CAN'T MISS: RADIOLOGICAL DIAGNOSIS OF SUBTLE SCAPHOID FRACTURES

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Our Patient #1: History and Physical Exam

• 36 yo with FOOSH 3 months ago

• Persistent pain in radial side of left wrist, worse with movement

• Anatomic snuffbox tenderness

http://www.picturesof.net/pages/110102-144849-942053.html
Our Patient #1: Differential Diagnosis

- Fracture (scaphoid, triquetrum, lunate, distal radius)
- Ligament or Tendon Injury
- Dislocation
- Osteoarthritis
- Infection
- Nerve impingement
Our Patient #1: Plain Films

PA View

Oblique View

Findings: Linear lucency in scaphoid waist with surrounding sclerosis
Our Patient #1: MRI

Findings:

• Fracture line through scaphoid waist

• Bone marrow edema

• Cystic areas in the bones

T2-weighted MRI

CONSIDER: WAS THIS MRI INDICATED?
Our Patient #2: History and Physical Exam

- 27 yo, fells horizontally on right wrist and forearm
- Persistent pain in radial side, swelling
- Anatomic snuffbox tenderness

Our Patient #2: Plain Films

Findings: Soft tissue/bone artifact, no evidence of fracture
Our Patient #2: Interval History

- Wrist immobilization with cast
- Scheduled for repeat radiographs 2 weeks later
- Pain persisted, still worse with movement
- Continued anatomic snuffbox tenderness
Our Patient #2: Plain Films, 1 Month Later

Findings:

- Linear lucency reflecting scaphoid fracture or soft tissue density
Our Patient #2: MRI

Findings:

- Fracture line through scaphoid waist/distal pole boundary
- Bone marrow edema in distal pole

CONSIDER: WAS THIS MRI INDICATED?
Objectives

• Regional Anatomy of the Wrist

• Menu of Radiological Tests

• When to Order Certain Radiological Tests
Scaphoid Fractures: The Basics

- Accounts for 79% of carpal fractures

- Mechanism of injury: dorsiflexion and radial deviation

- Young and healthy population

- 70% in waist, 20% in proximal pole, 10% in distal pole

- Prognosis improves with more distal fractures
Regional Anatomy: Carpal Bones

Proximal Row
A–Scaphoid
B–Lunate
C–Triquetrum
D–Pisiform

Distal Row
E–Trapezium
F–Trapezoid
G–Capitate
H–Hamate

Blood is supplied from the distal to proximal pole, making the proximal pole susceptible to AVN in scaphoid fractures.
Menu of Radiological Tests

- Plain films
- Ultrasound
- Bone scan
- CT
- MRI
Menu of Radiological Tests: Plain Films

- 1st diagnostic step
- Use specialized views to visualize scaphoid
- Misses up to 20% of scaphoid fractures
- Low inter- and intra-observer reliability in multiple studies
- Bone and soft tissue artifacts possible

Menu of Radiological Tests: Scaphoid Views

Neutral PA

30 degrees

45 degrees

60 degrees

Beam is angulated toward the elbow; useful for detecting waist fractures
Menu of Radiological Tests: Ultrasound

Findings: Cortical disruption, hematoma
Findings: Cortical disruption, soft tissue swelling, joint effusion

- High-spatial resolution sonography (5–15 MHz)
- Specific, but not sensitive; rarely used in United States

Menu of Radiological Tests: Radionuclide Bone Scan

- High sensitivity, low specificity
- Age affects rate of osteoblastic activity
- Quantification bone scan has higher specificity but rarely used

Findings: Increased uptake in the right scaphoid

Menu of Radiological Tests: CT Scan

• High sensitivity and specificity

• Best spatial resolution allows for detection of displacement, angulation, and non-union

• Longitudinal axis slices preferred; risk of missing oblique non-unions

• Useful for operative planning
Companion Patients #1 and #2: CT Scan

Findings: Scaphoid waist fracture

Findings: Displaced scaphoid waist fracture

Smith M, et al., ANZ J. Surg, 2010 Jan;80(1-2), 82-90
Menu of Radiological Tests: MRI

T2-weighted MRI

- Most sensitive and specific imaging test
- Useful for evaluating soft tissue injuries and avascular necrosis
- Is it cost-effective?

Findings: Fracture line, bone marrow edema
When to Order Certain Radiological Tests

• Studies showed that imaging protocol varies significantly: In study of 105 hospitals across 6 continents, only 7% of hospitals shared same protocol.

• Four-view plain radiograph may miss scaphoid fractures; patients may present months to years after initial injury.

• Balance diagnostic use, cost-effectiveness, patient compliance.

• ACR recommends use of repeat radiographs or MRI for initially undetected fractures.

• In prospective study, use of early MRI, before repeat radiographs, resulted in therapeutic consequence in 66% of cases.

• Cost-effectiveness studies have been equivocal.
When to Order Certain Radiological Tests: Algorithm

Initial Radiographs Show Fracture?

Yes

Concern for Complications/Displacement?

No

Treatment

OA (Plain Film)

No fracture detected and persistent symptoms

Repeat MRI

Or CT

Fracture detected

Refer to Concern for Complications/Displacement

Yes

Which Complication?

OA (Plain Film)

SLAC (Plain Film)

AVN (MRI)

Non-Union (CT or MRI)

Displacement (CT)

Casting and repeat radiographs in 10–14 days

Or MRI
Back to Our Patients #1 and #2

Patient #1: Injury 3 months prior, evidence of non-union on plain films

MRI indicated? YES

Patient #2: Initial plain radiographs normal, follow-up radiographs were inconclusive

MRI indicated? YES
Summary

• Scaphoid fractures are most common carpal fracture

• Menu of radiological tests include plain films, ultrasound, bone scan, CT, and MRI

• Four-view plain films, including scaphoid view, is initial radiological test

• MRI has highest sensitivity and specificity for detecting scaphoid fractures

• CT useful for assessing displacement and for operative planning
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References


References


