AMSER Radiology Case of the Month
April 2021

Wrist Pain

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Patient Presentation

Chief complaint: Persistent left wrist pain

History of present illness: Patient is a 48-year-old female with no significant PMH who presented to her PCP with daily intermittent pain in her left wrist. She reports a recent history of multiple traumas to her left wrist. Inciting injuries to the wrist were characterized as hyperextension.
Patient Presentation

Past medical history: GERD, depression, anxiety, fibromyalgia

Review of systems: Joint pain, swelling, and restricted motion in left wrist; Numbness, tingling, and burning sensation in left wrist

Physical exam: Swelling of left thumb carpometacarpal joint, as well as dorsally on radial aspect of the wrist, with significant tenderness; decreased left wrist range of motion, with palmar flexion of 50 degrees and dorsiflexion of 60 degrees compared to 70 degrees on right; decrease in radial and ulnar deviations on left wrist compared to right

Labs: None

Imaging: Previous imaging attained on 09/2020
Previous Imaging

Posterior-Anterior Radiograph

Lateral Radiograph

Oblique Radiograph

Capitate
Hamate
Pisiform
Triquetrum
Lunate
Scaphoid
Trapezium
Trapezoid
Hamate
Capitate
Lunate
Proximal Pole of Scaphoid
Distal Pole of Scaphoid
Waist of Scaphoid
Previous Imaging

X-ray wrist 3+ views left (09/2020): No fracture, dislocation, nor joint space abnormality. No bony defects nor soft tissue abnormalities are seen.
What imaging should we order next?
### Variant 1: Chronic wrist pain. With or without prior injury. Best initial study.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
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<tbody>
<tr>
<td>X-ray wrist</td>
<td>Usually Appropriate</td>
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<tr>
<td>MRI wrist without IV contrast</td>
<td>Usually Not Appropriate</td>
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<td>MRI wrist without and with IV contrast</td>
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<tr>
<td>MR arthrography wrist</td>
<td>Usually Not Appropriate</td>
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<tr>
<td>US wrist</td>
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<tr>
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<tr>
<td>Bone scan wrist</td>
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**Ordered on 09/2020**

### Variant 2: Chronic wrist pain. Routine radiographs normal or nonspecific. Persistent symptoms. Next study.

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<td>MRI wrist without IV contrast</td>
<td>Usually Appropriate</td>
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<tr>
<td>MR arthrography wrist</td>
<td>May Be Appropriate</td>
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<tr>
<td>MRI wrist without and with IV contrast</td>
<td>Usually Not Appropriate</td>
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**Order next**
MRI Images Not Labeled

T1-Weighted Coronal Sequence

T2-Weighted Fat-Saturated Coronal Sequence
MRI Images Labeled

T1-Weighted Coronal Sequence

T2-Weighted Fat-Saturated Coronal Sequence

DR: Distal radius
L: Lunate
TRI: Triquetrum
H: Hamate
C: Capitate
TRA: Trapezoid
MRI Images Labeled

T1-Weighted Coronal Sequence

Non-displaced fracture at scaphoid waist

T2-Weighted Fat-Saturated Coronal Sequence

Marrow edema involving proximal pole of scaphoid
MRI Images Not Labeled

T1-Weighted Coronal Sequence

Proton-Density Axial Sequence through Scaphoid
Serpiginous T1 marrow replacement of proximal pole of scaphoid
Differential Diagnosis

1. Scaphoid fracture with avascular necrosis
2. Scaphoid fracture
3. Bone contusions
4. Focal red marrow
Final Diagnosis

Imaging: MRI wrist without contrast left

Indication: Persistent left wrist pain *with normal X-rays three months prior*

Technique: Multiplanar, multisequence MRI of left wrist performed without use of intra-articular contrast; T1 and fluid sensitive sequences were acquired in axial, coronal, and sagittal planes

Finding/impression: Nondisplaced scaphoid waist fracture with proximal pole osteonecrosis

