

APPROPRIATE IMAGING OF THE LOWER EXTREMITY



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OBJECTIVES

- I. Overview of appropriate imaging
 - Cost
 - ACR
- II. Plain x-ray views
- III. Advance imaging
 - MRI
 - CT
 - Bone Scan

OBJECTIVES

- IV. Hip/pelvis
 - Acute
 - Chronic
- V. Knee
 - Acute
 - Chronic
- VI. Ankle/foot
 - Acute
 - Chronic



OVERVIEW



- Cost
- ACR
- Imaging modalities

IMAGING MODALITIES

MODALITY	CHARGE (APPROXIMATE)	TIME (MINUTES)	IDEAL USES	CONTRA- INDICATIONS
CT SCAN	\$845	15-30	Bony anatomy, clarify fx, tumor matrix	Pregnancy
MRI	\$1500	60	Soft tissue, bone edema, fx lines, fluid, bursa, tumor matrix	Ferromagnetic materials, pacemaker, defib, metallic hardware
BONE SCAN	\$700	INJECTION + IMAGING 90 MINUTES	Increased bone turnover, stress fx, fractures, tumor	Pregnancy, radioactive dye allergy
X-RAY	\$35-250	5-15	Bony anatomy, alignment, fx, periosteal rxns, callus, non- union	Pregnancy

ACR (American College Radiology)

- Musculoskeletal imaging committee
 - 8 radiologists
 - 2 orthopedic surgeons
 - Rating between 1 and 9
 - 1 least appropriate
 - 9 most appropriate



Careers - Become a Radiologist ...

OBJECTIVES

- IV. Hip/pelvis
 - Acute
 - Chronic
- V. Knee
 - Acute
 - Chronic
- VI. Ankle/foot
 - Acute
 - Chronic



TIPS

- TREAT THE PATIENT, NOT IMAGING
- TREAT THE PATHOLOGY NOT PAIN
- EVALUATE FUNCTION AND CORRELATE WITH IMAGING IF NECESSARY



ADVANCED IMAGING



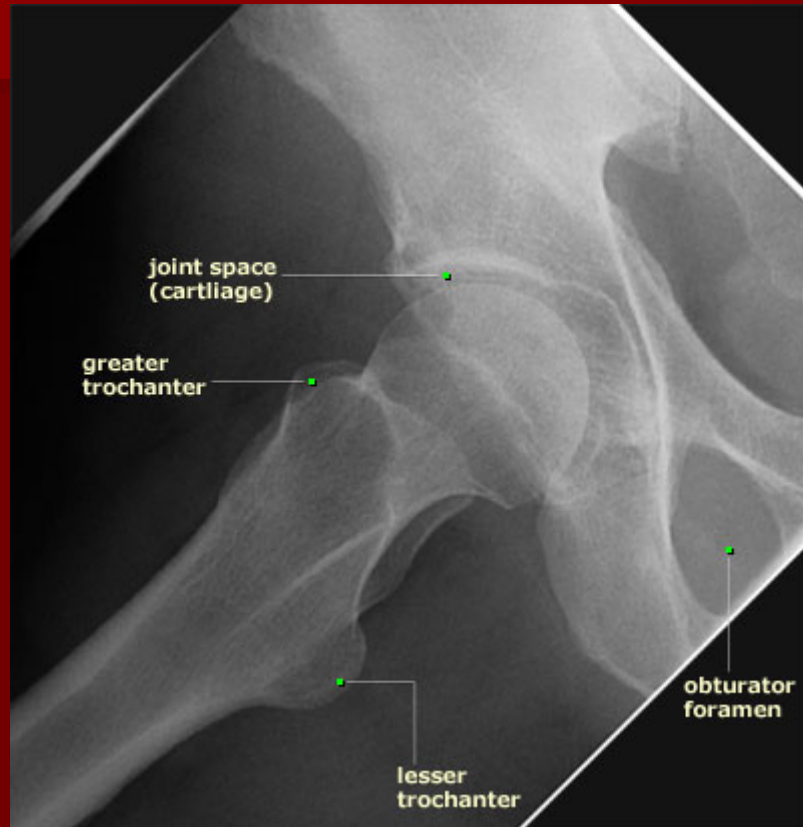
- ORDER:
 - IMAGING MODALITY
 - WORKING DIAGNOSIS
 - SPECIFICITY OF LOCATION
 - Eg. MRI left knee
 - Evaluate degenerative tear posterior horn medial meniscus

CASE # 1 -Acute Hip Pain

65 y/o female slips and falls at home. She is unable to bear much weight, and she c/o some severe right groin pain.



CASE # 1-Acute Hip Pain



- SUSPECT:
 - *Femur fracture (shaft, neck)*
 - *Pelvic fracture*
- Plain PELVIS AP
 - (NOT SINGLE HIP)
 - ***ACR (9)***
 - Frog leg view
(externally rotated)
view (if AP negative)

CASE #2- Chronic Hip Pain

- 50 y/o female c/o right groin pain x 6 months. No prior traumatic injury. Pain with walking and some painful loss of hip range of motion.



