Scintigraphy in skeletal trauma

B. K. ADAMS

Summary

Five case reports demonstrate the value of bone scintigraphy in trauma. The bone scans clearly demonstrated fractures of the hip and pelvis that were not radiologically evident or the presence of which was doubtful, and also identified a number of unsuspected fractures in a patient with multiple injuries.

S Afr Med J 1989; **76:** 109-111.

Improvements in radionuclide imaging techniques have led to bone scintigraphy becoming an essential part of fracture work-up in recent years. Bone scintigraphy is capable of detecting 95% of fractures within 24 hours in patients aged under 65 years and localises a similar percentage in patients aged over 65 years by 72 hours.[1,2] Moreover, scintigraphy is capable of identifying fractures that are not evident on initial radiographs — 'occult' fractures, especially multiple fractures of the pelvis, non-displaced hip fractures and unsuspected fractures.[3,4] In addition, the use of single photon emission computed tomography (SPECT) permits precise localisation of the fracture to a portion of the bone.[4]

The following case reports emphasise the importance of bone scintigraphy in patients with suspected fractures.

Case reports

Case 1

A 77-year-old woman presented a week after a fall with pain in the left hip and difficulty in walking. Physical examination revealed pain on movement of the left hip with tenderness on its lateral aspect.

Radiographs of the pelvis were reported as normal.

Bone scintigraphy. Bone scintigraphy was performed because radiological investigation was negative. It was done on a gamma camera 2 hours after intravenous administration of 740 MBq technetium-99m methylene diphosphonate (MDP). The bone scan (Fig. 1) demonstrated an intense focus of activity on the inferior aspect of the left acetabulum and a less intense focus in the left inferior pubic ramus. Both are compatible with fractures due to the fall. In addition, scintigraphy demonstrated a low-intensity focus in the left sacro-iliac joint.

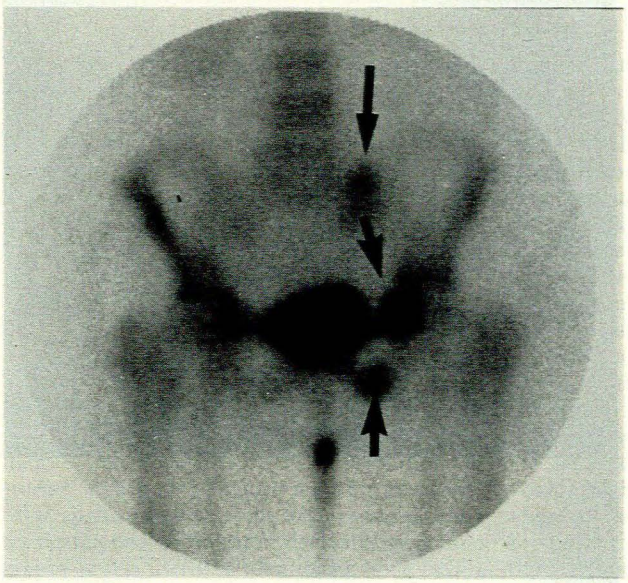

Fig. 1. Case 1. Anterior bone scan of pelvis showing three fractures.

Case 2

An 80-year-old patient presented with severe pain on the right of the pelvis after a motor vehicle accident. Physical examination revealed tenderness over the right pubic and left sacro-iliac joint regions. Radiological investigation of the pelvis showed fractures of the right superior and inferior pubic rami.

Bone scintigraphy. As the patient continued to complain of left lumbosacral pain, bone scintigraphy was performed a month after the accident. In addition to increased uptake in the pubic fractures, this showed an intense focus in the left sacro-iliac joint (Fig. 2). On review, the radiograph showed widening of the left sacro-iliac joint. These abnormalities of the sacro-iliac joint and pubis are compatible with fractures sustained during the trauma.

