

Management of Clinically Suspected Scaphoid Fractures: A Survey of Current Practice in Israel

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ABSTRACT: **Background:** Fracture of the scaphoid is the most common fracture of a carpal bone. Nevertheless, the diagnosis of SF might be challenging. Plain X-rays that fail to demonstrate a fracture line while clinical findings suggest the existence of such a fracture is not uncommon. Currently there is no consensus in the literature as to how a clinically suspected SF should be diagnosed, immobilized and treated.

Objectives: To assess the current status of diagnosis and treatment of clinically suspected scaphoid fractures in Israeli emergency departments

Methods: We conducted a telephonic survey among orthopedic surgeons working in Israeli EDs as to their approach to the diagnosis and treatment of occult SF.

Results: A total of 42 orthopedic surgeons in 6 hospital EDs participated in the survey. They reported performing a mean of 2.45 ± 0.85 clinical tests, with tenderness over the snuffbox area being the sign most commonly used. A mean of 4.38 ± 0.76 X-ray views were ordered for patients with a clinically suspected SF. The most common combination included posterior-anterior, lateral, semipronated and semisupinated oblique views. All participating surgeons reported immobilizing the wrists of patients with occult fractures in a thumb spica cast based on their clinical findings. Upon discharge from the ED patients were advised to have another diagnostic examination as follows: 29 (69%) repeated X-rays series, 18 (43%) were referred to bone scintigraphy and 2 (5%) to computed tomography; none were referred to magnetic resonance imaging.

Conclusions: No consensus was found among Israeli orthopedic surgeons working in EDs regarding the right algorithm for assessment of clinically suspected SF. There is a need for better guidelines to uniformly dictate the order and set of tests to be used in the assessment of occult fractures.

IMAJ 2009;11:225–228

KEY WORDS: scaphoid fracture, bone scintigraphy, scaphoid compression test, snuffbox swelling, thumb spica cast

Fracture of the scaphoid is the most common fracture of a carpal bone, with an estimated incidence of 38 per 100,000 men and women per year [1]. An estimated 0.2% of all referrals to emergency departments are patients diagnosed as having a scaphoid fracture. The scaphoid bone, which is located on the radial aspect of the first carpal row, is covered with articular cartilage on most of its surface area and is supplied by branches of the radial artery. The dorsal branch enters the bone at the level of the scaphoid waist and supplies 70–80% of the blood to the bone. The remainder is supplied by a palmar branch that enters at the level of the distal pole. Because the proximal pole of the scaphoid relies solely on intraosseous blood supply, avascular necrosis is seen more often with fractures involving the waist or more proximal parts of the bone [2]. The total incidence of non-union at the fracture site and osteonecrosis of the proximal pole after SF is estimated to be 5–10% for the former and 15–30% [2] for the latter, with a higher incidence in proximal or displaced fractures [3]. These complications may eventually lead to osteoarthritis and collapse of the first carpal row, a state otherwise known as scaphoid non-union advanced collapse wrist. Importantly, SFs are commonly seen in young adults aged around 30 [4,5] and compromise of function can therefore have deleterious effects on their livelihood in addition to the impact on the quality of life that is reduced in affected individuals of all ages.

SFs can be isolated or associated with other concomitant injuries to ligamentous and/or osseous structures around the wrist joint, such as perilunate fracture dislocation, fractures of the distal radius, fractures of other carpal bones, and more [5,6]. The natural history of an isolated SF is associated with prolonged time to union and a mean non-union rate of up to 10% [3]. Proximal third fractures require the longest time to heal both clinically and radiographically and are associated with prolonged periods of cast immobilization and non-union rates of up to 33% [5,7]. Time to union may take as long as 6 months in some cases [3].

The diagnosis of SF is based on physical and radiographic findings. Temporary immobilization and repeated diagnostic efforts are the common practice when a clinically suspected fracture is diagnosed in the absence of radiographic evidence of a fracture line [3]. Different X-ray views and sets of views are described in the literature for the detection of SF, but there

SF = scaphoid fracture
ED = Emergency Department

is no consensus as to the number and set of views required [8]. While magnetic resonance imaging is considered the gold standard in the detection of SF, both computed tomography and bone scintigraphy are widely used as a second-line diagnostic modality in cases of a clinically suspected SF [3].

The most commonly used method of immobilization for occult SF is the "thumb spica" cast, consisting of a circular short forearm cast with incorporation of the thumb. There are other ways to immobilize the wrist, such as the short forearm Colles' cast, long arm cast, Munster cast and bandage, but there is no proven superiority for any of them [1,3,5,7,9].