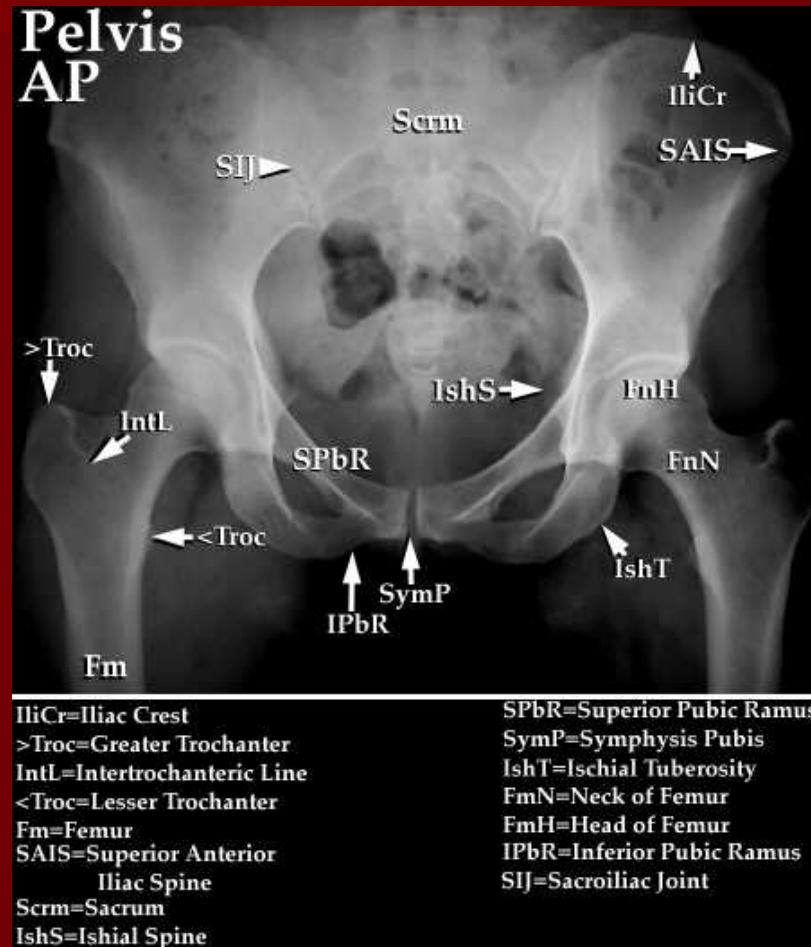
CASE #2- Chronic Hip Pain

■ Suspect:

- *Osteoarthritis of the hip*
- *Transient osteoporosis of the hip*
- *Avascular necrosis of the hip*
- *Femoral neck stress fracture*
- *Pelvic stress fracture*
- *Osteitis Pubis*
- *Tumor*

■ Pelvis (AP, frog leg)

- **ACR: 9**
- **Negative x-ray, suspect:**
 - *Trochanteric bursitis*
 - *SI joint*
 - *Piriformis syndrome*
 - *ITB*
 - *Adductor*
 - *Soft Tissue injuries*



CASE #2-

Chronic Hip Pain

- Consider further imaging:
 - Arthritis on plain x-ray?
 - MRI not recommended
 - ACR: 2
 - No arthritis
 - MRI (ACR: 9)
 - Bone Scan (no ACR rating)
 - Suspect:
 - *AVN hip*
 - *Transient osteoporosis*
 - *Pelvic stress fx*
 - *Femoral neck stress fx*
 - *Labal tear (MRI-arthrogram)*



MRI PELVIS



CASE #3-Acute Knee Pain



- 35 y/o male c/o knee pain after ski injury. He is unable to flex his knee 90 degrees.

OTTAWA CRITERIA-KNEE



- 1. Age 55 or older
- 2. Isolated tenderness of the patella
- 3. Tenderness of the head of the fibula
- 4. Inability to flex at 90 degrees
- 5. Inability to bear weight
- * Joint effusion within 24 hours

CASE #3-Acute Knee Pain



- Walk with no limp
- Twisting injury and no effusion
- Suspect:
 - *Patellar instability*
 - *Collateral ligament injury*
 - *Synovial plica*
 - *Fat Pad impingement*
 - *Stable knee injuries*
 - No x-rays
 - ACR: 2

