

Succession of a Scaphoid Imaging Protocol

RT 2

Imaging Protocol

Background

The scaphoid bone is uniquely positioned to articulate with five surrounding bones: the trapezium, trapezoid, capitate, lunate, and the distal radius.¹ See **Figure 1** below. Eighty percentage of the scaphoid bone is comprised of cartilage, permitting limited space for the insertion of supplying arteries. The scaphoid bone is known to play an integral role in the function of the wrist; therefore, anomalies involving the scaphoid can hold serious consequences.¹

The scaphoid fracture was first identified in 1905 by Destot, a French surgeon, anatomist, and radiologist. Fractures involving the scaphoid account for 2-7% of all fractures and predominately occur in young, active males. With that, scaphoid fractures are involved in 82-89% of all carpal fractures.¹



Figure 1. Anatomical depiction of the scaphoid bone.²

Clinical Presentation

The typical cause of a scaphoid fracture results from a trauma injury from a fall on the out-stretched hand with the wrist in radial deviation inducing impact of the palm.¹ While there are no reliable clinical tests to confirm or rule out a scaphoid fracture, observable swelling of the anatomic snuffbox and pain when applying pressure on the snuffbox can be evaluated. See **Figure 2** below. Additionally, pain with pressure on the scaphoid tubercle or when applying axial pressure on the first metacarpal bone all have a sensitivity of 100%. Their specificity, however, ranges from 9-48% with a tender tubercle representing the highest specificity.³ A diminished grip strength compared to the uninjured side of over 50% increases the positive predictive value for a scaphoid fracture.^{4,5}



Figure 2. Anatomic snuffbox indicated by red triangle.¹

Diagnostic Radiography (X-Ray)

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| Advantages: 1. Cost effective 2. Allow for morphological measurements ⁶ 3. Easily rule out fracture if fat stripe on radiograph is normal ⁷ | Disadvantages: 1. 2-5% of fractures on capitate-side surface cannot be seen on initial image ⁷ 2. Occult fractures occur in 20-25% of scaphoid fractures ⁶ | Figure 3. Diagnostic image of scaphoid fracture indicated by arrow. ⁸  |
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Ultrasound

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| Advantages: 1. Cost effective ⁹ 2. Identify dislocated fractures through cortical disruption or parossal hematomas ⁷ 3. More sensitive and specific for diagnosing fractures missed on initial radiographs ⁹ | Disadvantages: 1. Non-dislocated fractures can be hard to detect ⁷ 2. Carpal bone configuration poses problems for scanning proximal and distal thirds of scaphoid ⁷ | Figure 4. Ultrasound image of scaphoid fracture indicated by arrow. ¹⁰  |
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Computed Tomography (CT)

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| Advantages: 1. Shows healing, especially if hardware is present ⁷ 2. Demonstrate displacement in all planes of orientation ⁷ 3. Immediate diagnosis ⁶ | Disadvantages: 1. Unable to accurately evaluate for bone contusions ⁷ 2. High cost ⁹ 3. High radiation exposure to patient ⁶ | Figure 5. CT image of scaphoid fracture indicated by arrow. ¹¹  |
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Magnetic Resonance Imaging (MRI)

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| Advantages: 1. Screening tool for patients with negative radiographic results ⁷ 2. Good diagnosis of occult fractures and soft tissue injuries ⁹ 3. Immediate diagnosis ⁶ | Disadvantages: 1. Not a useful tool for evaluation of healing ⁷ 2. May lead to overdiagnosis of scaphoid fractures ⁷ 3. High cost ⁹ | Figure 6. MRI image of scaphoid fracture indicated by arrow. ¹¹  |
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Discussion

Diagnostic radiographs are preferred as initial imaging to rule out obvious fractures, dislocations, or soft tissue damage seen by fat pad abnormalities. Since some fractures may not appear on radiographs until two weeks later, other follow-up imaging may be warranted.⁷ When initial radiographs are negative, morphological characteristics can be measured to help determine if additional imaging is needed. See **Figure 7** below.⁶ Each modality has benefits and limitations to diagnosing scaphoid fractures.

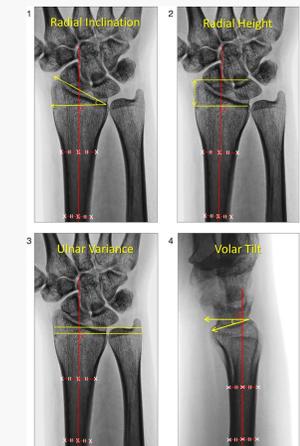


Figure 7. Radiographic measurements⁶

Risk of scaphoid fracture is higher when radial inclination (RI) is $>28.6^\circ$, volar tilt (VT) is $>12.2^\circ$, radial height (RH) is >14.8 mm, or ulnar variance (UV) is a negative number.⁶

Conclusion

Early scaphoid diagnosis is critical as 90% of all acute fractures heal properly when treated immediately.⁷ Once the clinical assessment dictates that medical imaging is necessary, ordering initial diagnostic x-rays is a cost effective approach to rule out many fractures. Morphological measurements can easily be taken from the images and if RI, VT, or RH are elevated or UV is negative, then additional advanced modality imaging should be ordered based on the suspected type of injury.⁶

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