In order to assess quality of treatment, practical management and potential complications associated with this entity, we conducted a survey among orthopedic surgeons working in Israeli emergency departments regarding their algorithm of diagnosis and treatment of occult SFs.

PATIENTS AND METHODS

We conducted a telephone questionnaire survey among orthopedic surgeons practicing in EDs in six major hospitals in Israel between January 2008 and March 2008. They were asked to respond to the following questions:

- How many years have you been working as an orthopedic surgeon in an emergency department?

- What clinical signs will you look for or what kind of tests would you perform when a scaphoid fracture is being suspected?
- What kind of X-ray views will you order upon positive findings on physical examination?
- Which further diagnostic modalities would you recommend in case you have not found a fracture on X-rays?
- When and where would you send the patient for a follow-up examination?
- What kind of immobilization treatment, if any, will you perform or recommend prior to discharge from the emergency department?

RESULTS

A total of 42 orthopedic surgeons assigned to the EDs of 6 major hospitals in Israel were identified by the hospitals' registers. Each physician was contacted and all agreed to participate in our telephone survey.

The responders had a mean of 3.4 ± 1.52 years of experience (range 1–6) as residents in orthopedic surgery. Most of them ($n=37$, 88%) reported relying on more than one clinical sign for diagnosing a SF, with an average of 2.45 ± 0.85 (range 1–5) signs per examination [Table 1]. A total of eight clinical signs were mentioned by the participants of the survey, the most frequently used being tenderness over the snuffbox area (93%) [Table 1]. No one combination or single set of clinical signs predominated among these surgeons. Seven X-ray views were mentioned, of which a mean of 4.38 ± 0.76 (range 3–7) was routinely used during the assessment process of a clinically suspected SF [Table 2]. The most prevalent combination of radiographic views included posterior-anterior, lateral, semipronated and semisupinated oblique views, which were routinely used in 43% of the cases. There was a consensus ($n=41$) among the participants of this study regarding the need to keep the wrist and thumb immobilized in a "thumb spica" cast when there was no radiographic evidence of a fracture line in a clinically suspected SF. Only one physician reported using a supporting wrist splint instead.

The participating physicians reported referring patients with the aforementioned diagnosis for a follow-up appointment in the outpatient clinic within 11.1 ± 2.6 days (range 7–14) following the injury, with a recommendation to undergo and bring with them the results of a second diagnostic assessment modality. Twenty-nine (69%) recommended the performance of another set of X-rays in conjunction with a repeated clinical examination, 18 (43%) recommended bone scintigraphy, and 11 (26%) recommended both, i.e., repeated X-rays and bone scintigraphy. Two physicians (5%) recommended a CT scan while none recommended MRI as the second imaging modality. Referral for a consultation with a hand surgeon was recommended by 11 (26%) of the

Table 1. Clinical signs and tests used to detect scaphoid fractures

Sign/Test	No. (%)
Snuffbox tenderness	39 (93)
Scaphoid compression tenderness	14 (33)
Limited wrist range of motion	13 (31)
Tenderness over scaphoid tubercle	11 (26)
Snuffbox swelling	10 (24)
Grinding test	9 (21)
Limited first-finger range of motion	3 (7)
Tenderness with radial deviation	1 (2)

Table 2. X-ray views during the assessment of clinically suspected scaphoid fractures

View	No. (%)
PA	37 (88)
Lateral	41 (98)
Oblique – semipronated	38 (90)
Oblique – semisupinated	34 (81)
PA with ulnar deviation	19 (45)
PA with radial deviation	4 (10)
PA with clenched fist	5 (12)

PA = posterior-anterior

participants, whereas all the others refer their patients to a general orthopedic outpatient clinic.

DISCUSSION

As many as 18 clinical signs and tests are described in the literature for the assessment of clinically suspected SFs, but they were all found to have a specificity within the range of 0.65–0.8 and sensitivity within the range of 0.85–0.97 [10]. The most commonly used clinical sign for the diagnosis of SF is tenderness over the anatomical snuffbox area, with a sensitivity of 0.93 and specificity of 0.165 [10]. Currently, there is no single set of clinical tests considered to be the gold standard for the diagnosis of SF. Moreover, there is no consensus in the literature regarding the predictive value of each test that might be related to variations in the way they are performed [11]. The scaphoid compression test, for example, was found to be 100% sensitive and 80% specific for detecting SF in one study [12], compared to 70.5% sensitive and 21.8% specific in another [13]. Previous studies showed that clinical examination as part of the assessment of SF has a specificity of 0.26, but it can be improved by combining several clinical signs [4]. In a recent pilot study Steenvoorde et al. [10,14] showed that a clinical decision tool that is based on a combination of different tests can improve the accuracy of detecting SFs. The authors evaluated 18 signs and tests used for the detection of SF, from which 7 were chosen as being most sensitive: clamp sign, palmar tenderness over the scaphoid, axial thumb compression, pain on resisted supination, pain in ulnar deviation, loss of snuff box concavity, and snuffbox tenderness [10,14].