CASE #3-Acute Knee Pain

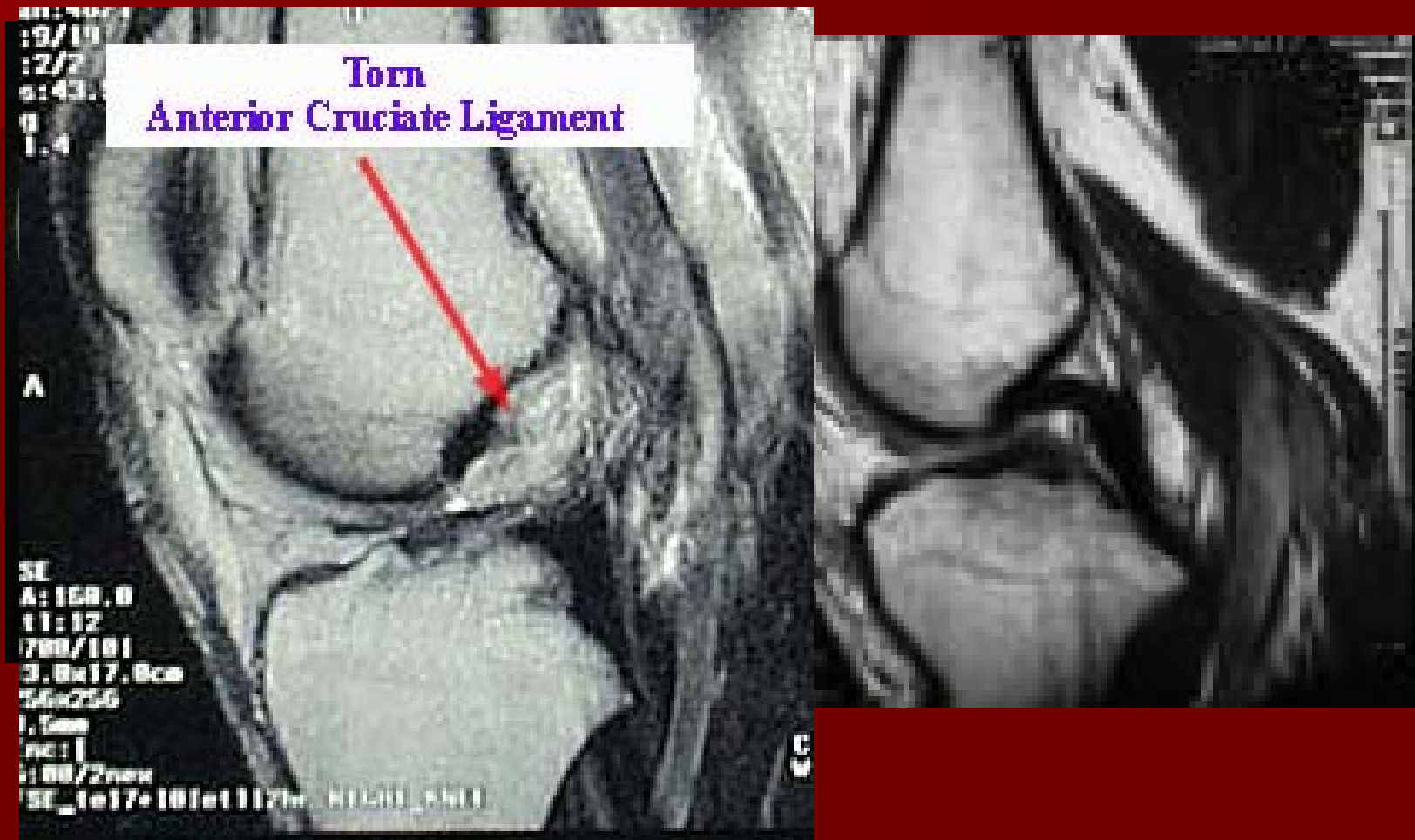


- Meet Ottawa Criteria:
- Suspect:
 - *Patellar fracture*
 - *Fibular head fracture*
 - *Loose body (OCD injury)*
 - *Tibial plateau fracture*
 - *Femoral condyle fracture*
 - *Tibial spine avulsion*
 - *Lateral tibial plateau avulsion (segund's fracture)*
 - 2-v Knee, wtbearing AP or PA, lateral + Merchant's if anterior knee pain
 - ACR: 9

CASE #3-Acute Knee Pain

- NO ACR
recommendations for
acute twisting knee
injury with instability,
recurrent swelling or
mechanical symptoms
- SUSPECT:
 - *Cruciate ligament injury*
 - *Meniscal injury*
 - *OCD injury/loose body*
- MRI (no ACR rating)

MRI KNEE



ACL-Meniscus

- LOCKED BUCKET HANDLE-ACL
 - *Test Passive terminal extension*
 - 2-stage arthroscopy
 - Repair meniscus
 - Delayed ACL reconstruction

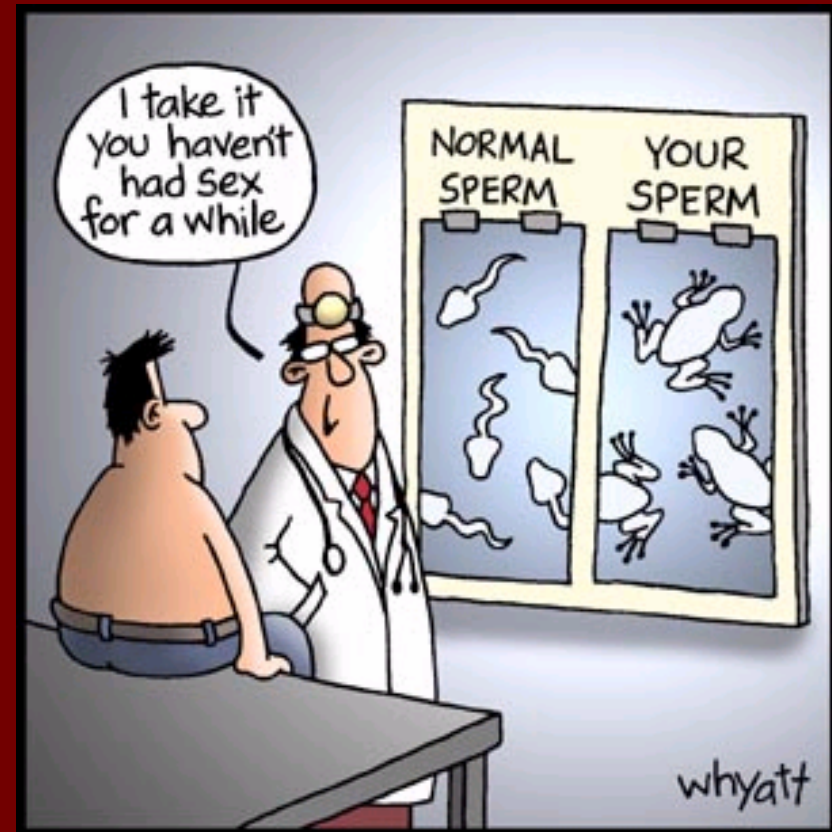


SPECIFICITY OF CONDITION

- NOT ALL CRUCIATE LIGAMENT TEARS NEED SURGERY
 - ACL IN MIDDLE AGE, PARTICULARLY WITH ARTHRITIS MAY NOT NEED IT
 - PCL TEARS AND SOME MENISCAL TEARS CAN BE TREATED CONSERVATIVELY
 - MRI SHOULD BE PREOPERATIVE TOOL.

CASE #4-Chronic/Non-traumatic knee pain

- 53 y/o male with medial compartment pain and mild swelling x 2 months. Stable knee exam, ttp of medial compartment.



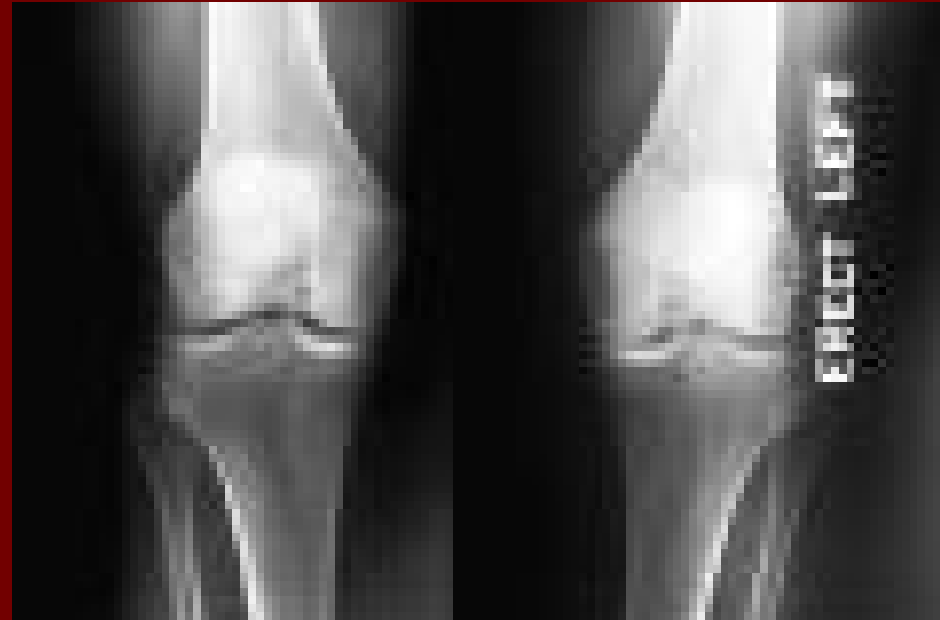
CASE #4-Chronic/Non-traumatic knee pain

■ Suspect:

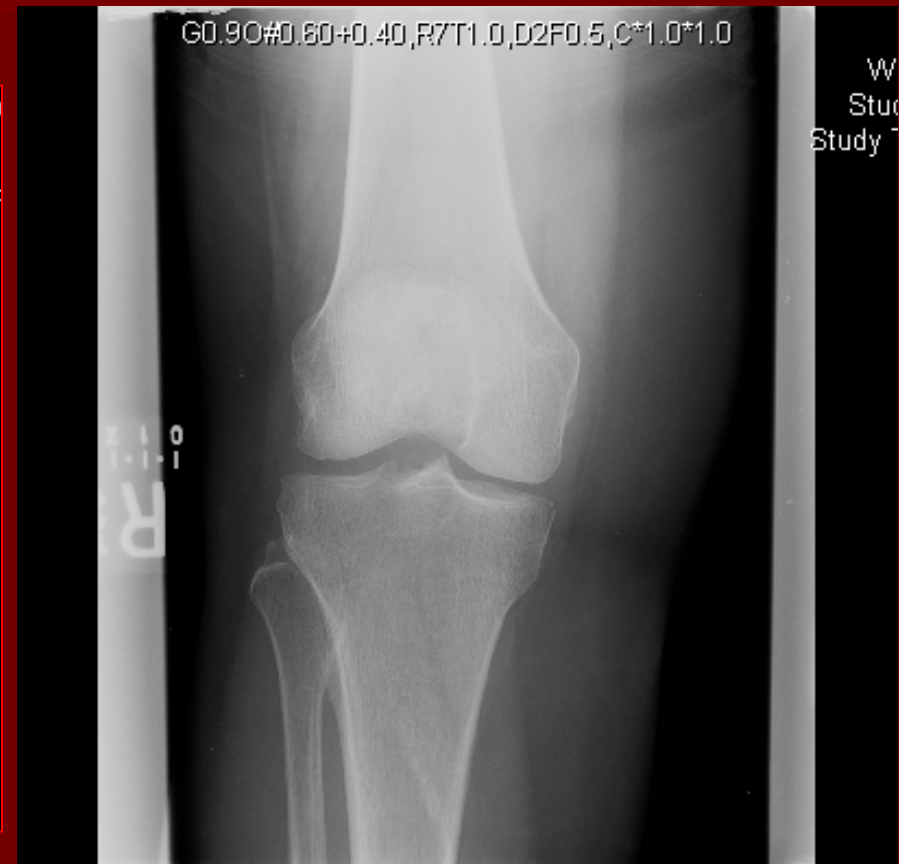
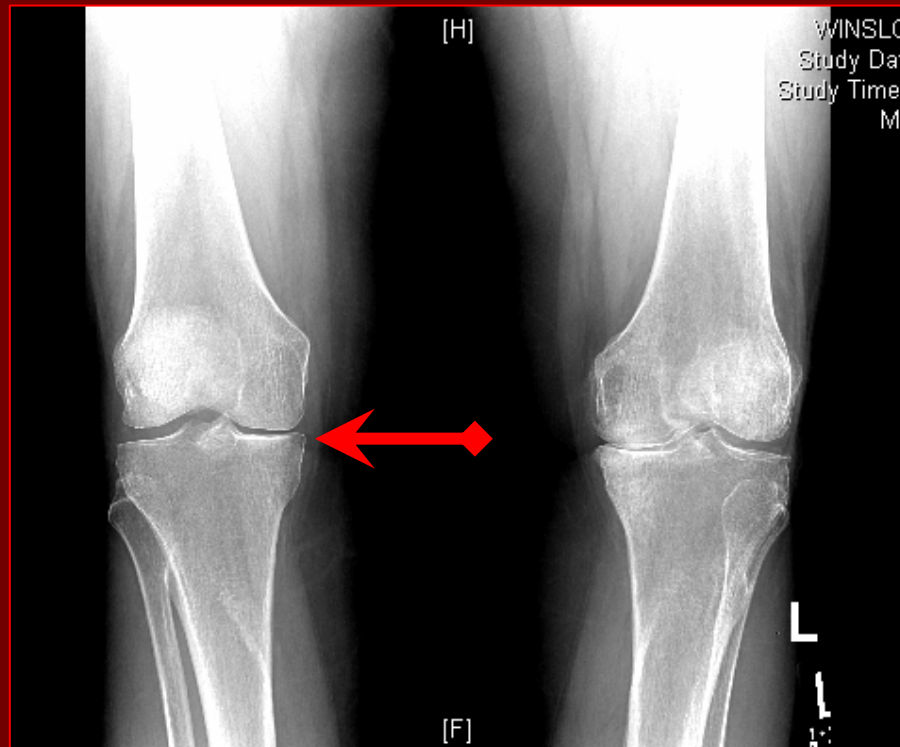
- *Arthritis (medial, lateral, patellofemoral)*
- *Patellar malalignment*
- *AVN femoral condyle*
- *Loose bodies*
- *Osteochondral lesions*
- *Stress fractures*
- *Tumor*
- *Pellegrini-Stieda*

