

# Diagnostic Imaging Pathways - Scaphoid Fracture

## Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with a suspected scaphoid fracture.

**Date reviewed: August 2013**

**Date of next review: 2017/2018**

**Published: August 2013**

## Quick User Guide

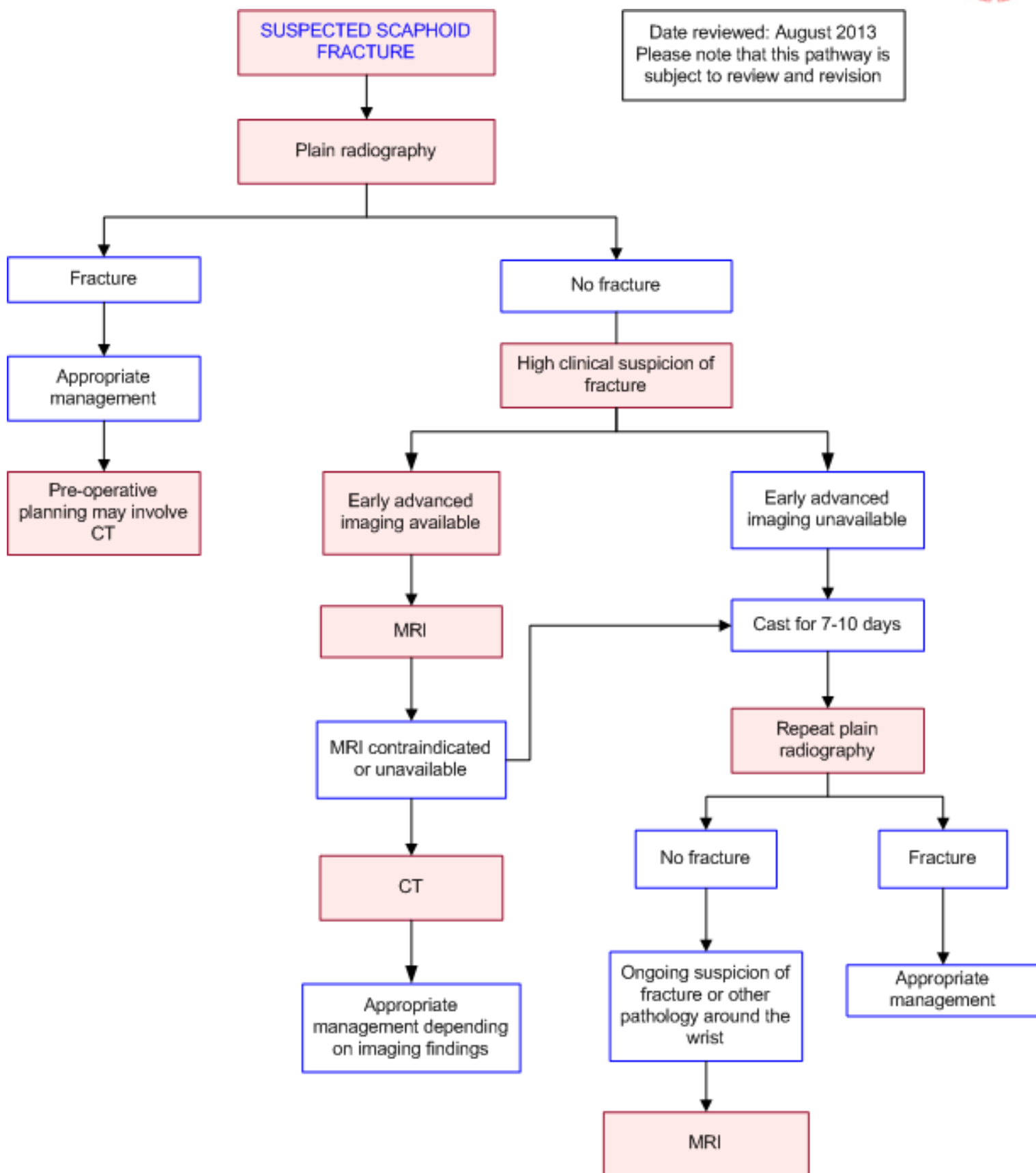
Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

## Pathway Diagram



## Image Gallery

*Note: These images open in a new page*

**1 Scaphoid Fracture**



Image 1 (Plain Radiograph): Fracture of the scaphoid bone.

**2 Scaphoid Fracture**

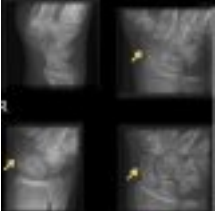


Image 2 (Plain Radiograph): Undisplaced fracture of the scaphoid bone (arrows).

**3 Scaphoid Fracture**



Image 3 (Plain Radiograph): Non-union of scaphoid fracture. Note sclerosis at fracture line.

**4 Scaphoid Fracture**



Image 4 (Computed Tomography): Coronal image of the wrist showing fracture through the proximal waist of scaphoid (arrows).