X-rays are the most commonly used imaging modality for the diagnosis of SF [2], but they carry low sensitivity and high false positive rates in the detection of SF both in the acute trauma setting and on serial follow-up examinations [2,15,16].

For this reason, some authors consider serial X-rays as an unacceptable means of diagnosing SFs [15]. Numerous X-ray views are described in the literature for the detection of SFs; some of them combine different maneuvers (e.g., pronation, supination, etc.) while others use different angles in an attempt to increase the sensitivity and specificity of this modality [2,8,15,17]. There is no consensus in the literature as to which combination of X-ray views should be used as the standard of care for the diagnosis of SF [8]. Both PA and PA with ulnar deviation views were found to be essential for the diagnosis of SFs, with an ability to detect occult fractures that were not detected on other views [18]. The American College of Radiology recommends a series of four views (lateral, PA, PA with ulnar deviation, and semipronated oblique) as part of the assessment of clinically suspected SFs [17]. When X-rays

fail to demonstrate a fracture line, a second imaging modality is usually used to confirm or exclude the diagnosis. MRI is considered to be the gold standard for definitive diagnosis in these kinds of cases (sensitivity 95–100% and specificity 100%) [3,19,20], but CT (sensitivity 89–97% and specificity 91–100%) is still more commonly used as a second-line imaging modality [21,22]. CT scans, however, were found to be only slightly superior when compared to bone scintigraphy performed at least 72 hours after the trauma (sensitivity 92–100% and specificity 87–98%) [3,23,24]. An international survey involving 200 hospitals worldwide found no consensus on the use of both first-line radiographs and second-line detection methods in the management of SFs. The survey found that MRI and CT scans are more commonly used as a second-line imaging modality among medical centers in Europe and North America [25].

We conducted a telephonic questionnaire survey to assess how Israeli orthopedic surgeons in six major emergency departments diagnose and treat clinically suspected SFs. The participants used 2.45 different tests on average as part of the assessment of suspected scaphoid fractures. Palmar tenderness over the scaphoid, axial thumb compression, loss of snuff box concavity (described as snuffbox swelling), and snuffbox tenderness described as most beneficial by Steenvoorde et al. [14] were commonly performed. According to the results of our survey, all patients with clinically suspected SF are immobilized (mostly by thumb spica) prior to their discharge from the ED. They are then referred to the outpatient orthopedic clinic for reassessment and for repeated X-rays or bone scintigraphy in an attempt to confirm or exclude the diagnosis.

The American College of Radiology recommends the MRI as the most appropriate imaging modality in the case of a suspected SF, with non-contrast CT being considered second best, followed by bone scan and ultrasound [17]. None of the physicians we questioned recommended MRI and few recommended CT.

Our results show that a set of two to three clinical signs is the preferred clinical diagnostic tool used by ED orthopedic surgeons in Israel. Although reported as having high sensitivity and specificity, the clamp sign was not mentioned by any of the doctors who participated in our survey. The ACR appropriateness criteria recommend using a set of X-ray views – including PA, PA with ulnar deviation, lateral, and 45°supinated oblique – to confirm or exclude the presence of a fracture line [17]. Only 31% of the participants of this study reported using all four views routinely.

The preferred method of immobilization for an ovoid SF is a long or a short-arm thumb spica cast with the wrist in slight (10–20°) dorsiflexion [1,3,5]. According to our survey, physicians in Israeli EDs keep the patients immobilized in a

PA = posterior-anterior

ACR = American College of Radiology

thumb spica cast and refer them for a follow-up visit at the orthopedic outpatient clinic within 7–14 days. Bone scintigraphy was more commonly used than CT and MRI as a recommended second-line imaging modality, but it was not the standard of care in the majority of cases. These results raise the possibility that a large number of patients may be unnecessarily immobilized in a cast for occult SFs for a longer time than needed, without being definitively diagnosed.

We conclude by stressing the need for better guidelines and further research to devise a treatment algorithm that will enhance and improve the diagnostic and therapeutic management of patients with clinically suspected SFs with the aim of minimizing unnecessary immobilization and obviating SF-associated complications.

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