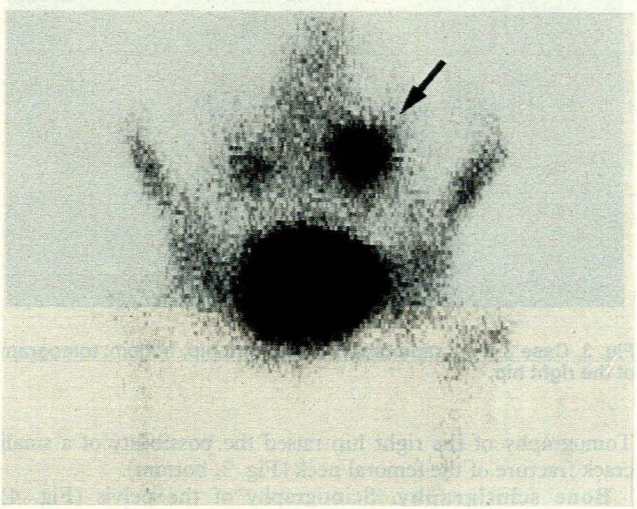

Fig. 2. Case 2. Bone scan of the pelvis (anterior view) showing a fracture through the sacro-iliac joint.

Case 3

A 67-year-old woman had a Moore prosthesis in the left hip. She presented 2 weeks after having injured her right hip in a fall. Examination revealed pain on movement of the right hip. Radiographs of the pelvis were equivocal (Fig. 3, top).

Department of Nuclear Medicine, University of Cape Town and Groote Schuur Hospital, Cape Town
B. K. ADAMS, M.B. CH.B., M.MED. (COMM. HEALTH), M.MED. (NUCL. MED.)

Accepted 10 Nov 1988.

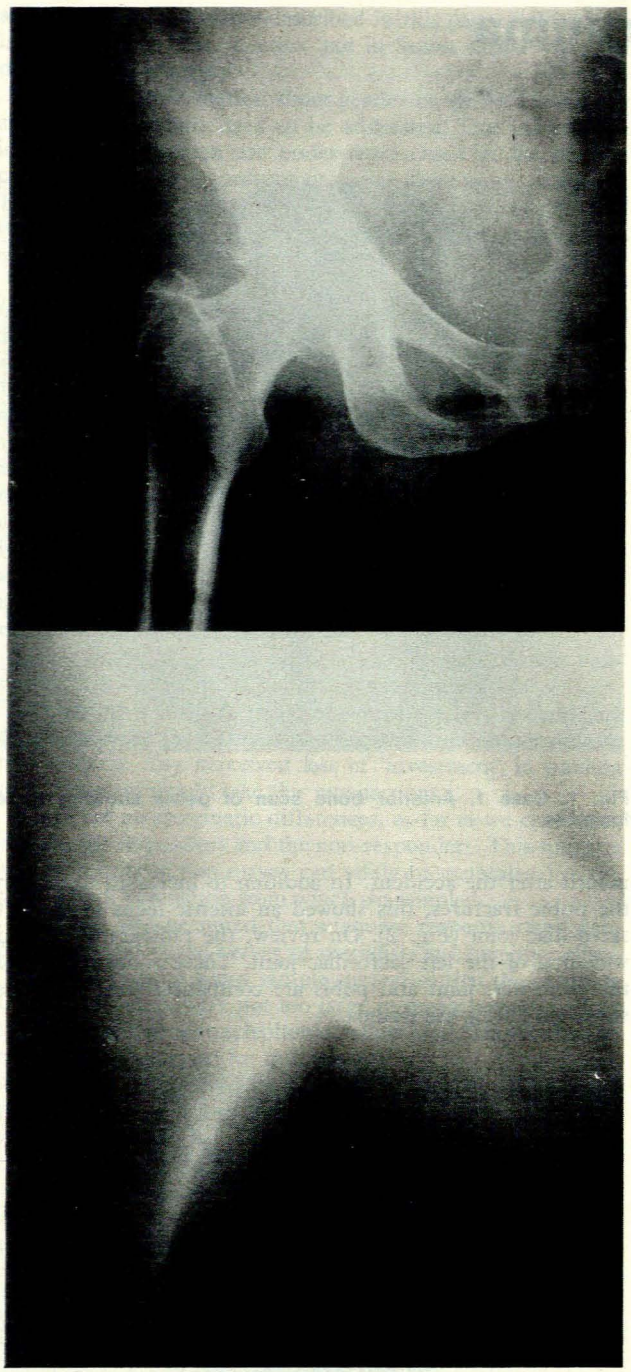

Fig. 3. Case 3. Top: **radiograph of the right hip;** bottom: **tomogram of the right hip.**

Tomography of the right hip raised the possibility of a small crack fracture of the femoral neck (Fig. 3, bottom).

