**SCCEP 2013 LLSA Course Article 3**

**Does this Patient With Diabetes Have Osteomyelitis of the Lower Extremity?**


**Article:** A “Rational Clinical Examination” paper from JAMA, presents a clinical scenario and scours the literature for EB studies to answer the above question. **Conflicts: None reported.**

**Clinical Scenarios:**

**Case 1:**
- 52 y.o. Woman with IDDM for 12 years and CC of 2.2 X 1.5 cm foot ulcer that probes to bone
- Pt has neuropathy, swelling and pain over left foot, diminished pedal pulses and normal VS. 
- Culture shows Gram + Cocci and Gram - Bacilli, Sed Rate 75, X-Ray shows cortical erosion
- **Does this patient require an MRI of foot?**

**Case 2:**
- 64 y.o. Man with NIDDM with CC non-healing ulcer over 4th MC head right foot x 3 weeks
- Pt has neuropathy, retinopathy and nephropathy. He completed 10 days of ABX
- Pt has erythema, swelling over 1 cm round ulcer that does not probe to bone
- Culture shows Gram + Cocci and Gram - Bacilli, Sed Rate 25, WBC 14,500, X-Ray is normal
- **How likely is osteomyelitis?**

**Why is the Diagnosis of Osteomyelitis Important (and Challenging)?:**

1. Foot-related Complications account for up to 20% of all diabetes-related admissions
2. Diabetic foot problems (mostly infections) are most common cause of non-traumatic amputations
3. Inadequately treated Osteo increases risk of amputation peri-opervative mortality is 7.4%
4. **Diagnosis of Osteo of lower limb in DM is challenging:**
   1. Classic Signs and Symptoms masked by Neuropathy and PVD
   2. Definitive test of bone biopsy in invasive and may be contraindicated
   3. **This paper will concentrate on H&P, labs X-Rays and MRI findings**

**History**

1. Risk Factors:
   a. Duration of diabetes and degree of glycemic control
   b. PVD: both micro and macro-vascular
   c. Presence of peripheral neuropathy
2. Recent trauma or history of prior ulcers:

**Physical Exam**

1. VS, F/C/S, presence of wound or ulcer
2. Presence of foot deformities, tenderness, neuropathy and venous or arterial insufficiency
3. **Differentiating different causes of leg ulcers by their location and appearance**
   a. **Venous:** Above malleoli irregular borders, edema, dermatitis, hyper-pigmentation
   b. **Arterial:** Affect toes and shin, with pale borders and a punched out appearance
   c. **Diabetic:** Affect areas of increased pressures like soles, or where shoes rub
4. **Ulcer area:** Multiply width x length
5. **Probe to bone** test: Use sterile stainless steel and probe for hard gritty surface
6. **Wagner Grade**: Grade 0-5
   - a. Grade 0: No open lesion, may be healed lesion or deformity
   - b. Grade 1: Superficial ulcer
   - c. Grade 2: Deep, to tendon, bone or joint capsule
   - d. Grade 3: Abscess, osteomyelitis or tendonitis
   - e. Grade 4: Gangrene of toe or forefoot
   - f. Grade 5: Gangrene of foot

**Study Methods:**
- Medline from 1966-2007 for English language with appropriate keywords
- Two investigators reviewed all articles independently
- Additional studies gleaned from articles' references, previous reviews and expert polling
- Abstracts and letter publications were accepted to minimize publication bias
- Only 21 out of 279 articles (total of 1027 patients) met inclusion/exclusion criteria

**Inclusion Criteria:**
- Articles reporting original studies on H&P, Lab, Plain X-Rays in the diagnosis of Osteo in DM
- Data could be extracted to constructed 2 X 2 tables or article reported operating characteristics
- Diagnostic test was compared with a reference standard (Bone Biopsy for Micro or Histo)
- MRI Test characteristics were based on a single high quality Meta-Analysis of Osteo in DM

