



The clinical scaphoid fracture: early computed tomography as a practical approach

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ABSTRACT

INTRODUCTION Up to 40% of scaphoid fractures are missed at initial presentation as clinical examination and plain radiographs are poor at identifying scaphoid fractures immediately after the injury. Avoiding a delay in diagnosis is essential to prevent the risk of non-union and early wrist arthritis. We demonstrate the use of CT scanning for the early confirmation of a scaphoid fracture.

PATIENTS AND METHODS We conducted a retrospective, chronological review of patients who attended an upper limb fracture clinic from January 2001 to October 2003 in a small district general hospital. We performed a CT scan on all 'clinical scaphoid' patients who had negative plain X-ray films.

RESULTS Overall, 70% of patients had a CT scan within 1 week of injury and not from date of accident and emergency attendance; 83% of patients had a CT scan within 2 weeks of injury. Of 118 patients identified, 32% had positive findings and 22% of 'clinical scaphoid' patients had scaphoid fractures. The proportion of positive findings for an acute scaphoid fracture was 68%. Additional pathologies identified on CT were capitate, triquetral and radial fractures.

CONCLUSIONS Our audit shows that it is practical to perform CT on suspicious scaphoid fractures in a small district general hospital. We identified an extremely high false-negative rate for plain X-rays and demonstrate that the appropriate use of CT at initial fracture clinic attendance with 'clinical scaphoid' leads to an earlier diagnosis and reduces the need for prolonged immobilisation and repeated clinical review.

KEYWORDS

Scaphoid fracture – Computed tomography – Fracture clinic

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Carpal injuries are common presentations to emergency departments, general practitioners and orthopaedic clinics. The scaphoid bone is the most commonly injured of the carpal bones accounting for 50–80% of carpal injuries and predominantly occurs in young, healthy individuals.^{1,2} Scaphoid fractures are the most problematic to diagnose in a clinical setting because it can take up to 6 weeks for scaphoid fractures to become conclusive on plain X-ray films. It is estimated that up to 40% of scaphoid fractures are missed at first presentation.^{3,4} A recent meta-analysis of scaphoid fractures calculated that the positive predictive value of clinical examination (those who proved to be 'clinical scaphoid' warranted X-rays of scaphoid views who subsequently had scaphoid fracture) is in the range 15–69% with an average of 21%.⁵ This means that four out of five patients without a fracture will be unnecessarily immobilised before radiological diagnosis is confirmed.

Patients and Methods

We conducted a retrospective, chronological review of patients who attended an upper limb fracture clinic from January 2001 to October 2003 in a district general hospital. Patients with negative X-ray findings but positive clinical signs for scaphoid injury satisfied the criteria for CT. We defined clinical signs for a scaphoid injury as tenderness over the anatomical snuffbox, pain on axial loading of first metacarpal and tenderness over scaphoid tubercle in the presence of normal plain films and included patients whose plain X-rays proved inconclusive.

Patients with clinical indications of scaphoid fracture but negative plain films had their wrists immobilised in a scaphoid cast in the accident unit while awaiting a hand clinic appointment.

CT scans, where necessary, were carried out on the same day as review on the first presentation to the fracture

Table 1 Types of injury sustained by the study group (n = 118)

Injury	Number of patients (%)
Fall onto outstretched hand (FOOSH)	94 (80%)
Road traffic accident	11 (9%)
Sport related	9 (8%)
Direct trauma	4 (3%)

clinic with results available immediately. This facility was made available by the radiology department.

