


# Optimizing Skeletal Plain Film Radiography

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# GOALS and OBJECTIVES

- ✦ To be able to appropriately use plain film radiography for patients with MSK complaints
  - Describe indications and contraindications to plain film xray
  - Describe standard and special views of specific joints
  - Describe a systematic approach to interpreting plain films

# NEEDS ASSESSMENT

- ✦ MSK complaints make up a large portion of our office visits and are increasing
- ✦ Increased pressure to control costs
- ✦ **BOTTOM LINE:** Need to be cost-effective

# CAVEAT

- ✦ Any radiological (or laboratory) procedure does not replace the need for a thorough history and physical exam.
- ✦ These tests are confirmatory
- ✦ Know your anatomy
- ✦ Try to illicit the mechanism of injury (MOI)
- ✦ SPEAK with the radiologist!
- ✦ TREAT the PATIENT, NOT the XRAY

# INDICATIONS

- ✦ When diagnosis is uncertain and management may be affected
- ✦ When diagnosis is evident, but extent of injury is unclear
- ✦ When treatment has failed and the reasons for so are unclear
- ✦ When an objective assessment of disease existence, progression, resolution is required
- ✦ Preoperative localization and planning

# CONTRAINDICATIONS

- ✦ Pregnancy (relative)
- ✦ If evidence/guidelines exist that specifically recommend against it (see Ottawa Ankle Rules, Acute Low Back Pain Guidelines)

# PEARLS

- ✦ Always start with plain films first
- ✦ At least 2 views at 90° angles to each other
- ✦ Special views (ie scaphoid)
- ✦ Trace outline of each bone (cortical defects)
- ✦ Bone density changes (lucency vs opacity)

# PEARLS (cont)

- ✦ Know osseous relationships
- ✦ Understand pediatric bone anatomy
- ✦ Comparison views beneficial
- ✦ Re-xray every 2-4 weeks



# Case 1

- ✦ 30 yo male assembly line worker with acute left low back pain for 3 days after twisting awkwardly. No other symptoms. Using rest, acetaminophen.



# Case 1 (cont)

- ✦ Exam: Decreased FF due to pain, left paravertebral spasm with somatic dysfunction. Neuro exam normal. No bony TTP.
- ✦ Xray?
- ✦ NO!!
  - Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society, *Ann Intern Med*, 2007; 147:478-491

# Case 1 (cont)

- ✦ Recommendation 2: “Clinicians should not routinely obtain imaging or other diagnostic tests in patients with nonspecific low back pain”
- ✦ Recommendation 3: “Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions are suspected on the basis of history and physical examination.
  - (both strong recommendations, moderate quality evidence)

# RED FLAGS

## ✦ Cancer

- Age >50
- Male with diffuse osteoporosis or compression fracture
- Cancer history
- Insidious onset
- Worse at night

## ✦ Infection

- Recent infection or surgery
- Diabetes, steroids, immune disorders
- Constitutional symptoms

# RED FLAGS (cont)

## ✦ Neurological Risk

- *Progressive* neuro deficit
- Foot drop
- New bowel or bladder dysfunction
- Saddle anesthesia
- Significant trauma

# CASE 1 (cont)

## ✦ Treatment

- Reassurance
- Stay active (no bed rest)
- OTC meds
- Home Exercise Program (HEP)
- Maybe PT
- Recheck in 1 month

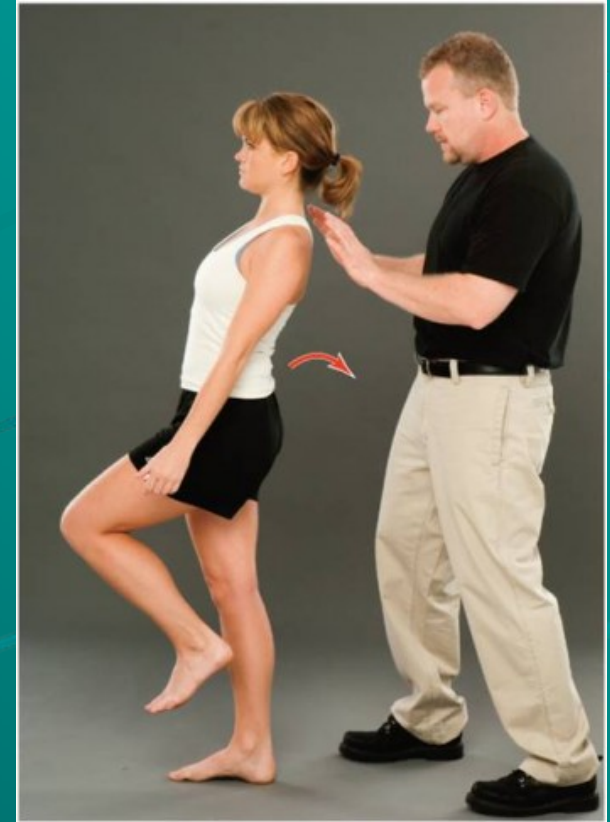
# Case 2

✦ 17 yo female diver with 4 weeks of acute right low back sharp pain. Worse with lumbar extension. No radicular symptoms.



