Clinical Sport Medicine for Nuclear Medicine Radiologists

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Conflict of Interest

- I have no conflicts of interest related to any of the material presented in this lecture.
- I have no personal arrangements or investments with any specific company

Bone and Joint Imaging in Sport Medicine

- Occult Fracture
- Hidden Fracture
- Stress Fracture
- Periostitis
- Soft Tissue – Myositis Ossificans
- Joint – osteochondral injury, bone bruise, impingement

Occult Fracture/Hidden Fracture

- Occult
  - Clinical suspicion but negative X-ray
- Hidden
  - Small bones, joints hard to see (subtalar)
- Will not discuss
  - Tumours
  - Osteomyelitis

Occult

- Classic
  - wrist scaphoid bone
- Other
  - Tibial plateau fracture

Hidden

- Pars interarticularis
  - Stress fracture
  - Defect (old versus new)

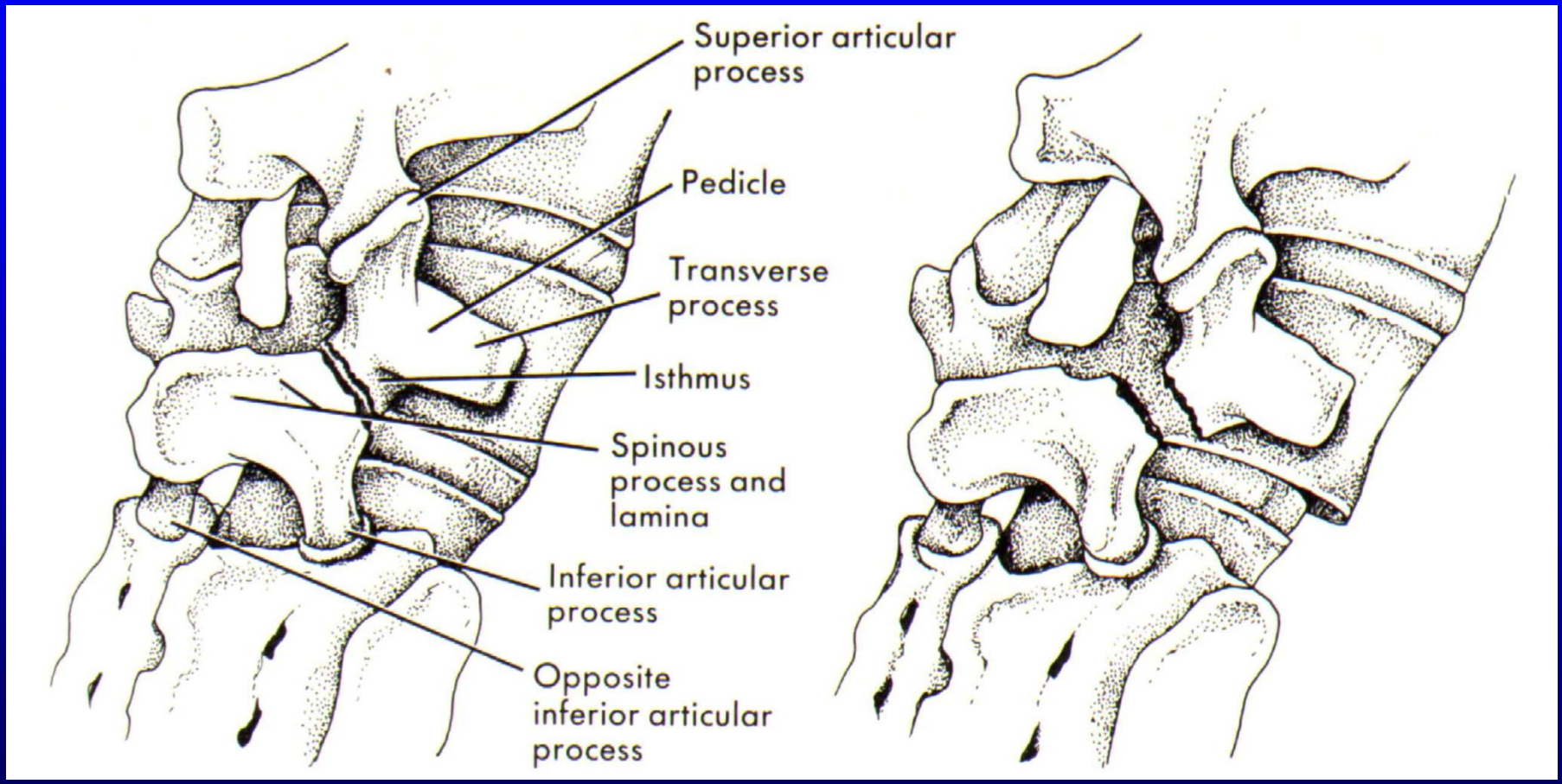
.. Pars Interarticularis

- Congenital spondylolysis
- Stress fracture
- Non union

…Pars Interarticularis

- Extension sports
  - Gymnastics
  - Dance (ballet)
  - Bowling in Cricket
  - Football (lineman)

…Pars Interarticularis



…Pars Interarticularis

- Low back pain
- Pain in extension
- Imaging
  - X-ray
  - MRI vs Bone Scan (SPECT, SPECT CT)
  - Young athletes - ?radiation dose?

…Pars Interarticularis

- Treatment stress fracture
  - Rest (<20% union) - prolonged
  - Modified Boston brace (35% union)
  - USA acute bone grafting
- Treatment old spondylolysis
  - Rest, therapy, injection
  - Surgery

Stress Fracture