## Teaching Points

- Early identification of the presence of a fracture and degree of displacement is important to prevent adverse complications such as avascular necrosis, non-union and osteoarthritis [1](#)
- The initial diagnostic modality for suspected scaphoid fracture is plain radiography, but up to 30% of fractures are radiographically occult at the time of presentation
- Based on current evidence, early MRI is most accurate in detecting occult scaphoid fracture, and has the advantage of simultaneously evaluating bone marrow abnormalities and surrounding soft tissue injuries
- Early imaging is preferred as it results in faster identification of fractures and other injuries and reduces unnecessary immobilisation. If early MRI is unavailable or contraindicated, CT is an alternative
- Depending on local resources, presumptive casting and repeat plain radiography in 7-10 days remains a specific alternative, but if clinical suspicion continues after negative follow-up radiographs, further imaging with MRI is required to exclude a scaphoid fracture
- Imaging modality choice will depend on patient age and preference, hand dominance, activity level and availability of MRI
- Evaluation of the diagnostic performance of different imaging modalities is limited by the lack of a consensus reference standard

## Plain Radiography

- Screening method of choice for evaluating clinically suspected scaphoid fracture
- Standard four view series (posteroanterior (PA), lateral, oblique and ulnar-deviated PA with cephalad angulation) is recommended. [2](#) Up to 30% of scaphoid fractures are radiographically occult at the time of presentation [3](#)
- Plain radiographs are even less sensitive for detecting other carpal fractures in patients with suspected scaphoid fracture [3](#)
- Specific (95%) but relatively insensitive (45%) in diagnosing displacement compared to arthroscopic assessment as the gold standard. [4](#) Presumptive casting and follow-up radiographs, when resorption at the fracture line may make previously occult fractures visible, has an estimated pooled 91.1% sensitivity and 99.8% specificity in the diagnosis of suspected scaphoid fractures on metaanalysis. [5](#) Reported sensitivities vary considerably, possibly due to poor interobserver agreement of follow-up radiograph findings [5,6](#)
- While useful if positive, follow-up radiographs cannot exclude fracture and further evaluation with MRI is recommended in the case of high clinical suspicion [5,6](#)

## Magnetic Resonance Imaging

- MRI is considered the best advanced imaging modality for suspected radiographically occult scaphoid fractures [3,5,7](#)
- A recent metaanalysis estimated a pooled 97.7% sensitivity and 99.8% specificity and excellent reliability for the diagnosis of suspected scaphoid fractures, more sensitive than CT or follow-up radiography and more specific than bone scan [5](#)
- There is mounting evidence that early MRI is marginally or comparably cost effective compared to conventional management with immobilisation and reassessment and may reduce the potentially large societal cost of unnecessary immobilisation, but is influenced by local availability of scanning resources [7-12](#)
- Hospitals with the facilities to implement early MRI have found it to have a high clinical impact [3,13,14](#)
- Allows in one test without ionising radiation the accurate detection of [7,13-15](#)
  - Occult scaphoid and other carpal bone fractures
  - Accompanying soft tissue injuries, a minority of which have the potential for significant morbidity, such as triangular fibrocartilage injuries and scapholunate ligament injuries [15-17](#)
  - Bone marrow abnormalities, such as avascular necrosis, and bone marrow oedema or 'bruising', which was reported to have a 2% risk of occult fracture development in one prospective study [18,19](#)
- Preoperative gadolinium-enhanced MRI can be used to evaluate the vascularity of the proximal pole in scaphoid non-unions which can help inform surgical decision to use a vascularised rather than standard non-vascularised bone graft. [20,21](#) However, it is relatively insensitive compared to intra-operative assessment as the gold standard and can not reliably predict prognosis in these patients. [22](#) Contrast enhanced MRI is also useful in post-operative monitoring [23](#)
- Disadvantages compared to CT include
  - Inferior to MDCT in depicting cortical involvement in occult scaphoid fractures [24](#)
  - Longer scanning time needed; is difficult for some patients where claustrophobia or pain may lead to increased risk of movement artefact

## Computed Tomography

- A recent metaanalysis estimated a pooled 85.2% sensitivity and 99.5% specificity for the diagnosis of suspected scaphoid fractures, inferior to MRI and associated with ionising radiation [5](#)
- May be used for suspected radiographically occult scaphoid fracture as an alternative when MRI is contraindicated or unavailable [3](#)
- Useful in
  1. Depicting occult scaphoid and other fractures of the wrist, where it is superior to plain radiographs, especially for capitate fractures, [3](#) and depicting cortical involvement in occult scaphoid fractures, where it is superior to MRI [24](#)
  2. Detecting scaphoid fracture displacement, [25](#) although compared to arthroscopic examination they remain only 77% sensitive. [4](#) This is important given it affects the decision to proceed to surgery over conservative management, and the risk of non-union [1](#)
  3. Surgical planning of complex fractures
  4. Diagnosis of union; less accurate at excluding non-union [26](#)
- CT arthrography is equal to MRI in detecting palmar and central segment tears and superior in detecting dorsal segment tears of the scapholunate and lunotriquetral ligaments in cadavers, [27](#) although it is limited by invasiveness

## Bone Scan

- A recent metaanalysis estimated a pooled 97.8% sensitivity and 93.5% specificity for the diagnosis of suspected scaphoid fracture [5](#)
- Similarly sensitive but less specific than MRI, and more sensitive but less specific than CT, in the detection of scaphoid fractures. [5](#) It is used for suspected radiographically occult scaphoid fracture as an alternative when MRI is contraindicated or unavailable
- A normal bone scan practically excludes a fractured scaphoid but specificity is limited by indiscriminate <sup>99m</sup>Tc-methylene disphosphonate uptake between underlying causes such as occult fracture, bone bruising, soft tissue injury, osteomyelitis or osteoarthritis [28](#)

## Ultrasonography

- Ultrasound is rapid and inexpensive but is user dependent, has variable sensitivity and specificity and relatively poor performance of both false positives and negatives. [7,29](#) It cannot exclude fracture, causes pain and it is difficult to image the proximal and distal poles of the scaphoid. Further delineation with other imaging is required
- Some studies have investigated the use of ultrasonography to triage patients to CT or MRI with clinical suspicion of radiographically occult scaphoid fractures [30,31](#)

## References

Date of literature search: May 2013

The search methodology is available on request. [Email](#)

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

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