# Case 2 (cont)

- ✦ + TTP over right side of L5
- ✦ + Stork test on right
- ✦ Normal neuro exam
- ✦ Tight hamstrings and Psoas muscles
- ✦ Xray?
- ✦ YES, need to look for spondylolysis



## Case 2 (cont)

- ✦ Spondylolysis is a fracture of the pars interarticularis, usually overuse, repetitive motion, adolescent athletes who perform a lot of extension
- ✦ Unilateral and usually L4 or L5
- ✦ If bilateral then could lead to spondylolisthesis (slippage)

# Case 2 (cont)

- ✦ AP, lateral and obliques
- ✦ Look for break in the neck of the "Scotty Dog"
- ✦ If xray normal, consider SPECT bone scan or thin slice (1mm) MRI through vertebra(e) in question (looking for edema (white) on T2 weighted images) or thin slice (1mm) reversed gantry tilt CT scan
- ✦ TALK with radiologist



Normal



Spondylolysis

# MY APPROACH

- ✦ Acute pain, worse w/ ext, no prior hx and xray positive: treat as spondy and then CT (thin slice (1 mm) reversed gantry) in 3 months to assess healing
- ✦ As above but xray -: SPECT bone scan; if hot then treat and CT in 3 months
- ✦ As above but xray/SPECT -: probably not spondy, look for other cause

# MY APPROACH (cont)

- ✦ Classic symptoms but chronic or prior hx (recurrent), Xray + or -: SPECT bone scan. If + then CT to assess healing (because bone scans can remain + for up to a year)
- ✦ If SPECT – then STOP. Rehab, consider search for other cause

# Case 2 (cont)

## ✦ Treatment

- Rest
- Physical therapy (core strengthening)
- Avoid extension
- Bracing??
- Goal is eliminating pain and not necessarily achieving bony healing of the fracture site

✦ Current Concepts in the Diagnosis and Treatment of Spondylolysis in Young Athletes, *Current Sports Medicine Reports*, 6(1):62-66, February 2007

# Case 3

- ✦ 24 yo male playing pick up basketball 2 days ago, inverts right ankle after jumping and landing on another player's foot.



## Case 3 (cont)

- ✦ + swelling and bruising of lateral ankle
- ✦ + TTP of anterior portion of distal fibula
- ✦ + pain with anterior drawer and talar tilt (no laxity)
- ✦ Neurovascular exam normal

