

BONE SCINTIGRAPHY IN THE EVALUATION OF FRACTURE OF THE CARPAL SCAPHOID BONE

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The purpose of the present prospective study was to assess the value of 99m-Tc-MDP wrist scintigraphy performed as a routine examination in excluding or detecting carpal scaphoid bone fracture.

The following conclusions are drawn: 99m-Tc-MDP wrist scintigraphy is of high sensitivity, but low specificity in the detection of scaphoid bone fractures. The scintigraphy is expedient to exclude scaphoid bone fracture, if performed after secondary clinical and radiographic assessment, and guided by negative scintigrams a reduction of clinical examinations, radiographies and superfluous casting days is achieved.

Key words: carpal bones; radionuclide imaging; technetium; wrist injuries

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Since the introduction of the technetium 99m labeled phosphorus complexes in 1971, these compounds have been used increasingly in the orthopaedic field (Kirschner & Simon 1981). Increased uptake of bone-seeking radiopharmaceuticals in fractured areas can always be noted a few days after the injury. The uptake increases for several weeks or a few months and then slowly declines (Wendeberg 1961, Muheim 1973, Rosenthal et al. 1976, Lund et al. 1978). Its value is established in detecting certain fractures in which radiograms are inconclusive, especially stress fractures, rib fractures and in the evaluation of the battered child (Prather et al. 1977, Iimori et al. 1975, Smith et al. 1980, Haase et al. 1980).

Two studies concerning the value of technetium bone scintigraphy in diagnosing fractures of the carpal scaphoid bone have hitherto been reported. Ganel et al. (1979) performed 49 scans within 72 hours after a wrist trauma, and found the early assessment of a

fracture, in the presence of nondiagnostic radiograms, the major advantage of the wrist scintigraphy. Jørgensen et al. (1979) performed 50 scans 10 days after a wrist injury, and found the examination of particular help in the cases where the fracture did not become radiographically apparent until a week or more had passed.

The purpose of the present study was to assess the value of 99m-Tc-MDP wrist scintigraphy performed as a routine examination 10 days after the injury in excluding or detecting a fracture in the carpal scaphoid bone.

PATIENTS AND METHODS

A prospective study was performed in a 1-year period (1980). Included were all patients in whom a fracture in the scaphoid bone was suspected despite negative or inconclusive radiograms. The study included 100 patients (101 wrists), 39 women and 61 men, ranging from 10 to 80 years (mean 33 years). After the clinical and radiographic assessment a plaster was applied from

above the elbow to the knuckles, including the proximal phalanx of the thumb. All patients underwent ^{99m}Tc -MDP scintigraphy of both wrists 10 days after the trauma (retaining the cast). Twelve days after the trauma the clinical examination was repeated, and in case of tenderness in the anatomical snuff-box, secondary radiograms of the scaphoid were performed (two oblique views). A radiographically established fracture was treated according to the usual practice of the department. If no fracture was detected, casting was continued, and the clinical and radiographic control repeated at 1–2-week intervals, until the tenderness disappeared or a fracture was revealed. All patients in the study were clinically and radiographically examined 2 months after the injury.

The scintigraphy was performed with a Nuclear-Chicago Pho/Gamma 3 scanner, equipped with a parallel hole collimator, 3 hours after intravenous administration of 10–15 mCi ^{99m}Tc methylene diphosphate (^{99m}Tc -MDP). Detailed descriptions were given, independent of clinical and radiographic assessment. The following grading was applied:

“negative”: homogeneous and symmetrical tracer uptake in the wrists.

“positive”: focal uptake radially or centrally in the wrist (Figure 1).

“inconclusive”: diffuse tracer uptake in the wrist or focal uptake in the ulnar part of the wrist.

RESULTS

By reexamination on the 12th day after the injury, tenderness in the anatomical snuff-box was still present in 51 wrists and radiograms revealed 19 fractures in the carpal or surrounding bones, including seven in the scaphoid bone. At later controls or follow-up an additional four scaphoid fractures were exposed. In the 50 wrists without tenderness at examination on the 12th day no fracture or fracture healing was demonstrated at follow-up.

Among 34 negative scintigrams, tenderness in the anatomical snuff-box was noted in 16 patients at examinations on the 12th day, for which reason a further 18 clinical examinations and 11 radiographies were performed (follow-up not included) and casting continued altogether 108 days, although fracture or other casting requiring lesion in the wrists was never detected (Table 1).

