Diagnosis of scaphoid fractures

A prospective multicenter study of 1,052 patients with 160 fractures

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In a prospective multicenter study of 1,052 patients with clinical signs of a scaphoid fracture, mammographic films and fine intensifying screens were used at the radiographic examination. 5 standardized projections including 3 special projections focused on the scaphoid were taken. 150 fractures were diagnosed at the first examination but in 10 cases the fracture was first diagnosed at a second radiographic examination after 10–14 days.

The second examination still seems mandatory despite the use of high quality radiographs with optimal spatial resolution and contrast, and the value of supplementary special projections.

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Since some scaphoid fractures are not visible on the first radiographs, another radiographic examination is recommended (Schnek 1933, Perschl 1938, Lindgren 1949, Russe 1960, Trojan 1961, Melone 1981, Waeckerle 1987). Immobilization with a plaster cast between the 2 radiographic examinations is accepted practice.

We investigated whether an improved initial radiographic examination using a combination of special scaphoid projections (Larsen et al. 1983, Frøkjær et al. 1990) could reduce the need for temporary immobilization and further radiographic invetigation.

Patients and methods

Between 1991 and 1993, 1,052 consecutive patients with a clinically suspected scaphoid fracture were included in a multicenter study. There were 572 men and 480 women with a mean age of 35 (15–89) years.

Exclusion criteria were: 1) age below 15 years, 2) more than 7 days delay between the trauma and the first radiographic examination, 3) previous scaphoid fracture in the investigated hand, 4) generalized diseases affecting bone structure, and 5) patients who had no second examination (n 84).

In all cases we used mammographic films and a fine reinforcement screen, giving a spatial resolution on 14 lines/mm (using a standardized grate phantom) and a fine contrast. Radiographs were made on day 1, and after 10–14 days immobilization with a short arm plaster cast (removed before examination). If the symptoms persisted, a third radiographic examination was performed after another 10–14 days.

For the 5 projections, the patient was initially placed in a zero-position: the shoulder abducted 90°, the elbow flexed 90°, the forearm in neutral rotation (no supination or pronation), the wrist in neutral position (no radial or ulnar deviation, and no palmar flexion or extension) and the fingers stretched. Standard posteroanterior and lateral projections were obtained.

3 special projections focusing on the scaphoid were taken:

1) The zero-position modified by maximal ulnar deviation of the wrist and 15 degrees of pronation. The tube angulated 15° distally. It is a modification of the projection recommended by Russe (1960) and Trojan (1961) and is especially suitable for visualizing fractures in the proximal 1/3 of the scaphoid.

2) The wrist with maximal ulnar deviation and the tube angulated 30° distally. This projection has an almost optimal relation between some of the fractures and the X-ray plane (Larsen et al. 1983).

3) The wrist semisupinated and the fingers semiflexed (writing position). The tube vertically orientated. The projection is particularly recommended for detection of fractures in the distal 1/3 of the scaphoid (Roesgen and Hierholzer 1988).

Results

We found 160 scaphoid fractures (15 percent of the investigated wrists). The location was the distal third in 29 percent, the middle in 66 and the proximal third in 5 percent of the fractures. One third of the fractures were transverse (Table 1).

In 10 patients the fracture could not be diagnosed on the first radiographic examination (Table 2). 5 of these patients (1–5) initially had a false negative set of radiographs, but the fractures were revealed at the second radiographic examination. Another of the fractures (case 6) could not be verified until a third set of radiographs was taken. In 4 of the patients (7–10) a fracture was suspected, but a second radiographic examination was necessary to verify the diagnosis.

Thus, in 6 percent (95 percent confidence interval: 3–11 percent) of the fractures a second radiographic examination (after 10–14 days) was necessary to establish the diagnosis. None of them was displaced or angulated.

The radiographic examinations revealed 4 previously unknown scaphoid non-unions and 85 other fractures. Among the latter fractures, we found 53 fractures of the distal radius and 27 (13 triquetrum) carpal and metacarpal fractures. 2 patients had both a scaphoid fracture and a fracture of the distal radius in the same upper extremity.

Table 1. Type of 160 scaphoid fractures

	Type	Percent
Transverse	I	36
Horizontal	II	27
Oblique	III	5
Avulsion	IV	22
Non-classified	V	10

Table 2. False negative scaphoid fractures on first radiographic examination

Patient	Location[a]	Type[b]	Patient	Location[a]	Type[b]
1	m	V	6	d	II
2	m	II	7	p	II
3	d	IV	8	m	II
4	m	V	9	m	II
5	p	V	10	m	III

[a] d distal, m middle, p proximal third
[b] see Table 1

Discussion

The scaphoid is the commonest of the carpal bones to be fractured (Dunn 1972). The rate of false negative primary radiographs is reported to vary from 2 percent (Leslie and Dickson 1981) to 20 percent (Waeckerle 1987). Using high-quality radiographs and supplementary special projections that give a full view of the scaphoid, we found a false negative rate of 6 percent.

Leslie and Dickson (1981) reported that only 2 percent of the fractures were not visible on initial examination, and that these fractures were incomplete compression fractures that would heal under almost any circumstances. However, with a false negative rate of 6 percent and some misdiagnosed fractures located in the proximal part of the scaphoid, we believe that a second radiographic examination 10–14 days after the trauma is mandatory.

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