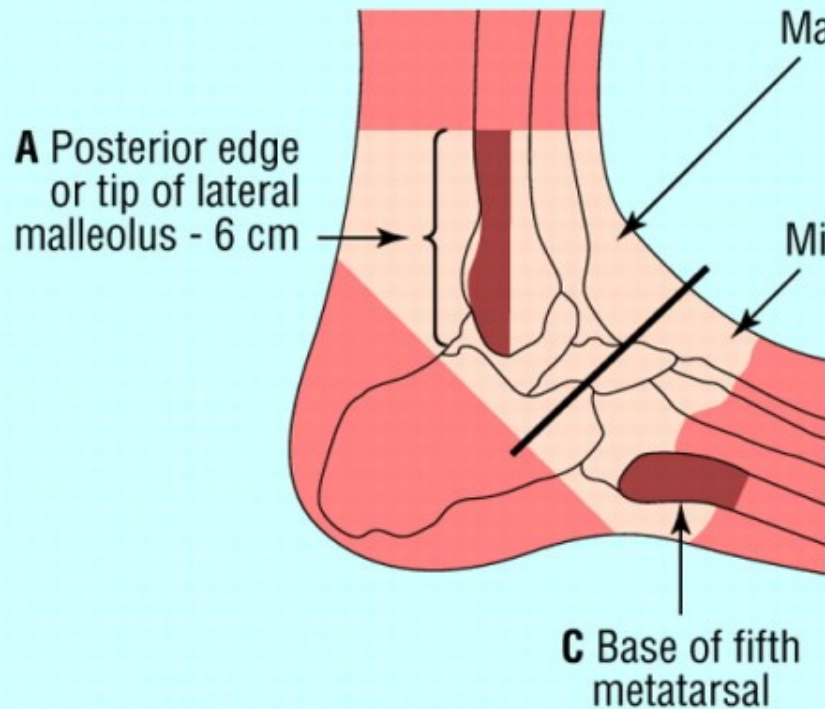
# Anterior Drawer and Talar Tilt



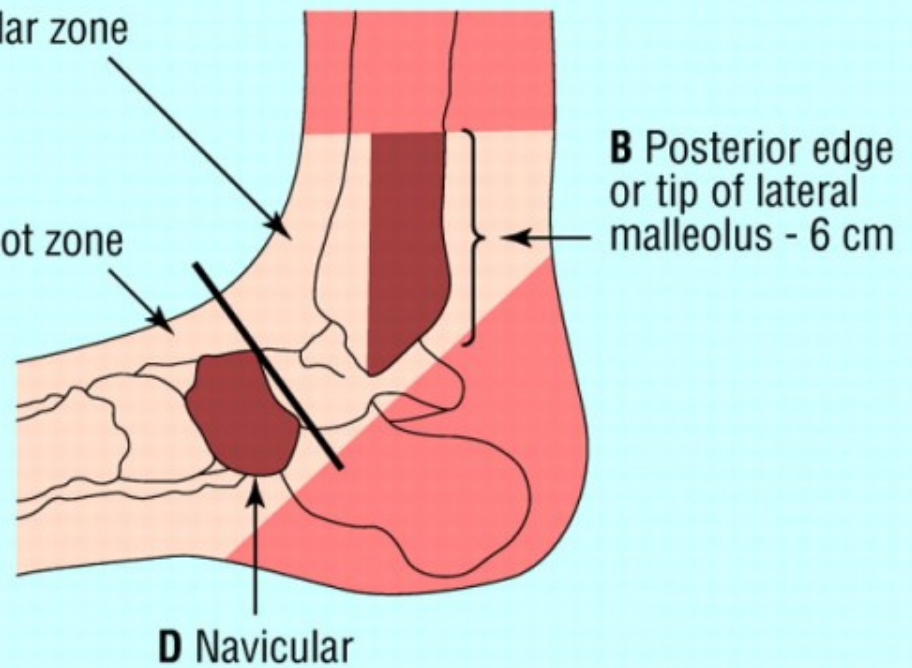
# Case 3 (cont)

- ✦ NO!!
- ✦ Know Ottawa Ankle and Foot Rules
  - Bachman LM, Bachmann LM, Kolb E, et al. Accuracy of Ottawa ankle rules to exclude fractures of the ankle and mid-foot: systematic review. Available at: <http://www.bmj.com/cgi/content/full/326/7386/417>. Accessed on February 23, 2009
- ✦ Treat with R.I.C.E., OTC meds (Acetaminophen), HEP, PT, ankle brace

## Lateral view



## Medial view



A series of ankle x ray films is required only if there is any pain in malleolar zone and any of these findings:

- Bone tenderness at **A**
- Bone tenderness at **B**
- Inability to bear weight both immediately and in emergency department

A series of ankle x ray films is required only if there is any pain in mid-foot zone and any of these findings:

- Bone tenderness at **C**
- Bone tenderness at **D**
- Inability to bear weight both immediately and in emergency department

# Case 4

- ✦ 22 yo female collegiate cross country runner with progressive shin pain x 1 month. Frequently, skips menses. Not on OCP's. Low body fat. Pain seemed to have started after switching from trail running to running on cement.



# Case 4 (cont)

- ✦ + antalgic gait
- ✦ + pes cavus feet
- ✦ + TTP along anteriomedial portion of distal 1/3 of Tibia
- ✦ + pain with tuning fork vibration
- ✦ + pain with single leg hop
- ✦ XRAY?

# Case 4 (cont)

- ✦ YES!!
- ✦ Need to rule out stress fracture vs shin splints (aka medial tibial stress syndrome)
- ✦ Stress fracture = fatigue fracture (abnormal forces on normal bone)
- ✦ Recall intrinsic and extrinsic risk factors for overuse injury

