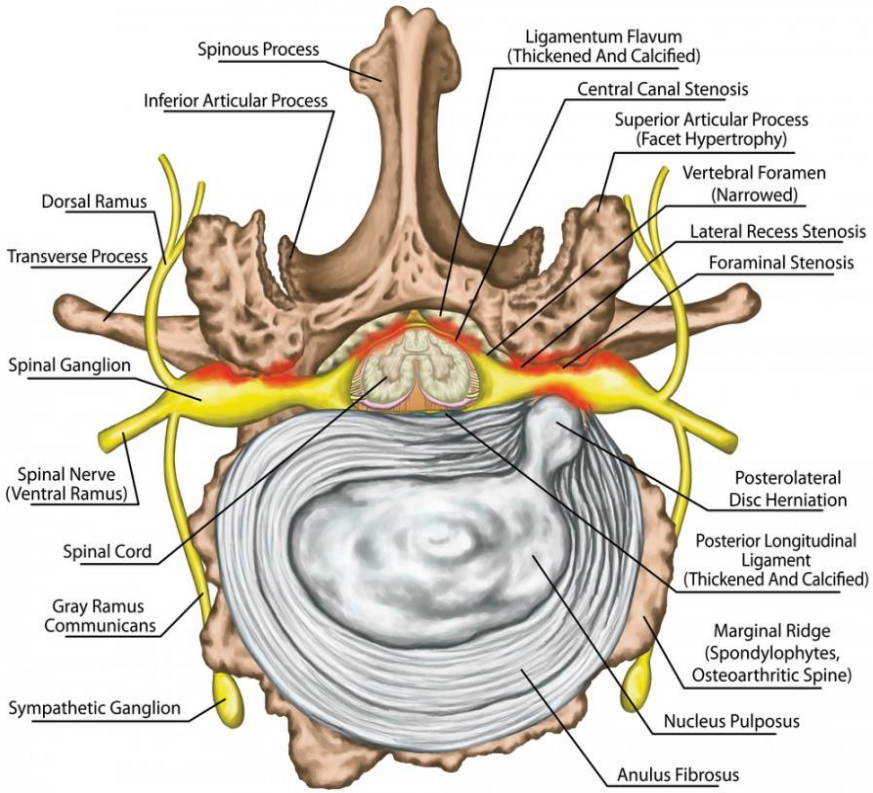
• L1-L2	Hip Flexion	Pat. Tendon Reflex
• L3	Knee Ext/ Hip Add	Pat. Tendon Reflex
• L4	Ankle Dorsiflexion	
• L5	Great Toe Ext./ Ankle Ev./ Hip Add	
• S1	Ankle PF/ Hip Extension	Achilles Reflex
• S1-2	Knee Flexion	

Lumbar Spine



Lumbar Disc Herniation

- Intervertebral Disc- shock absorbers between vertebrae
  - Annulus fibrosus: tough, flexible outer ring
  - Nucleus pulposus: soft center
- Back pain, unilateral leg pain, numbness/ tingling, weakness