**Exclusion Criteria:**
- Pediatrics
- Mixed populations of diabetics and non-diabetics

**Prior Probability of Osteomyelitis (Reasonable "pre-test" probability)**
1. 12 to 100% in selected Studies
2. One large retrospective cohort study: found 15% of DM with foot ulcer had or got Osteo

**Accuracy of Symptoms and Signs for Osteo**
1. "Bone Exposure" defined as seeing or probing bone:
   - a. Highly suggests Osteo if Present: LR 9.2
   - b. Doesn't R/O osteo if absent: LR 0.7 (95% CI 0.5-0.92)
2. Ulcer Size > 2 cm²
   - a. Suggests osteo: LR 7.2
   - b. < 2 cm² lowers but doesn't R/O osteo LR .7
   - c. presence or absence of erythema, swelling or purulence doesn't change prob of Osteo
3. "Probe to Bone" evaluated in three studies
   - a. Positive test: LR 6.4 (95% CI 3.6-11)
   - b. Negative test: LR 0.39 (95% CI 0.2-0.76) Bad at R/O Osteo
4. **Clinical Gestalt:** three studies, two incorporating the subjective Wagner scale
   - a. Clinical impression of Osteo: LR 5.5 (95% CI: 1.8-17)
   - b. Clinical judgement Osteo absent: LR 0.54 (95% CI: 0.3-0.97) Bad at R/O Osteo

**Accuracy of Lab for Osteo**: 4 studies including a total of only 108 patients, 3 on ESR, one on WBC
5. ESR > 70
   - a. Positive test: LR 11 (95% CI 6.6-179)
6. WBC and Swab culture both performed poorly at diagnosing Osteo
**Accuracy of Plain Radiographs for Osteo:** 16 studies and 567 patients. Characteristics signs of Osteo on plain film include focal loss of trabecular pattern, periosteal reaction and frank bone destruction, often with tissue swelling.

1. Positive Findings: LR 2.3 (95% CI 1.6-3.3) Minimally useful
2. Negative Findings: LR 0.63 (95% CI 0.51-0.78) **Bad at R/O Osteo**

**Other Imaging Modalities including MRI:**

1. Nuclear imaging with Tech99, tagged WBC, etc. lack specificity
2. MRI:
   a. **Positive MRI in ALL patient (not just DM) LR 3.8 (95% CI 2.5-5.8)**
   b. **Negative MRI in Diabetics LR 0.14 (95% CI 0.08-0.26)**

**Limitations of the Literature:** *Only 10 higher quality studies were found,* most studies were retrospective, tertiary care centered based which results in selection bias. Finally, patients who lack the classical features of Osteo were less likely to get a bone biopsy, which may cause "verification bias" and make the tests appear more sensitive than they are.

**Scenario Resolution:**

**Case 1:**
- 52 y.o. Woman with IDDM for 12 years and CC of:
  - 2.2 X 1.5 cm foot ulcer (LR 7.2)
  - Probes to bone (LR 6.4)
  - Sed Rate 75 (LR 11)
  - Most Clinicians would treat as Osteo without an MRI
  - An positive MRI would increase probability to 80%

**Case 2:**
- 64 y.o. Man with NIDDM with CC non-healing ulcer over 4th MC head right foot x 3 weeks
  - Over 1 cm round ulcer that does not probe to bone (Both decrease likelihood of Osteo)
  - **How likely is osteomyelitis? Assuming prevalence of 15%, none of the above finding lower the probability enough to exclude the disease. A Negative MRI decrease the post-test probability to 2.4%**

**Clinical Bottom Line**

1. Clinical utility of history has not been studied
2. **Ulcer Size > 2 cm² and + probing to bone are helpful in establishing Osteo**
3. Sed Rate >70 and positive plain films **May Be** helpful in establishing Osteo
4. **No test reliably rule out Osteo,** except MRI in a low probability patient
5. MRI should be interpreted in light of pre-test probabilities
6. **Swab (surface) cultures, WBC and sign of inflammation around ulcer are useless**