# RISK FACTORS

## ✦ Intrinsic Factors

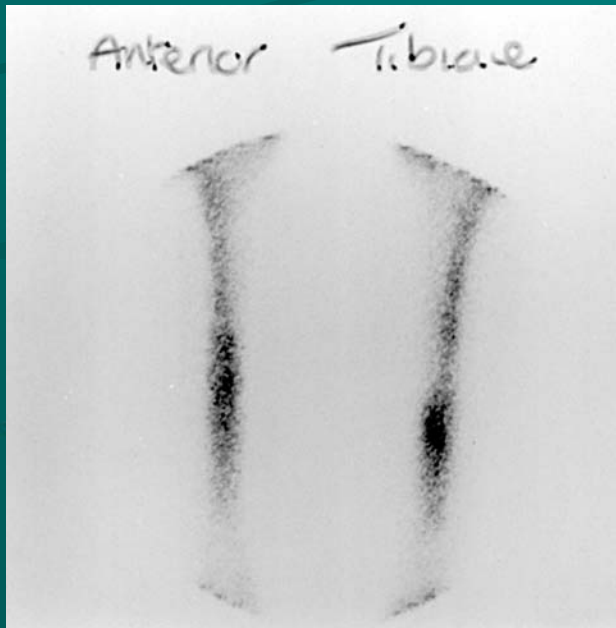
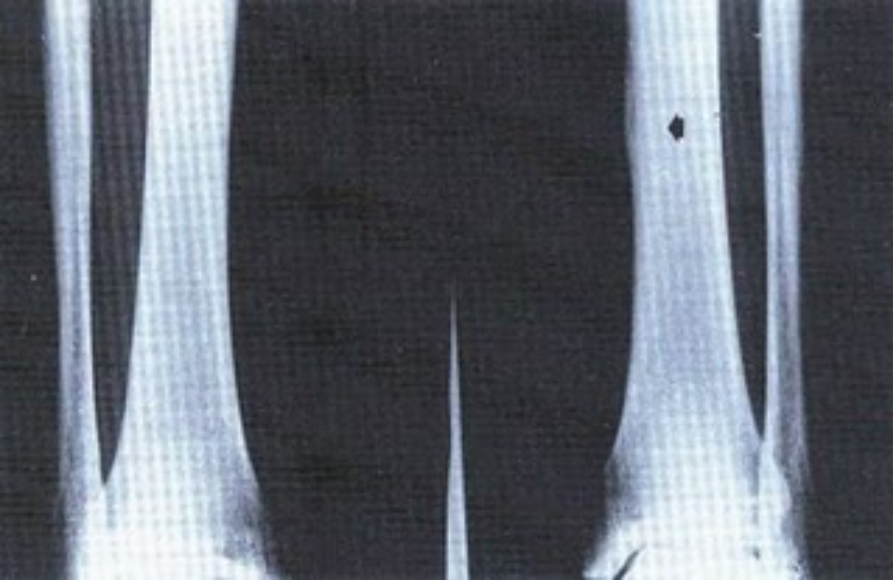
- Malalignment/S.D.
- Leg lengths
- Pes planus/cavus
- Tight achilles
- Poor flexibility
- Co-morbidities
- Nutritional (Intake vs Absorption)
- hORMONAL

## ✦ Extrinsic Factors

- Change in mileage
- Change in terrain
- Increase in hills
- Old shoes
- Running on slanted surface
- Proper bike fit for cyclists

## Case 4 (cont)

- ✦ Xray may show irregularity of medial tibial cortex
- ✦ May see sclerosis (opacity) of distal tibia shaft
- ✦ May need triple phase bone scan or MRI to differentiate if xray negative
- ✦ Treat with rest (NWB if severe), PT, pain control, ice/heat, cross-train, gradual return to sport



# MORE TIPS

- ✦ For patients 40 yo and over with knee pain:
  - Get *weightbearing* AP and Tunnel views before ordering an MRI
  - Subtle/absent joint space narrowing on non-weightbearing supine views will become more pronounced
  - You will eliminate the need for MRI
    - ✦ Petron DJ et al, Use of Knee MRI by PCP in Patients Aged 40 and Older, *Sports Health*, Sept/Oct 2010, 2:5, pages 385-389.

# MORE TIPS

- ✦ Patient with wrist pain, after falling on outstretched hand, and snuffbox TTP:
  - Working Dx?
  - What additional view do you need?
  - What do you do if xray is negative?

# MORE TIPS

- ✦ Pain over hypothenar eminence after acute injury
  - Need hook of hamate view and lateral oblique or carpal tunnel views
  - Better visualization of hook, pisiform and triquetrum

# MORE TIPS

- ✦ Acromioclavicular Sprains/Injury
  - Do NOT get with weights
  - It is painful
  - It only differentiates a grade 2 from a grade 3
  - It will NOT change your treatment

# MORE TIPS

## ✦ Shoulder views

- True AP: Could for GH OA
- AP in Ext Rot: Greater Tuberosity
- AP in Int Rot: Hill-Sachs lesion
- Axial: GH alignment, fractures of glenoid
- Y outlet: subacromial space, spurs, type of acromion
- Zanca: subacromial/clavicular spurs