Bone scintigraphy. Scintigraphy of the pelvis (Fig. 4) showed an intense focus in the right femoral neck region compatible with a fracture.

Case 4

A 75-year-old woman fell and injured her right hip 2 days before admission to hospital. On physical examination the right hip was held in abduction and was extremely tender on movement. Radiographs of the pelvis and right hip, including tomograms, were reported as negative.

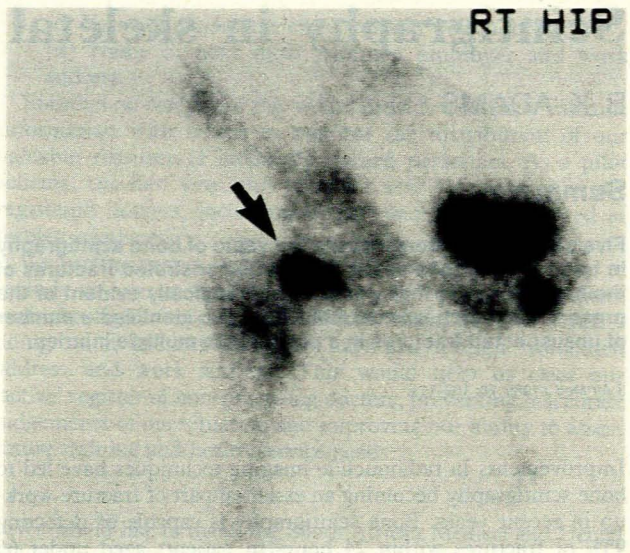

Fig. 4. Case 3. Bone scan showing a fracture of the right femoral neck.

Bone scintigraphy. This investigation revealed an intense, linear focus of activity in the intertrochanteric region of the right femur, indicating a fracture at this site (Fig. 5).

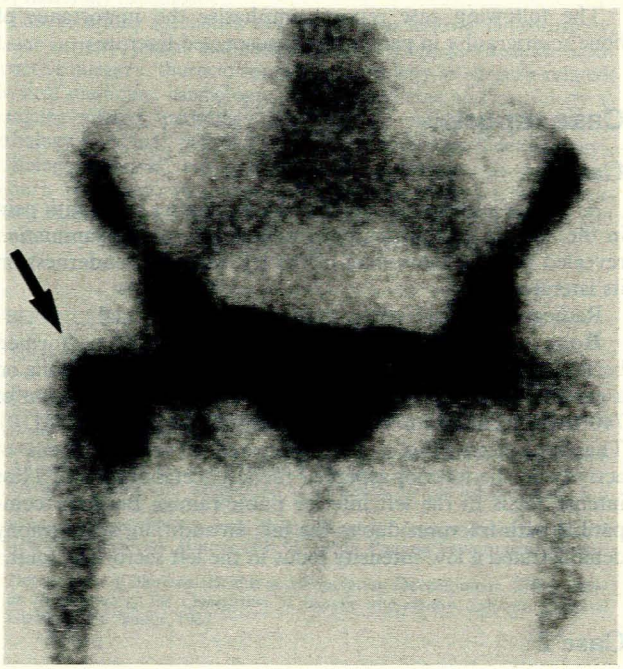

Fig. 5. Case 4. Bone scan of pelvis (anterior view) showing an intertrochanteric fracture.

Case 5

A 60-year-old man was referred after a motor vehicle accident in which he sustained a compression fracture of the third thoracic vertebra and a fracture of the right first metacarpal bone. Pain in the chest on the right was attributed to the vertebral fracture. Physical examination revealed tenderness over the upper thoracic spine, swelling of the right thumb and a swollen, contused left wrist. There were no neurological deficits.

Radiographs and tomography of the thoracic spine showed a compression fracture of the body of T3. A radiograph of the right thumb revealed a fracture at the base of the first metacarpal. Computed tomography confirmed the compression fracture of T3.

