Volume-Rad imaging in the evaluation of fractures of the posterior process of the talus

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My disclosure is in the Final AOFAS Program Book. I have no potential conflicts with this presentation.
Fractures of Posterior Process of Talus

- Fractures of posterior process of the talus are commonly missed in ankle sprains.
- Inadequate treatment may lead to non union.

- **Fracture Mechanism:**
  - Forceful plantar flexion (nutcracker effect)
  - Ankle inversion (avulsion fracture of lateral tubercle)
  - Forceful dorsi-flexion with pronation (fracture of Medial tubercle)

- **Clinical findings:**
  - Ankle sprain symptoms
  - Posterior ankle tenderness
  - Pain in posterior ankle with plantar flexion.
  - Decreased & painful motion of ankle and subtalar joint
  - Active flexion of great toe may produce pain at the posterior ankle

- **Diagnosis:**
  - Commonly missed in ankle sprains
  - Imaging: Radiography, CTScan, MRI and Bone Scan
Volume-Rad Imaging

- This recently invented application provides multiple high resolution slice images using an X-ray system.
- Low-dose projection images are taken during a single sweep of the X-ray tube over a limited angle.
- A computer then assembles the information to provide up to 60 high-resolution slice images with a selectable thickness ranging from 1 to 10 mm.
- This technique has been used in mammography for several years. It has recently become available for musculoskeletal radiography.
- It has lower cost and less radiation than a CT-scan.

Imaging Techniques:

- Radiography: 3 views of ankle (AP, Lateral, Mortise), with ankle in neutral position
- Volume-Rad images performed in the same room (Definium 8000 M3: GE healthcare, USA and Volume RAD:GE healthcare): 24 low-dose projection images were used to reconstruct tomographic sections with 4 mm nominal thickness without overlap. The detector was stationary, whereas the x-ray tube performed a horizontal continuous movement from -26° to +26° with the ankle in neutral position
Material and Methods

- Patients with suspected fracture of posterior process of talus after a trauma or ankle sprain from July 2009 to Oct 2011
- All patients had clinical symptoms of posterior process fracture: Pain reproduced by forced plantar flexion, tenderness over the retro calcaneal space
- Initial plain X-ray (3 views Ankle), Follow up imaging by Volume-Rad (Lateral Ankle)
- Confirmation by CT scan or MRI in 12 cases.
- 22 Patients (13 male, 9 female), 23 Fractures (one patient with bilateral fractures)
- Mean age: 37 years (Range 15-78). Median age: 27 years
- Inclusion criteria: Acute or chronic fracture of posterior process talus
- Exclusion criteria: Prior talus fractures; multiple talus fractures, severe arthritis, diabetic foot; and Charcot foot.
- Radiographic studies were read by 4 reviewers: One senior Musculoskeletal Radiologist, one musculoskeletal radiology fellow, two orthopaedics surgeons.
- All images were reviewed twice by each observer with four weeks interval between the observations
- The reviewers were blind to the information from the CT or MRI
- The images were analyzed for the following variables:
  1. Presence or absence of fracture of posterior process of talus
  2. If a fracture was present, was it acute or chronic?
  3. Identification of Medial and/or Lateral tubercle fractures
  4. Concomitant arthritis of ankle and/or subtalar joints
X-Ray

Volume-Rad

Fracture

M/L Tubercle

Subtalar Arthritis

Ankle Arthritis
Volume-Rad imaging proved to be more sensitive, specific and accurate for evaluation of fractures of the posterior process of the talus as compared to plain x-rays.

Inter-observer agreement value analysis shows a high level unanimity between observers in Volume-Rad compared to X-ray.

Intra-observer reliability shows that Volume-Rad imaging gives the reviewer a feeling of higher diagnostic confidence.

Although some lateral tubercle fractures can be identified in lateral x-ray of ankle, medial tubercle fractures are very difficult to detect.

Volume-Rad imaging is extremely accurate in differentiating medial and lateral tubercle fractures.

CT scan and MRI may help in the diagnosis of chronicity but Volume-Rad imaging may provide some information with less radiation and lower cost.

Volume-Rad imaging displays high sensitivity in evaluation of subtalar and ankle arthritis.
Conclusion

- We have demonstrated the value of Volume-Rad imaging to identify fractures of the posterior process of the talus and to assess concomitant arthritis.

- Volume-Rad imaging allows creation of sectional images with less overlapping anatomy. This provides clinicians a high degree of confidence in diagnosis as well as significant intra-observer reliability compared to x-ray.

- The multi-planar capacity of this technique and the enhanced cortical definition that it provides, allow improved assessment of these injuries.
References