■ 2-v Knee, wtbearing PA or AP, lateral + Merchant's if anterior knee pain

■ ACR: 9



WEIGHTBEARING KNEE X-RAYS



CASE # 4-Chronic/Non-traumatic knee pain

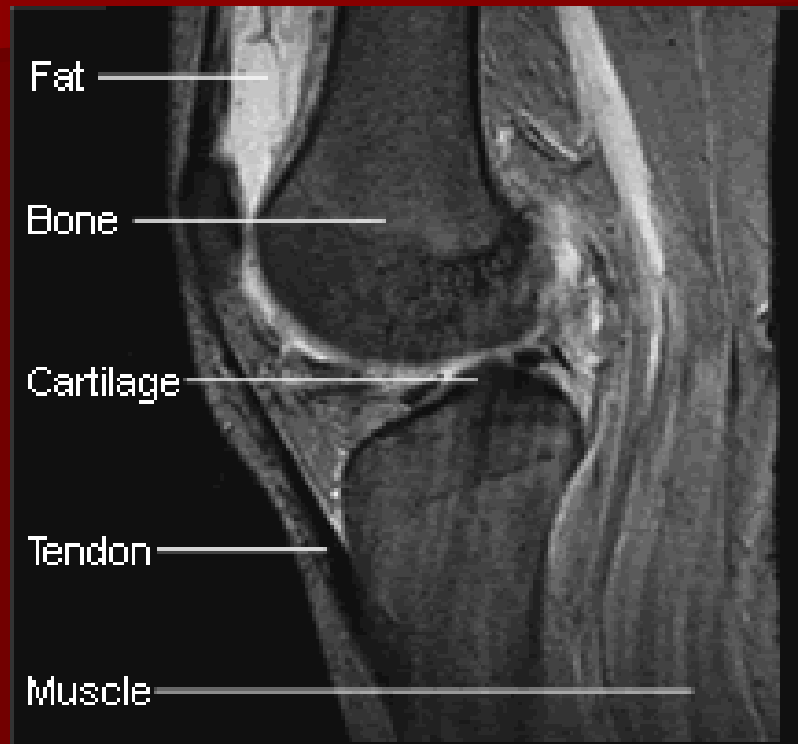


Figure 4. An MRI scan of the knee

- Consider further imaging?
 - MRI (ACR: 1) following conditions:
 - *Significant osteoarthritis*
 - *Inflammatory arthritis*
 - *Stress fracture on x-ray*
 - *AVN on plain x-ray*
 - *RSD*

CASE # 4-Chronic/Non-traumatic knee pain

- Consider further imaging?

– SUSPECT:

- *Degenerative meniscal injury (symptomatic)*
- *Chronic cruciate ligament injury*
- *AVN femoral condyle*
- *Osteochondral injuries*
- *Tumors*

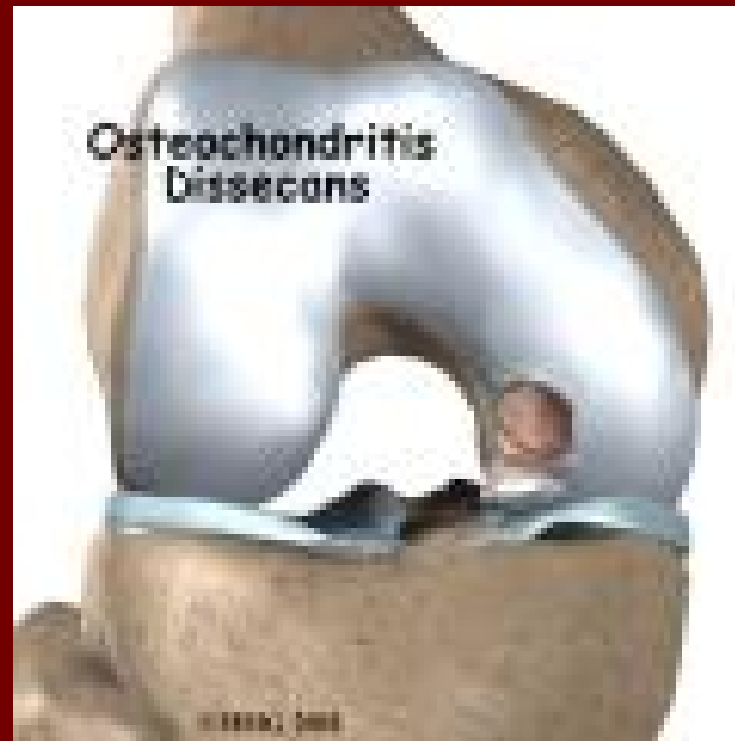
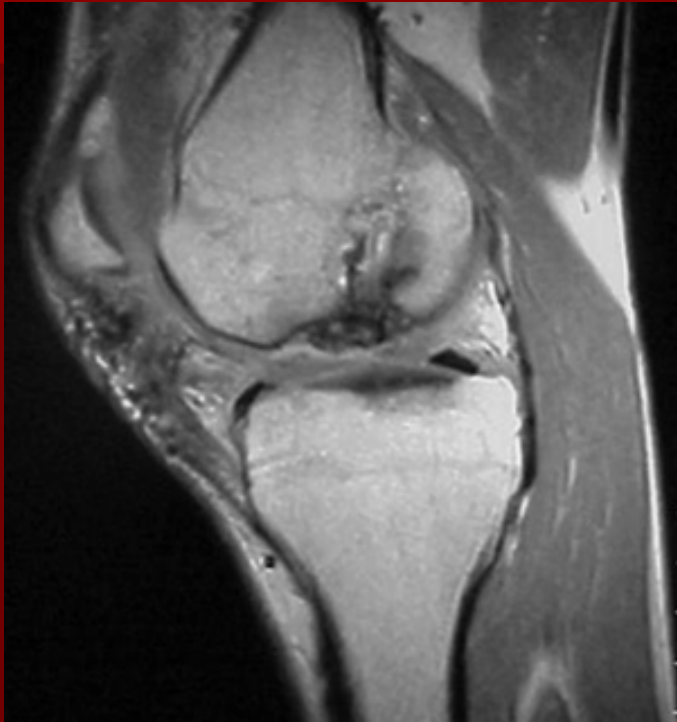
– ***MRI (ACR: 9)***

– **Note:**

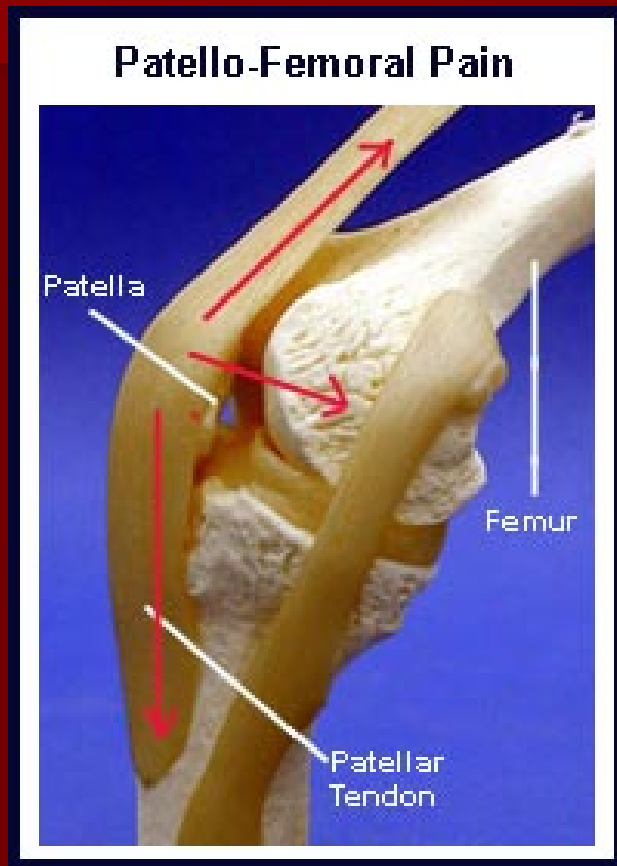
- *AVN may develop >6 wks after symptoms.*
- *Radial Meniscal Tears may heal*