- Overuse – athletes
- Poor bone quality
  - Transplant
  - Female Athlete Triad (Relative Energy Deficiency in Sport <RED-S>) BJSM 2014

…Stress Fracture

- Disruption of normal bone remodeling as a result of excessive repetitive stresses
  - Ground reaction force per step greater than 2X own body weight (70 kg runner)
  - Approximately 1175 steps/mile
  - Result – dissipate 220 tons of force/mile
- These stresses are within the physiologic range.

…Stress Fracture

- Gradual onset of vague pain
- Initially achy pain
- Progress to pain upon weight bearing
- Ache all the time

…Stress Fracture

- Positive Hop test (lower extremity)
- Tenderness of involved bone
- Swelling
- Pain with ‘Bowing’

…Stress Fracture

- Clinical
- X-ray
- Bone scan
  - Depending location → SPECT/SPECT CT
- MRI

…Stress Fracture

…Stress Fracture

- Bone Scan vs MRI (focal vs big picture)
  - MRI USA / Bone Scan Canada
  - Issue of Radiation (multiple bone scans)
  - Grading Stress Fracture
  - Dangerous stress fractures (femoral neck distraction side - ?occult fracture)

…Stress Fracture

- Treatment
  - Rest to 2 weeks pain free then gradual return to run over 4-6 weeks
  - Alternate activity – pain free
    - Water
    - Cycle
    - Activity away from the stress fracture
  - Total time – 3 months

…Stress Fracture

Treatment – Long Leg Aircast ®

…Stress Fracture

- Return to Activity related to (Nattiv et al, AJSM, 2013):
  - MRI grade
  - Lower BMD (energy, amenorrhea)
  - Predominant trabecular bone (femoral neck, pubic bone, sacrum)