Bone scintigraphy. Whole-body bone scintigraphy was performed after intravenous administration of 740 MBq ^{99m}TC MDP. The bone scan (Fig. 6) demonstrated two abnormal foci at the level of T3, the one on the right being more intense. In addition, there was a small focus at the level of T5 on the left. The fracture at the base of the first metacarpal on the right was clearly visualised, as was an additional focus in the region of the left wrist. Moreover, the scan demonstrated seven rib foci on the right anteriorly as well as a focus in the sternal angle. These foci are compatible with fractures sustained during the trauma.

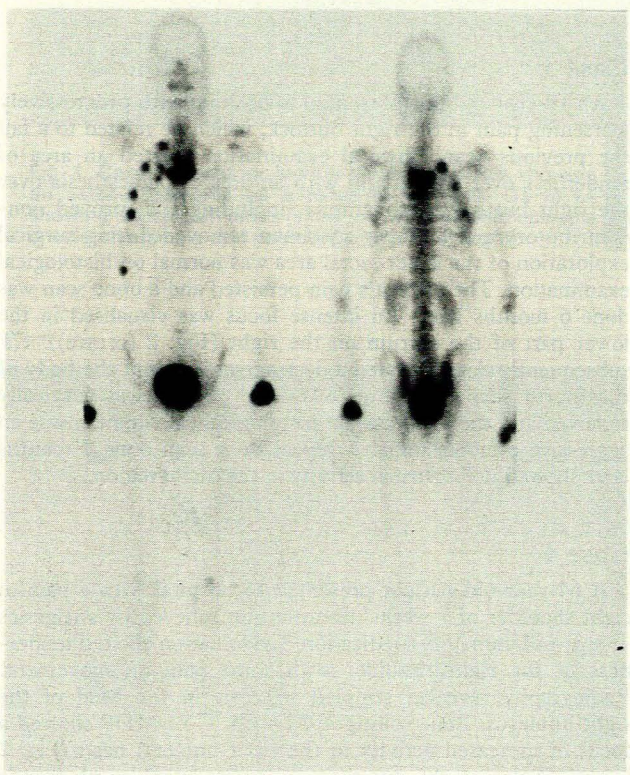

Fig. 6. Case 5. Whole-body anterior and posterior bone scans showing multiple fractures.

Discussion

The above reports illustrate the value of bone scintigraphy in the investigation of pelvic, hip and multiple bone injuries. As pelvic and hip fractures may occur as a result of relatively minor trauma in the elderly, early bone scintigraphy is essential. Where multiple bone injuries are suspected, e.g. after motor vehicle accidents or child abuse and in the unconscious patient, bone scintigraphy may be of critical importance. It is a quick, simple and relatively economical means of demonstrating fractures. Furthermore, scintigraphy is more sensitive than radiographs in the detection of unsuspected fractures. In addition, it may demonstrate fractures that are not visible on initial radiographs, since radiographic abnormalities may take up to 10 days to develop. Good quality images are possible despite plaster or fibreglass immobilisation of the limb.[2]

Bone scintigraphy can also differentiate fractures from stress injuries, joint abnormalities and acute muscle injuries.[4] Delayed studies at 8 and 24 hours may be necessary to distinguish between fractures and soft-tissue trauma, since radiopharmaceutical uptake in the latter decreases with time.[4] Serial scintigraphy is also useful in monitoring bone healing, but the time for the bone scan to return to normal extends well beyond the time for clinical and radiological healing. By the end of 2 years 90% of all fracture sites demonstrate normal uptake.[4] However, orthopaedic devices, delayed union or non-union[4] and other factors such as age, sex and concomitant disease[5] may result in prolonged periods of radionuclide concentration.

REFERENCES

1. Matin P. The appearance of bone scans following fractures, including immediate and long term studies. *J Nucl Med* 1979; **20:** 1227-1231.
2. Matin P. Bone scintigraphy in the diagnosis and management of traumatic injury. *Semin Nucl Med* 1983; **13:** 104-122.
3. Rosenthal L, Lisbona R. *Skeletal Imaging*. London: Prentice-Hall, 1984: 161-166.
4. Matin F. Basic principles of nuclear medicine techniques for detection and evaluation of trauma and sports medicine injuries. *Semin Nucl Med* 1988; **18:** 90-112.
5. Ross McDougall, Keeling CA. Complications of fractures and their healing. *Semin Nucl Med* 1988; **18:** 113-125.