



## Pilot study evaluating a clinical decision tool on suspected scaphoid fractures

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In an earlier study we have proposed a scaphoid decision-protocol in order to improve diagnostic accuracy in case of suspected scaphoid fractures. This pilot study evaluated this protocol. In this pilot study (n = 31) most cases with clinical suspicion of scaphoid fractures reached a positive test result on the combined 7 clinical tests (93.5%). Using this test combination, no scaphoid fractures were missed (no false-negatives ; sensitivity 100%), but it also included many patients with no scaphoid fracture. Many of these, however, were found to have another fracture. In total, 48% had a scaphoid fracture, 19% another fracture and 32% no fracture. In the pilot study the proposed protocol seems to be a safe protocol, without missing scaphoid fractures. It leads to a reduction of unnecessary plaster casting of sprained wrists and produces a marked reduction in plain radiographic examinations.

**Keywords** : carpal scaphoid ; fracture ; clinical decision tool ; pilot study.

### INTRODUCTION

In another article in this issue (1), we have discussed the development of a scaphoid decision-protocol. This protocol was developed after we found that more than half of the patients, in our hospital, suspected to have a scaphoid fracture were eventually diagnosed with a sprained wrist only, and all those patients were treated with a below-elbow plaster cast for an average of 15 days. The current protocol was developed in order to minimise overtreatment of sprained wrists, but at

the same time without increasing the number of missed scaphoid fractures, for if non-union of a missed scaphoid occurs, outcome for the patient may be very bad. This report describes the protocol being evaluated in a pilot-study of 31 patients.

### METHODS

All patients at the emergency department of our community Hospital, aged 16 years and older, who were suspected to have a scaphoid fracture would be eligible for the pilot study. There should be a history of an adequate mechanism, like a fall on the outstretched hand. Patients

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with open fractures, with a trauma seven days or more before presentation, with a history of scaphoid fracture on the ipsilateral side, with any kind of bone disease, patients who were in follow-up elsewhere, and patients who had a general practitioner's (GP's) request for radiographs of the scaphoid would be excluded. Fracture mechanism and clinical findings on presentation were recorded.

## RESULTS

Over a period of 18 months, 31 patients with suspected scaphoid fracture were seen at the Community Emergency Department (see fig 1). All patients underwent the seven clinical tests of the "Scaphoid decision-protocol". Two patients (6%) had less than 5 points : 2 and 4 points respectively. According to the "Scaphoid decision-protocol" no Scaphoid radiographs should be made in these patients, but both patients received radiographs and both were found to have another fracture than that of the scaphoid. One was diagnosed with a fracture of the fourth metacarpal bone, the other with a fractured triquetrum. The other 29 patients had scores of 5 and higher (range 5-17 ; mean 11.4 ; SD 3.3). Of these 29 patients, 16 had radiological signs of a fracture (55%) : 15 patients had a scaphoid fracture and one patient had a fracture of the radius (fig 1). Negative initial radiographs were found in 13 patients. The remaining patients were treated with supporting bandages or plaster and they were invited for a follow-up session after two to three weeks.

At the follow-up session, 6 of the 13 patients (43%) no longer had clinical signs of scaphoid fracture and these patients were diagnosed with a sprained wrist. The other seven patients were all evaluated with the seven clinical tests. Five patients had less than 5 points. In one of these patients, the initial films showed a triquetrum fracture, which was missed in the earlier visit to the ED, one patient had a fracture of the lunate bone, and three were diagnosed with a sprained wrist. The other two patients had five points or more on the 7 tests (i.e. 11 and 16 points). Bone scans in these two patients revealed a fractured trapezium in the first and no fracture in the second patient. Thus, of 31 patients, 10 were diagnosed with a sprained wrist

and 21 were diagnosed with a fracture (15 scaphoid fractures, 2 triquetrum fractures, 1 fracture of the radius, 1 of the trapezium bone, 1 of the lunate bone and 1 fracture of the fourth metacarpal 4) (fig 1). This pilot study showed that the positive predictive value of a 7-test clinical score of five and higher at the initial visit for a scaphoid fracture was 48%, and for any fracture 55%. All patients with a scaphoid fracture (N = 15) scored 5 points or more on the 7 clinical tests (range of 7-17 points ; mean : 11.3 ; SD : 3.5).

### Evaluation of test performance

The seven tests included in the Scaphoid decision-protocol were included based on their performance mentioned in the literature, regarding their sensitivity and specificity. The seven tests included in the Scaphoid decision-protocol did not all perform as well as stated in the literature. The combination of the seven tests had a sensitivity of 100%, i.e. no scaphoid fractures were missed. The specificity of the combination of tests, however, was not particularly high. All patients with scaphoid fractures had a score on the Scaphoid decision-protocol of 7 and higher. If this cut-off value (i.e.  $\geq 7$  points) is used instead of  $\geq 5$  points the sensitivity of the Scaphoid decision-protocol is equally high and the specificity is slightly improved. Other measures of performance of this test were also rather high. The positive predictive value of the Scaphoid decision-protocol was found to be 51.7% and the negative predictive value 100%.

Our pilot study shows that most patients with a clinical suspicion of a scaphoid fracture reach five points or more at the seven clinical tests of the Scaphoid decision-protocol. If a clinician has good clinical selection, this should indeed be the case. Of the patients with 5 points and more and negative films (N = 13), four patients (31%) were diagnosed with a fracture. Of all 31 patients, 29 scored 5 points or more at the initial Scaphoid decision-protocol. Of these, 15 (52%) had a scaphoid fracture. The positive predictive value of the Scaphoid decision-protocol was therefore 51.7%, whereas the negative predictive value was found to be 100.0%. If we compare this with our situation



before the introduction of the protocol, our positive predictive value was only 26%, indicating a higher diagnostic accuracy.

All patients with a proven scaphoid fractures in this study, scored at least 7 points. This might imply that the indication for radiographs at 5 points could be increased to 6 or 7 points. Sensitivity remains the same, and specificity improves. This study only presents a pilot test of this new combination of tests to evaluate the presence of a scaphoid fracture. Further evaluation of the "Scaphoid decision-protocol" should be performed to indicate whether the Scaphoid decision-protocol tests have clinical value and such evaluation should reveal whether the cut-off value of 5 should be increased by one or two points.

Some patients were found to have a fracture at the follow-up visit at the hospital, while at their initial visit no fracture was seen on the radiographs. These patients were mostly treated with casting for 2 or 3 weeks. None of these patients had adverse outcomes due to delayed treatment of their fracture. All patients with negative radiographs at their initial visit and no clinical suspicion of a fracture at

their follow-up visit, had no adverse outcomes, such as significant loss of bone mineral and muscle mass, due to casting of their wrist.

Until we are able to present the results of the full study regarding the evaluation of the Scaphoid decision-protocol, we conclude that after an adequate initial series of radiographs for clinical suspicion of a scaphoid fracture, no second or third series are necessary. At a 2 or 3 weeks follow-up, most patients with negative initial films have no clinical signs of a fracture. The few patients that do, are better off undergoing a bone scan or MRI. Thus, with this study we showed that a large decrease in number of radiographs for fracture suspicion is possible, which will lead to a reduction of costs, without a decrease in the quality of the provided care.

## REFERENCES

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