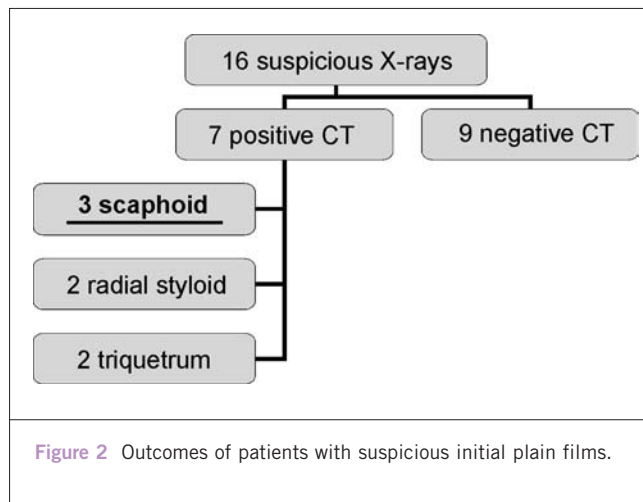
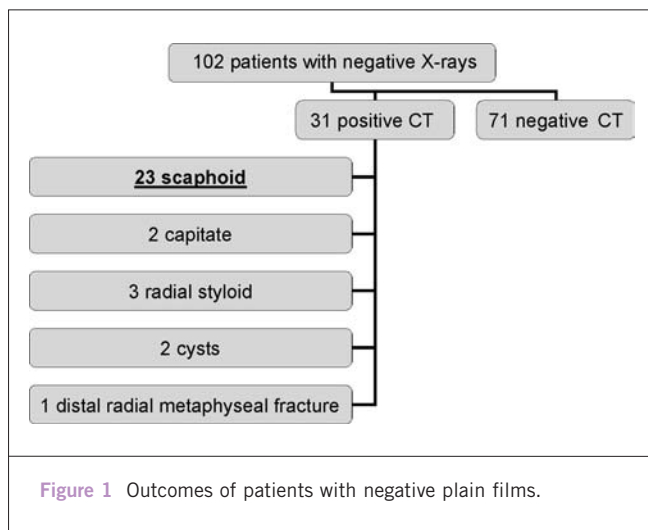
Results

A total of 118 patients presented with an acute wrist injury with subsequent signs of scaphoid injury in the absence of a diagnostic fracture on plain X-ray within the time period. Causes of injury are summarised in Table 1.

The age range was 10–72 years and the majority of patients were 29–45 years old. Of patients, 52% were female.

Eighty-four (70%) patients had CT imaging of their scaphoid within 1 week of the exact date of injury and 99 (83%) patients had CT imaging within 2 weeks of injury.

Of the 118 X-ray films, 16 were suspicious of which eight were suspected scaphoid fractures. Fractures of the distal radius and other carpal bones were also identified as shown in Figure 1. Overall, 102 patients had a clinical scaphoid injury but negative X-rays. Of these 102 patients with negative X-rays, 32 had positive CT findings. Of these 32 patients with positive CT scans, 25 revealed acute scaphoid fractures. The other 8 diagnoses included: two capitate, three distal radial fractures, two scaphoid cysts and one distal radial fracture (Fig. 1).



Of patients with normal plain radiographs, 31% (32 of 102) had positive findings, of which 22% (23 of 102) were scaphoid fractures. CT imaging confirmed 3 from 8 possible scaphoid fractures on plain X-ray films.

Of the patients with normal X-rays, 31% had positive findings on CT. The proportion of positive findings for an acute scaphoid fractures was 74% (23 of 31).

Eighty patients had normal CT findings. All patients were immobilised in a scaphoid cast until the fracture healed (for a period of 6–9 weeks) and discharged.

Two patients treated with plaster had continuing pain and underwent MRI scanning confirming no positive findings. One patient with a proximal pole fracture treated with



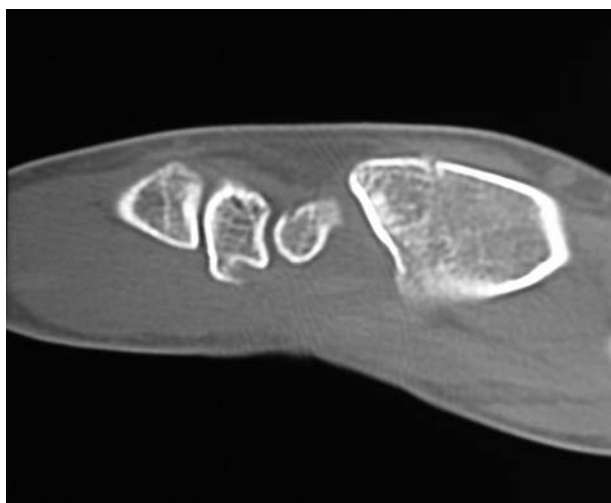


Figure 4 A distal radial styloid fracture.

plaster for 3 months, successfully underwent open reduction and internal fixation after a subsequent CT scan showed non-union.