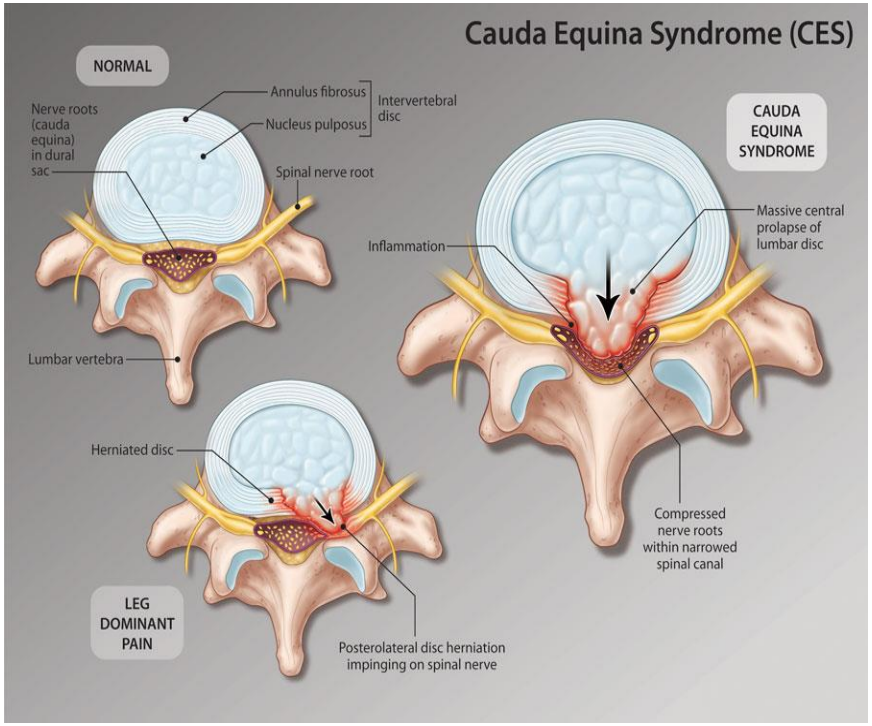


Lumbar Disc Herniation

- Risk factors: improper lifting, overweight, frequent driving, sedentary, smoking
- Exam: Neuro exam, Straight leg raise, MRI
- Tx: Rest, NSAIDs, Steroid dose pak, PT, Epidural Steroid Injection, Surgery

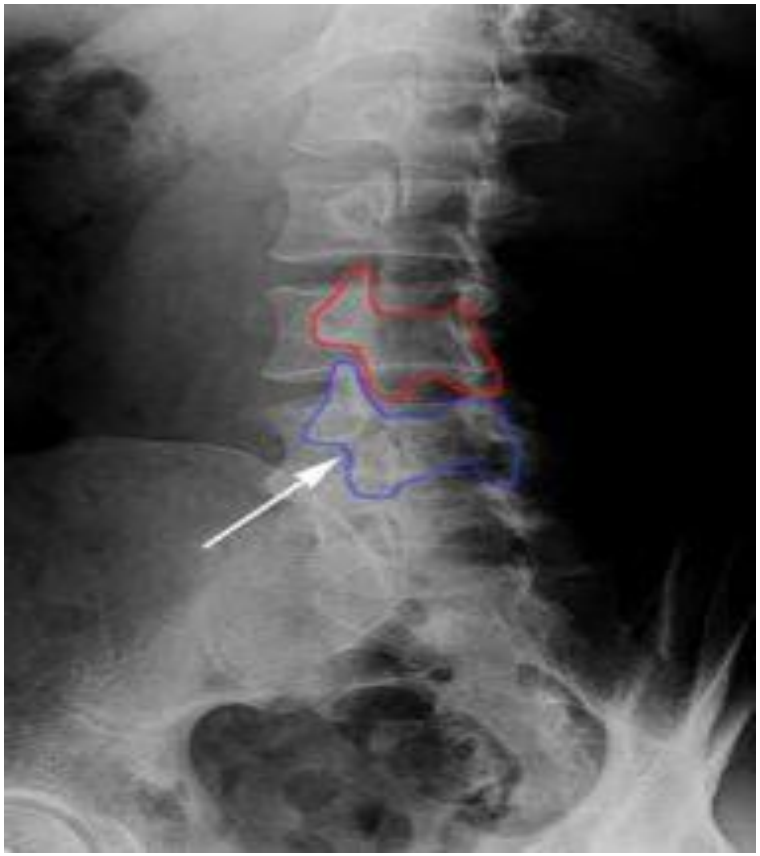
Cauda Equina Syndrome

- Low back pain, motor/ sensory abnormality, bowel/ bladder dysfunction, saddle paresthesia, loss of anal tone
- *SURGICAL EMERGENCY*
- Compression of nerve root bundle by herniated disc, tumor, infection, fx, stenosis