MRI-OCD LESIONS



CASE # 4-Chronic/Non-traumatic knee pain



■ Consider further imaging?

– SUSPECT:

- *Patellofemoral syndrome*
- *Osteoarthritis*
- *Tendonitis (Hamstring/Patellar)*
- *ITB syndrome*
- *Bursitis (Pre-Patellar/ITB)*
- *Synovial Plica*
- *Synovitis*
- *Meniscal Tear*

– ***NO MRI***

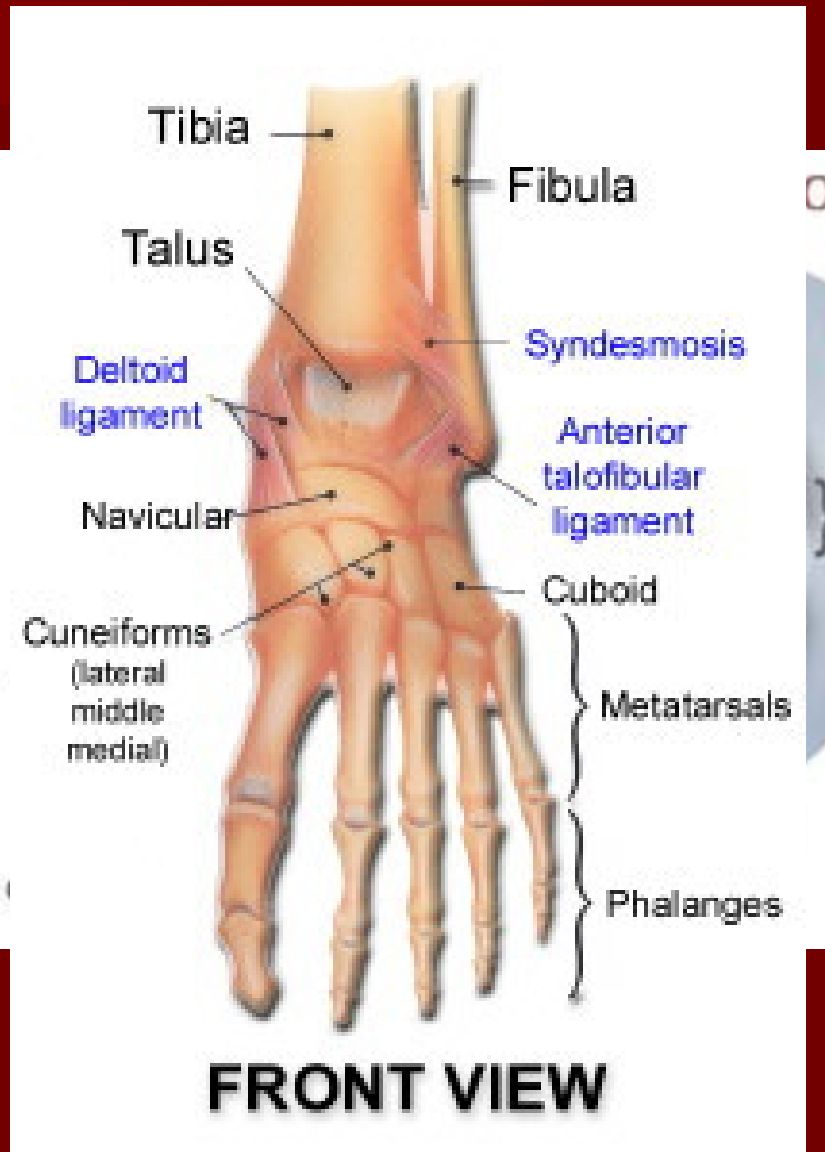
ANKLE VS. FOOT

■ ANKLE

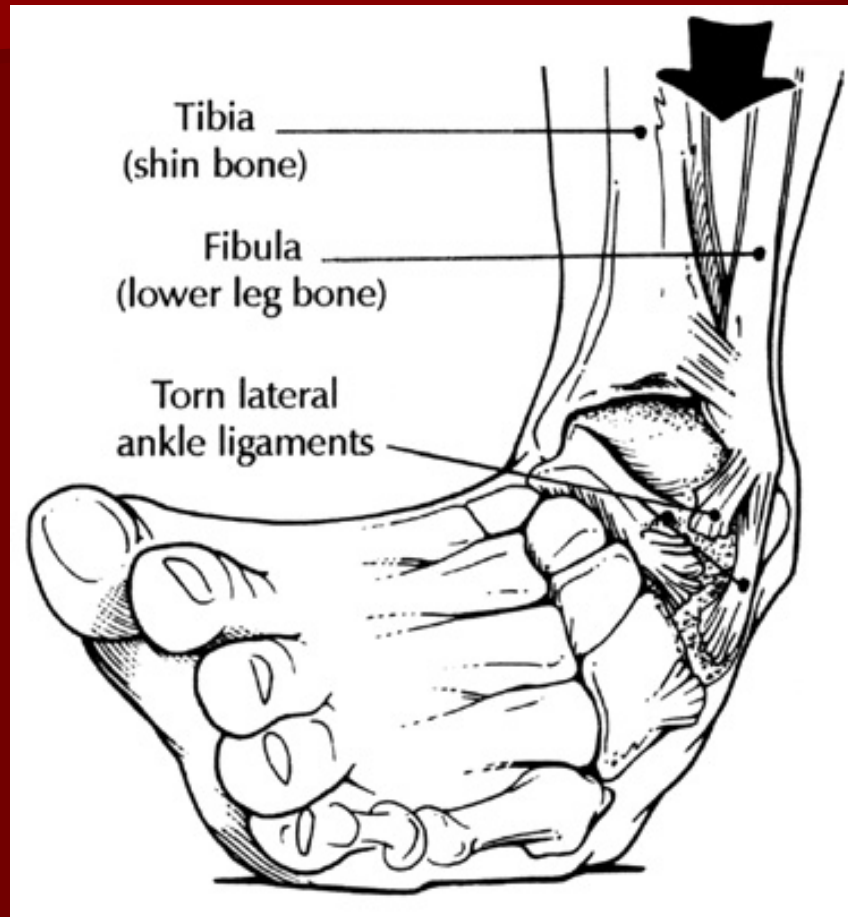
- Tibiotalar joint

■ FOOT

- Hindfoot
- Midfoot
- Forefoot



CASE # 5-Acute Ankle Injury

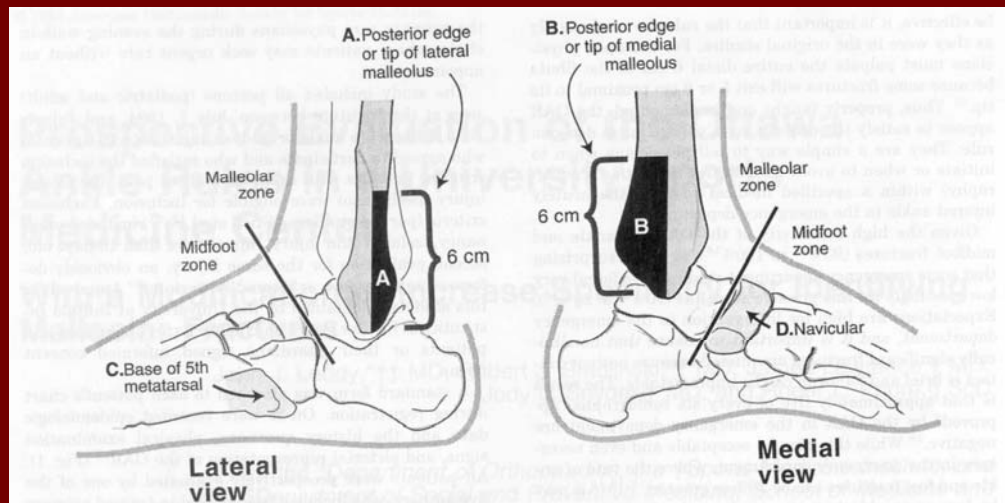


- 25 y/o male inverts right lateral ankle. He has lateral swelling and unable to bear weight immediately.

Case #5-Acute Ankle Injury

■ OTTAWA CRITERIA:

- *Non-weightbearing after injury or in emergency dept/clinic*
- *Tenderness over malleoli (posterior ½ lateral malleolus), talus, calcaneus*
- *Inability to ambulate 4 steps*



Case #5-Acute Ankle Injury



- SUSPECT:
 - *Fibular fx/lateral malleoli*
 - *Distal tibia fx/medial malleolus*
 - *Talus fx (lateral process/dome, neck)*
 - *Calcaneus(anterior process)*
 - *Syndesmotic injury*
- Ankle 3-v (AP, lateral, mortise)
 - ACR: 9
- Continued sx, repeat 3v
 - Suspect:
 - Missed/occult fx
 - Talar dome OCD

CASE #6-CHRONIC ANKLE PAIN

- 33 y/o male with recurrent ankle injuries and anterolateral ankle pain with mild swelling x 6 months.



CASE #6-CHRONIC ANKLE PAIN

■ SUSPECT:

- *Talar dome OCD*
- *Loose bodies*
- *Ankle/subtalar arthritis*
- *Tumor*