Discussion

Failure to diagnose and immobilise scaphoid injuries can lead to osteoarthritis, mal-union, non-union and avascular necrosis; non-union is in the order of 5–12%.^{6,7} Even asymptomatic non-union has been shown to lead to deterioration, both clinically and radiologically, with time.⁸ Fracture of the scaphoid bone can be difficult to diagnose because it may take up to several weeks for radiological evidence to be conclusive.⁹ Initial radiographic sensitivity can be up to 64% and falls on further imaging to only 30%.¹⁰ Immobilisation for a clinical scaphoid injury is usually in a scaphoid cast for at least 6 weeks until a conclusion is drawn from imaging in conjunction with repeated clinical examination. In such cases, the options available are a modified carpal view, bone scintigraphy, MRI, and CT. Some use modified views first and then proceed to CT when diagnosis is still in doubt.¹¹

Isotope bone scintigraphy as a second-line investigation has high sensitivity for fractures but poor specificity with a false-positive rate of 25% when compared with delayed radiograph.^{12,15} Taking into account that bone scintigraphy is more sensitive than plain radiograph, a significant proportion of patients may potentially be over-treated. CT is an accurate and reliable source of imaging to diagnose scaphoid fractures and has been shown to be more sensitive than bone scintigraphy (sensitivity, specificity and positive and negative predicted value of CT is 100% compared to 78%, 90%, 78% and 90%, respectively, for bone scintigraphy).¹⁴

It has been suggested that MRI should be used as the gold standard to diagnose scaphoid injuries.¹⁵ Some authors advocate that CT could be used as gold standard to record whether union has been achieved.¹⁶

MRI has definite advantages in that it provides an accurate diagnosis of scaphoid fractures including information on the vascularity of the fragments involved and elucidates soft tissue injuries that conventional scaphoid views, modified carpal box view and CT are not able to delineate. However, the use of MRI in most UK NHS hospitals to elucidate scaphoid injury in an acute setting is usually not practical.

Our clinic makes use of CT to image the 'clinical' scaphoid when initial films of scaphoid views fail to show pathology. Our findings that 31% of normal X-rays were pathological on CT imaging and the overwhelming number of these were scaphoid fractures (74% of pathologies) represent a large number of patients with fractures that were missed by initial plain films. Moreover, they also represent an even larger number of patients (69%) with clinical scaphoid that would have been plastered for at least 6 weeks and asked to re-attend fracture/hand clinic at least three times before discharge, confirming the prophecy 'we over-treat a lot of patients to avoid under-treating a few'.¹⁷

In addition, CT scans can help the surgeon decide whether a structural bone graft is required, the preferred screw fixation and whether a volar or dorsal approach is more appropriate.

The cost of scaphoid films is £16 and a limited CT scaphoid scan is £57 including radiologist fees. But CT scanning has the potential for greater savings in terms of allowing the diagnosis of a fracture to be made earlier and timely appropriate treatment to commence.

Conclusions

Our data demonstrate that it is possible to combine a CT facility with an upper limb clinic in a UK hospital and, thus, advance the diagnostic time period. We have shown an extremely high false-negative rate for plain X-rays and advocate CT at the first attendance to fracture clinic if there is suspicion of scaphoid injury. An earlier diagnosis leads to appropriate management and reduces restrictions to the patient in terms of prolonged immobilisation and repeated clinical reviews. We, therefore, recommend the early use of CT imaging as a second-line investigation for 'clinical scaphoid' injury.

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