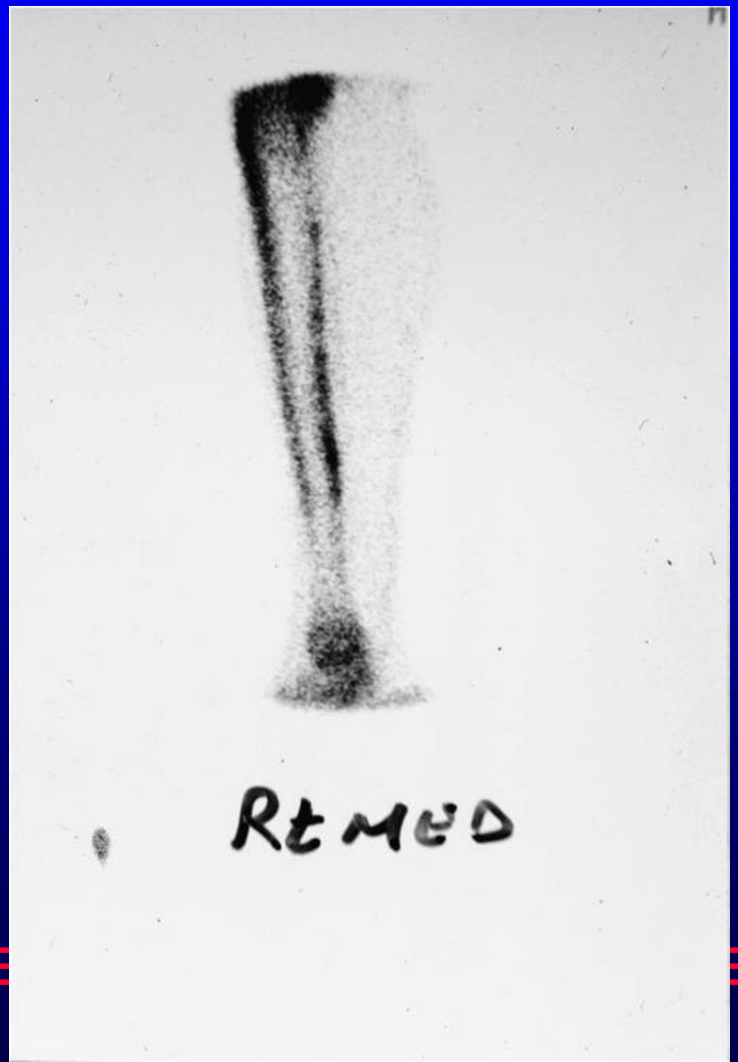
…Stress Fracture

- Dangerous Stress Fractures
  - Hip distractive side, femur, navicular, talar dome, Jones equivalent, tibial plateau
- Prone to Non union
  - Navicular, mid shaft anterior cortex tibia (Dreaded Black Line)

Leg Pain --
DO NOT USE '*SHIN SPLINTS*'

- A meaningless term restating 'shin pain'
- Medial Leg Pain
  - Stress fracture, deep posterior compartment chronic exertional compartment syndrome, tibialis posterior tendinopathy/tenosynovitis, tibial periostitis

…Periostitis



…Tibial periostitis

- ‘Medial Tibial Stress Syndrome’
- Medial leg pain (diffuse)
- Periostitis – Bone Scan
- Distribution – soleus attachment along medial border of the tibia

…Tibial Periostitis

- Treatment
  - Same as for stress fracture except no Aircast ®
  - Treatment failure/recurrent – potential for subperiosteal fat
    - MRI – sometimes
    - Bone scan – ongoing periostitis
    - Surgical exploration and periosteal stripping

…Periostitis Treatment

- Relative rest
  - Deep water run, cycle, weights
- 2 weeks pain free RTR program
- If recurrent, consider subperiosteal fat deposition