*Patient was referred to orthopedic hand specialist*
Case Discussion

Introduction

- Scaphoid fracture “break of scaphoid bone in wrist”
- Commonly caused by Fall On OutStretched Hand (FOOSH injury)
- Most common wrist bone fracture, accounts for 60% of all carpal fractures

Epidemiology and risk factors

- Males are affected more often than females, most common in 2nd to 3rd decades of life
- Less common in children and older adults as distal radius is weaker contributor to wrist and more likely to fracture
- Nondisplaced fractures may be occult on initial radiographs, leading to delayed diagnosis and risk for avascular necrosis

Mechanism of injury

- Direct axial compression or wrist hyperextension
- Proximal pole fracture (10-20%), waist fracture (60-80%), and distal pole fracture (10%)
Anatomy: Anatomic “Snuffbox”

Medial border (ulnar side): tendon of extensor pollicus longus

Lateral border (radial side): tendon of extensor pollicus brevis and tendon of abductor pollicus longus

Proximal border: styloid process of radius

Distal border: schematic "snuffbox" isosceles triangle

Floor: trapezium and scaphoid bone
Anatomy

Largest bone in proximal carpal row

80% of scaphoid bone is covered by articular cartilage

Articulates with radius, lunate, trapezium, trapezoid, and capitate

Link between proximal and distal carpal row
Case Discussion

Clinical presentation
- Focal tenderness at volar prominence at distal wrist for distal pole fractures, anatomic snuffbox for waist or midbody fractures, or distal to Lister's tubercle for proximal pole fractures
- Provocative tests: anatomic snuffbox tenderness dorsally, scaphoid tubercle tenderness volarly, and/or scaphoid compression test

Diagnosis
- Often diagnosed by posterior-anterior and lateral radiographs of wrist; however, fractures may be radiographically occult
- Individuals with tenderness in anatomic “snuffbox” are generally splinted in a thumb spica for 7-10 days
  - Repeat radiographs can demonstrate fracture healing to indicate presence of a fracture
  - Consider MRI without contrast in the setting of chronic wrist pain plus normal or nonspecific radiographs plus persistent symptoms
Case Discussion

Radiographs
- Recommended views
  - Neutral rotation posterior-anterior and lateral, semi-pronated 45° oblique view
  - Scaphoid view
  - 30° wrist extension, 20° ulnar deviation
- If radiographs are negative (approximately 30% of cases) and there is a high clinical suspicion, repeat radiographs can be obtained in 10-14 days

Bone scan
- Indications: occult fractures in acute setting
- Sensitivity/specificity: sensitivity (100%), specificity (98%)

MRI
- Indications: most sensitive for diagnosing occult fractures < 24 hours, assessment of vascular status of bone
- Sensitivity/specificity: approach 100% for occult fractures

CT scan
- Indications: evaluate fracture location, angulation, displacement, size, collapse, and progression of nonunion
- Sensitivity/specificity: sensitivity (62%), specificity (87%)
- High negative predictive value
Case Discussion

**Complications**
- Bony avascular osteonecrosis is a common complication because of scaphoid’s tenuous blood supply
  - Risk correlates to location: proximal 1/3rd fracture (high risk), waist middle 1/3rd fracture (moderate risk), and distal 1/3rd fracture (low risk)
  - Incidence of avascular osteonecrosis directly correlated with proximity of fracture to proximal pole
- Bony scaphoid non-union can also occur from undiagnosed or undertreated scaphoid fractures, may lead to wrist osteoarthritis
- Other complications: malunion, subchondral bone penetration with arthrosis, scaphoid non-union advanced collapse wrist (SNAC wrist), and osteoarthritis

**Treatment**
- Based on location in bone of fracture (proximal, waist, distal), displacement (instability) of fracture, and tolerance for cast immobilization
  - Options: closed cast management, percutaneous screw fixation, or open reduction internal fixation
  - Fractures disrupting blood flow from distal end of bone may not heal which may require surgery
Avascular Osteonecrosis

20-30% of blood supply comes from superficial palmar branch of radial artery and enters bone at tubercle.

70-80% of blood supply comes from dorsal carpal branch of radial artery and travels towards proximal pole unidirectionally creating a “vascular watershed”