■ Ankle 3-v

- ACR: 9



CASE #6-CHRONIC ANKLE PAIN

- Improved with rehab
- SUSPECT:
 - *Deconditioned ankle*
 - *Chronic ankle ligamentous instability*
 - *Tendinopathy*
 - *Other soft tissue injuries*
- No further imaging

CASE #6-CHRONIC ANKLE PAIN

- Continued sx and negative x-rays
- SUSPECT:
 - *Posterior tibialis tendonitis/tear*
 - *Peroneal tendonitis/tear*
 - *Talar Dome OCD*
 - *Tarsal Coalition*
 - *Stress fx (distal fibula/tibia)*
- MRI (ACR: 9)
- SUSPECT:
 - *Talar Dome OCD*
 - *Tarsal Coalition*
- CT SCAN (ACR: 2)



MRI ANKLE-TALAR DOME OCD



CASE#7-Acute foot injury

- 37 y/o female twists foot, has swelling on dorsum of foot.

CASE#7-Acute foot injury



■ MIDFOOT/FOREFOOT

■ SUSPECT:

- *Metatarsal fx*
- *Jones fx*
- *Phalynx fx*
- *LisFranc injury*
- *Tarsal coalition*
- *Accessory navicular*
- *Anterior process of calcaneus fx*
- *Lateral process of talus fx*
- *Turf toe (MTP sprain)*

■ Foot 3-v (AP/lat/oblique)

- ACR: 9

CASE#7-Acute foot injury



- NEGATIVE X-RAY
- Consider further imaging?
 - Uncommon injuries:
- SUSPECT:
 - *Posterior tibialis tendon tear*
 - *Peroneal tendon tear*
 - *LisFranc injury (should have had weightbearing feet with comparison views)*
- MRI foot (ACR: 9)

ACUTE-HINDFOOT INJURY

- Direct fall on hindfoot
- SUSPECT
 - *Calcaneus fx*
- **Calcaneus 2-v**
 - Lateral, Harris-Beath
 - ACR: 9



CASE #8-CHRONIC FOOT PAIN

- 54 y/o female with lateral mid-foot pain x 6 months with mild swelling and limp.