Of the scintigrams 54 were designated positive and 13 inconclusive, among which 25 fractures were detected, of these 11 scaphoid bone fractures. In all 11 cases of established scaphoid fracture, the scintigrams were designated positive. Among the remaining 42 positive or incon-

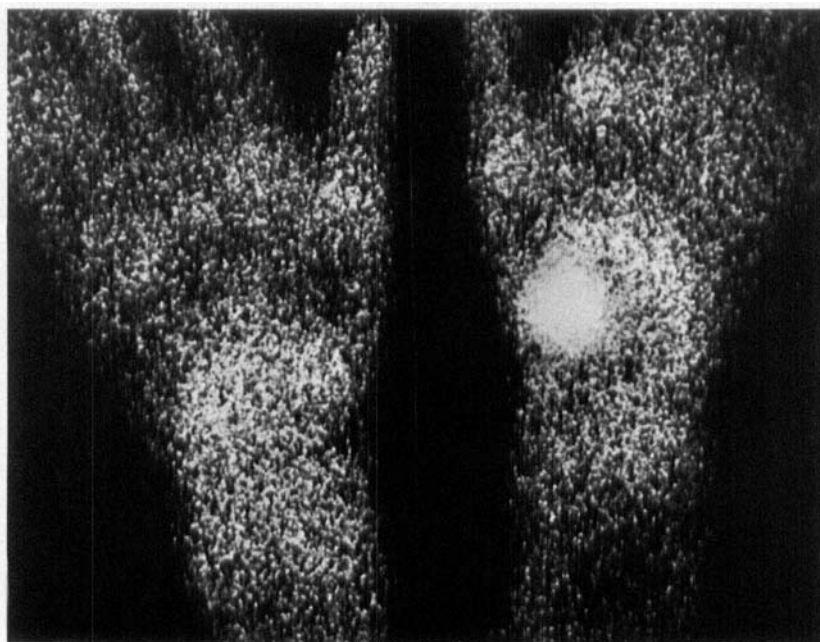


Figure 1. Left: normal tracer uptake in the wrist region. Right: focal increased accumulation radially in the wrist. Radiography revealed fracture in the scaphoid bone.

Table 1. Clinical, radiographic and scintigraphic findings

12 days after the injury			At later controls or at 2-month follow-up
scintigraphy	clinical suspicio	+ fracture	+ fracture
Positive	54	28	14 (7 scaphoid)
Inconcl.	13	7	5 (0 scaphoid)
Negative	34	16	0
Total	101	51	19
			6

Table 2. Clinical suspicio, negative radiography and corresponding scintigraphic findings the 12th day

Clinical suspicio	– fracture	Scintigraphy	At later controls or at 2-months follow-up
51	32	Positive	14
		Inconcl.	2
		Negative	16
			6 fractures (4 scaphoid)
			0
			0

clusive scintigrams, wrist cineradiography revealed three cases of scapho-lunate dissociations (Lincheid et al. 1972); one case of Kienboeck's disease of the lunate bone and one case of osteoarthritis of the first carpo-metacarpal joint were demonstrated radiographically. Finally tendovaginitis de Quervain was established in one case. Among the remaining 36 positive or inconclusive scintigraphies, no fracture or other specific diseases in the wrist could be discovered.

The combination of 1) positive scintigraphy, 2) tenderness and 3) normal radiograms occurred in 14 patients, in whom four scaphoid fractures were later revealed (Table 2).

DISCUSSION

In the previous investigations the high diagnostic sensitivity (100 per cent) but lesser specificity of the 99m-Tc-MDP wrist scintigraphy in detecting scaphoid bone fractures was established (Ganel et al. 1979, Jørgensen et al. 1979). The present study confirms these statements. Accordingly, a positive or inconclusive wrist scintigram can indicate a fracture, as well as other abnormal condi-

tions in the wrist area, whereas a negative scintigram excludes with certainty fracture in the scaphoid or surrounding bones.

However, the performance of scintigraphy before secondary clinical judgement appears inexpedient, as the examination is carried out in cases in which fracture can be enfeebled by it, as well as in cases in which secondary radiography may reveal a fracture. So, if employed with the purpose of excluding fracture, it should be performed after secondary clinical and radiographic assessment. In this study, employed for excluding fracture according to these guidelines, the number of scintigraphies could be reduced from 101 to 32, rendering superfluous 108 casting days, 11 radiographies and 18 out-patient clinical examinations.

CONCLUSIONS

Based on the present observations, the following conclusions are drawn:

a) a normal 99m-Tc-MDP wrist scintigraphy

- excludes fracture in the scaphoid or surrounding bones in the wrist area.
- b) the benefit of ^{99m}Tc-MDP wrist scintigraphy in detection or prediction of scaphoid bone fractures is limited, if performed as a routine examination.
- c) ^{99m}Tc-MDP wrist scintigraphy appears expedient to exclude scaphoid bone fracture, if performed in case of doubt after secondary clinical and radiographic assessment and guided by negative scintigrams, the number of clinical examinations, radiographies and superfluous casting days are reduced.

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