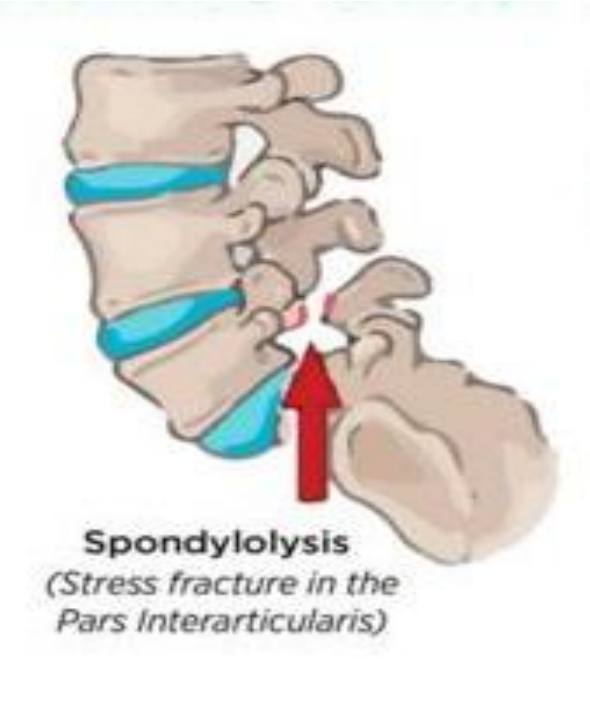


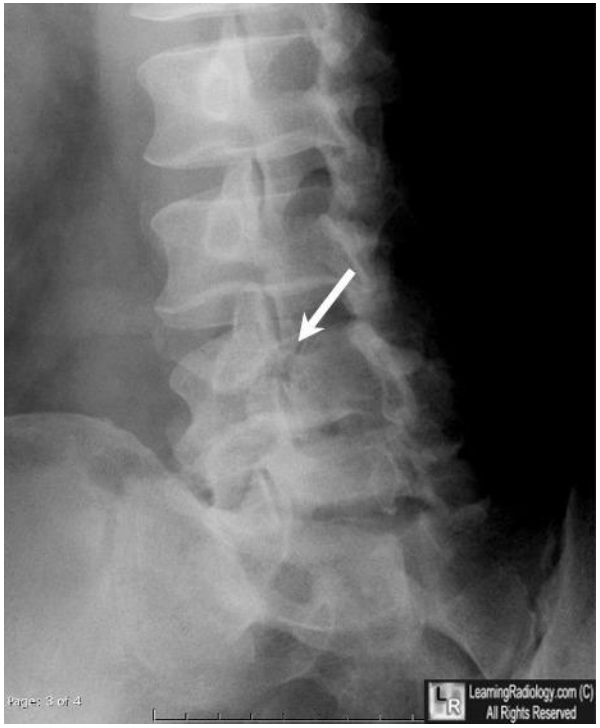
Spondylolysis

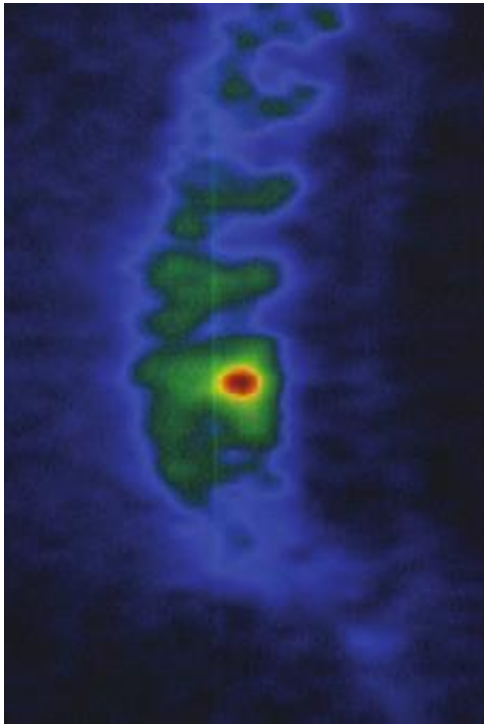
- Defect or stress fracture in the pars interarticularis
- Common in repetitive lumbar extension; Common at L5
- Pain with extension and rotation; tight hamstrings
- Spondylolisthesis- actual anterior slippage of vertebrae
- Imaging: oblique x-ray, CT SPECT



Spondylolysis







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