Limited diagnostic value of macroradiography in suspected scaphoid fractures

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In a prospective study 60, patients having suspected occult scaphoid fractures, but with normal conventional scaphoid radiographs, also underwent macroradiography. Clinical and conventional radiographic follow-up examinations and MRI identified 8 occult scaphoid fractures and 23 nonscaphoid lesions. Macroradiography identified only 50% of the occult scaphoid fractures.

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Fracture of the scaphoid bone is not only the commonest carpal fracture but also the commonest misdiagnosed carpal fracture (Leslie and Dickson 1981).

The immobilization period necessary to exclude occult scaphoid fractures and the different diagnostic methods are subjects of controversy (Bedford et al. 1982, Duncan and Thurston 1985, Dias et al. 1987, 1990, Hindman et al. 1989, Mehta and Brautigan 1990, Barton 1992, Hodgkinson et al. 1993). Bone scanning and MRI are excellent methods of diagnosis, but are expensive (Rolfe et al. 1981, Tiel van Buul et al. 1992, 1993, Gaebler et al. 1996, Grover 1996, Breitenseher et al. 1997).

Macroradiography, because of its magnification and high spatial resolution, has been proposed as an alternative imaging modality in the diagnosis of carpal injuries (Buckland-Wright 1989a, b, Nicholl et al. 1995). In comparison with conventional radiography, this method permits the detection of small lesions, particularly in cancellous bone, where trabeculae are thin. We prospectively assessed the value of macroradiography in the diagnosis of suspected scaphoid fractures.

Patients and methods

From January 1995 to September 1996, 60 patients with a clinically suspected scaphoid fracture were included in this prospective study. All patients had sustained a wrist injury and complained of pain, swelling or tenderness in the anatomical snuff-box, but had normal initial anteroposterior, lateral and 2 oblique scaphoid radiographs. The average age of the patients was 30 years.

All patients were immobilized in a below-elbow cast for 10 days, after which the wrists were reassessed clinically and radiographically (anteroposterior, lateral and two oblique scaphoid views). If both the clinical and radiographic examinations were normal, the immobilization was discontinued. If there was no radiographic evidence of a scaphoid fracture, but pain in the anatomical snuff-box persisted, cast immobilization was continued for an additional 2 weeks, after which additional clinical and radiographic examinations were performed. 6 weeks of immobilization was the follow-up limit used to rule out a scaphoid fracture. The clinical and radiological examinations were performed by experienced trauma surgeons, who were not involved in the study and who were blinded to the macroradiography and MRI results.

All patients had 4 scaphoid view magnification-radiographs, using a microfocal radiographic unit (0.03–0.13 mm focal spot, source size 30 Lp/mm, Dima Tec 013, Feinfocus, Germany), an average of 2 (0–6) days following trauma. The magnification factor was 4 times, allowing the entire carpus to be in the field of view. Interpretations of the macroradiographs were made by a senior radiologist, blinded to all clinical information.

Within 3 (0–6) days after the injury, 1.0 Tesla MR imaging (Gyroscan, Philips, Eindhoven, The Netherlands) with coronal STIR (short tau inversion recovery = T2-weighted with fat suppression) sequences, coronal T1-weighted SE (spin-echo) sequences and

Figure 1. Macroradiographs 2 days after trauma clearly show a fracture line through the scaphoid in a 24-year-old man.

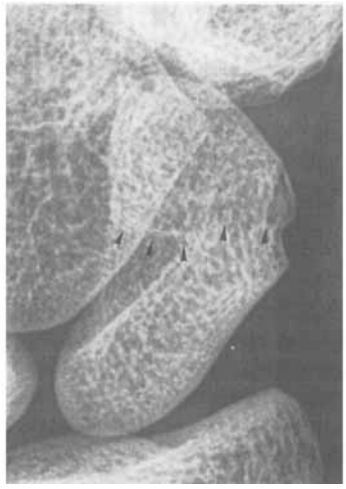

Figure 2. Hairline fracture of the scaphoid in a 21-year-old man 5 days after trauma.

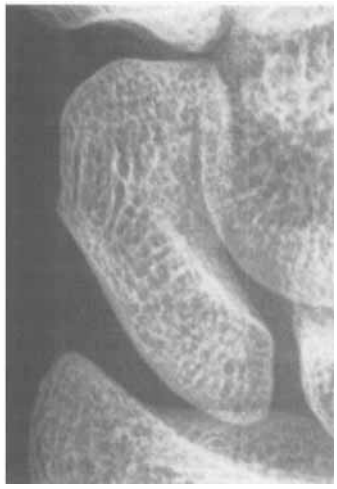

Figure 3. Macroradiographs 4 days after trauma show no fracture of the scaphoid in a 17-year-old girl. The patient still complained about pain in the anatomical snuff-box 10 and 24 days after trauma. 42 days after trauma, radiographs showed a line of sclerosis, indicating a remodeling process after a scaphoid fracture.

T2-weighted GE (gradient-echo) sequences was performed. The assessment of the MRI scans was done by a senior radiologist, who was blinded to the findings of radiography.

Results

In 8 patients, a scaphoid fracture was diagnosed by conventional radiographs after an average time of 18 (10–42) days. In all of these cases, the fractures were verified by MR imaging. In only 4 of these patients was the fracture identified by macroradiography (Figures 1–3). Macroradiography did not identify any fractures that were not identified by MRI as well as by conventional radiographs. In 23 cases injuries other than scaphoid fractures were identified as well by MRI as by conventional radiographs. Macroradiography showed 12 of these injuries.

Discussion

If scaphoid fractures are not immobilized, there is a substantial later risk of nonunion (Trojan 1961, Langhoff and Andersen 1988, Barton 1992). Since the diagnosis is often difficult to make initially, there is a tendency to overtreat patients with wrist injuries (Brismar 1988, Mittal et al. 1989, Abdel-Salam et al. 1992, Waizenegger et al. 1994).

Recently, macroradiography has been used to diagnose fractures and detect wrist pathology (Buckland-Wright 1989, Nicholl et al. 1995). With the superior magnification and spatial resolution of this method, an immediate diagnosis of carpal injuries would seem easy. However, our findings suggest a limited value of macroradiography in the diagnosis of occult scaphoid fractures. The characteristics of occult scaphoid fractures may explain the failure of macroradiography. It may take days or weeks until the microfractures of the trabecular bone, the bone edema and hemorrhage induce the repair process that makes the fracture radiographically visible. If a scaphoid fracture is clinically suspected and radiographs are initially negative, MRI (Gaebler et al. 1996, Kukla et al. 1997) or scintimetry should be performed.

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