CASE #8-CHRONIC FOOT PAIN



■ MIDFOOT/FOREFOOT

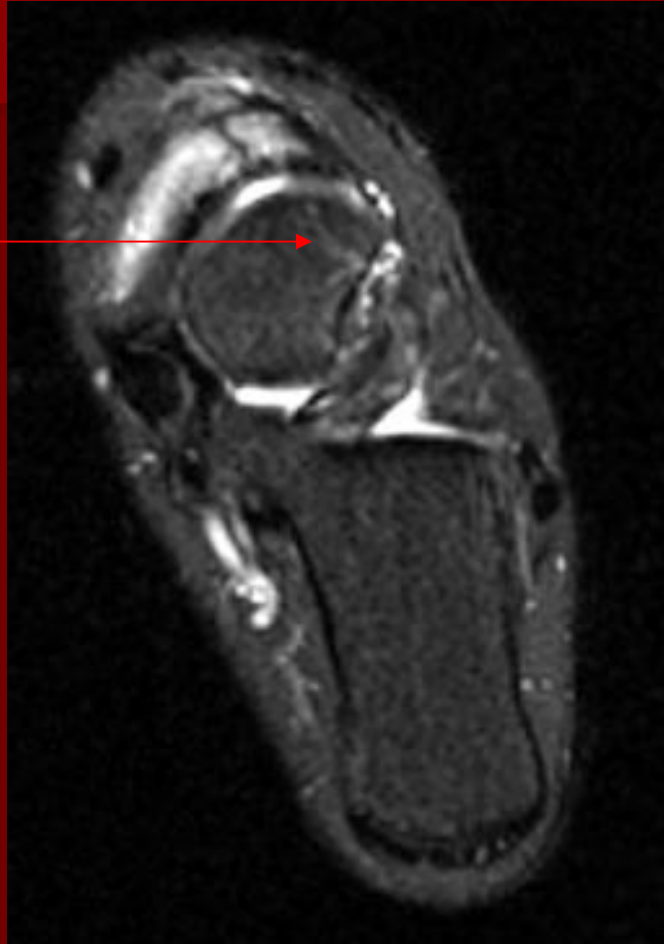
■ SUSPECT:

- *Metatarsal stress fx*
- *Tarsal navicular stress fx*
- *Cuboid stress fx*
- *Midfoot arthritis*
- *Accessory navicular*
- *Os cuboidis*
- *Freiberg's infraction*
- *Sesamoiditis (sesamoid/axial view helpful)*
- *Hallux valgus*
- *Tumor*
- *Jones stress fx*

■ Foot 3-v

- ACR: 9

CASE #8-CHRONIC FOOT PAIN



- MIDFOOT/FOREFOOT

- SUSPECT:

- *Tarsal navicular stress fx*

- CT scan foot

- ACR: 9

- SUSPECT:

- *Peroneal tendonitis/tear*
- *Poserior tibialis tendonitis/tear*
- *Stress fractures (talus, metatarsal, navicular)*
- *Painful accessory bones*

- MRI foot

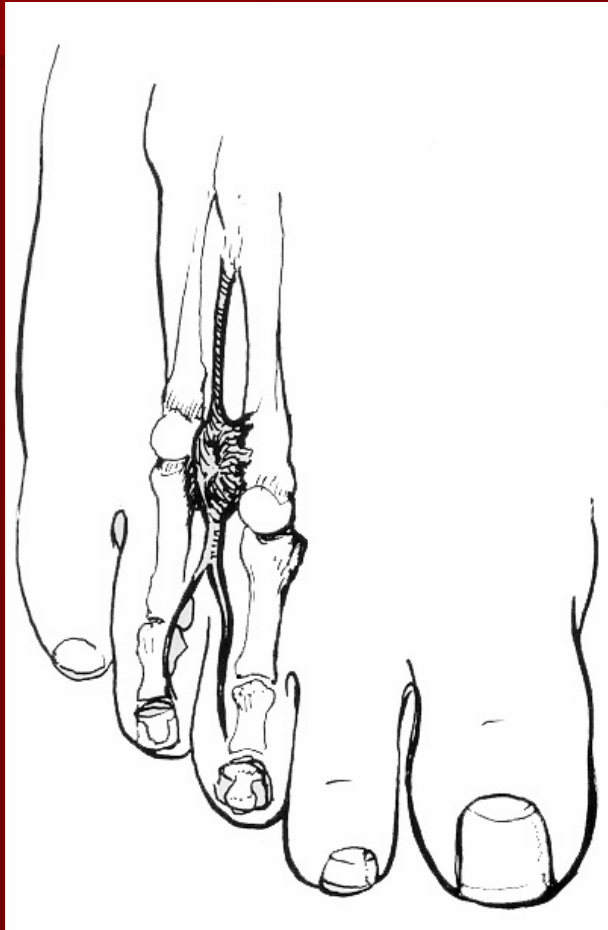
- ACR: 9

CASE #8-CHRONIC FOOT PAIN



- MIDFOOT/FOREFOOT
- SUSPECT STRESS FX:
 - *Tarsal navicular*
 - *Metatarsal*
 - *Talus*
 - *Cuboid*
 - *Calcaneus (hindfoot)*
- ***Bone scan***
 - *ACR: 6*
 - *+ scan for Navicular or Talus stress fx*
 - *CT scan or MRI/refer*
 - *All others and negative study follow clinically*

CASE #8-CHRONIC FOOT PAIN



- SUSPECT:
 - *Plantar fascitis*
 - *Neuroma*
 - *Metatarsalgia*
 - *Painful pes planus*
 - *Achilles tendonitis*
 - *Fat pad insufficiency*
- *No further imaging necessary*

CASE#9-CHRONIC HINDFOOT PAIN



■ SUSPECT:

- *Calcaneus stress fx*
- *Talar neck stress fx*
- *Subtalar arthritis*
- *Painful os trigonum*
- *Haglund's deformity*
- *Tarsal coalition*
(Calcaneonavicular coalition seen on foot oblique), Obtain foot 3-v as well

■ Calcaneus 2-v

- Lateral, Harris-Beath
- ACR: 9

SUMMARY

- CLASSIFY MUSCULOSKELETAL CONDITIONS AS ACUTE OR CHRONIC/NON-TRAUMATIC
- HAVE SPECIFICITY OF LOCATION OF SYMPTOMS/EXAM FINDINGS
- HAVE LINEAR THOUGHT PROCESS FOR DIFFERENTIAL DIAGNOSES AND SUBSEQUENT IMAGING
- CONSERVATIVE TREATMENT AND IMAGING IS OFTEN WARRANTED

DON'T ADD STRESS TO YOUR PATIENTS!