…Periostitis

- Other periostitis sites
  - Ulna
  - Femur
  - Anterior tibia

Leg Pain

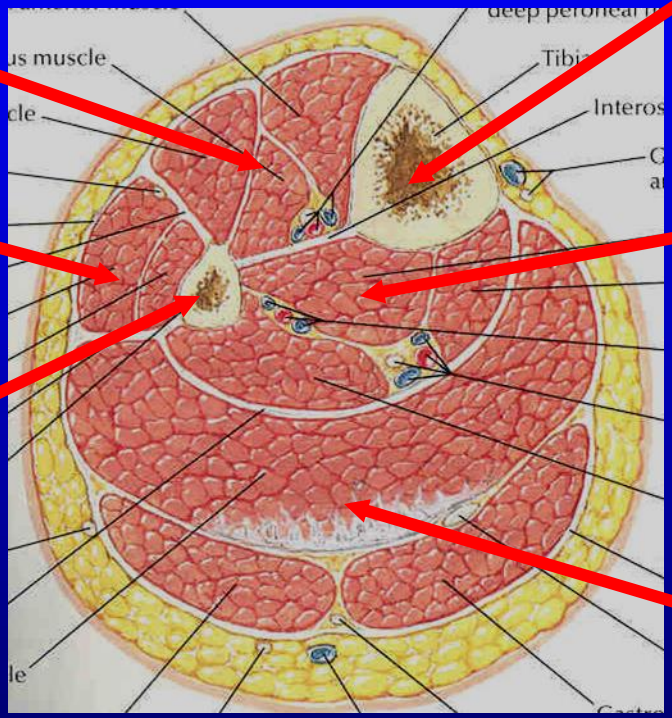
- Anatomy is everything
- Local versus referred

Relevant Anatomy

Anterior Compartment

Lateral Compartment

Fibula



Tibia

Deep Posterior Compartment

Superficial Posterior Compartment

ANATOMIC LOCATION	STRUCTURE	DIFFERENTIAL DIAGNOSIS
ANTERIOR	Bone	Anterior cortex mid-shaft tibial stress fracture
	Muscle	Chronic Compartment Syndrome (anterior)
	Nerve	Lumbar referred (L4 or L5)
		Common/deep peroneal nerve injury
LATERAL	Bone	Fibula stress fracture
	Muscle	Chronic Compartment Syndrome (lateral)
	Nerve	Lumbar referred
		Common/superficial peroneal nerve injury
		Superficial peroneal nerve entrapment
MEDIAL	Bone	Tibia (stress fracture or periostitis)
	Muscle	Tibialis posterior tendinopathy/tenosynovitis
		Chronic Compartment Syndrome (Deep posterior)
	Nerve	Tarsal tunnel syndrome
POSTERIOR	Muscle	Chronic Compartment Syndrome (superficial)
		Tibialis posterior syndrome
	Nerve	Lumbar referred (L5 or neural claudication as seen in spinal stenosis)
	Vessel	Deep vein thrombosis
		Atherosclerotic disease (vascular claudication)
		Popliteal artery entrapment

Myositis Ossificans

- Usually multiple blows to the same area
- Pain and dramatic loss of stretch (joint ROM)
- Tender

…Myositis Ossificans

- X-ray positive about 6 weeks
- Nuclear Med for early diagnosis and therefore appropriate treatment

…Myositis Ossificans

- Treatment
  - Rest
  - NSAIDs
- Recovery
  - 9-12 months
- Question – when not hot for potential surgical debridement?

Joint

- Osteochondral injury?
- Bone Bruise?
- Impingement?
- Soft tissue – likely MRI if needed (usually not)

Osteochondral Injury

- E.g. Post inversion ankle injury
  - Chronic pain
- MRI vs CT arthrogram vs scan SPECT CT

Bone Bruise

- E.g. Knee (ACL, other trauma)
  - Prognosis – minimum 3 months of healing time
- Clinically we generally know there is a bone bruise
- Clinical question – bone bruise vs locked knee (meniscus, loose body)

Impingement

- Wrist (positive ulnar variance)
- Anterior and posterior ankle
  - X-ray usually quite helpful but not always
  - Information needed for definitive Dx

- Potential for surgical correction

Questions/Concerns

- CT – increase radiation for what benefit
- Bone scan – recurrent therefore increase radiation
  - SHORTER WAIT TIMES
- MRI
  - No radiation
  - Able to see ‘bone bruise’
  - Able to see anatomy