Diagnosis of acute bone pain using isotope bone imaging

M. REICHL, M. A. KHAN & R. A. SLEET

Accident and Emergency Department, Southampton General Hospital, Southampton, England

SUMMARY

Twenty-one patients with acute bone pain in areas other than the scaphoid were referred for isotope bone imaging directly from the A&E department. Of these scans 61% were positive. The various pathologies seen included stress fractures, osteomyelitis and bony metastases. Implications of the findings are discussed.

INTRODUCTION

The use of isotope bone imaging in the diagnosis of radiograph-negative scaphoid fractures is well established (Deutsch & Gandsman, 1983). However their use in the diagnosis of other acute skeletal problems is less common (Maurice et al., 1987). This department has been using bone imaging for the diagnosis of scaphoid trauma for many years (Rolfe et al., 1981). More recently we have been referring patients with acute bone pain at other sites for isotope imaging. To establish the usefulness of isotope bone imaging for non-scaphoid problems in an A&E department we retrospectively reviewed our experience over a period of 12 months.

METHOD

In a 12-month period 75 patients were referred for isotope bone imaging directly from the A&E department. Twenty-one had anatomical areas other than the scaphoid imaged. In this group there were 10 men and 11 women. The mean age was 38.8 years (range 16-82). There was no statistical difference in the ages or types of injuries between men and women. All presented within 1 to 28 days (mean 9 days) from the onset of severe bone pain. Plain radiographs of the relevant areas were reported by a consultant.
or senior registrar in radiology and were all negative. Patients were imaged at least three days after the onset of pain.

Isotope bone imaging was performed two hours after the intravenous injection of 555 MBq (15 mCi) of $^{99}$Tc$^m$ methylene diposphonate, using a gamma camera, fitted with a low-energy high-resolution parallel hole colimator. Only static imaging was performed, as dynamic imaging is considerably more time consuming and in the majority of situations adequate results are achieved using static imaging. The total body radiation due to this dose is 0.25 rads (Amersham International, 1986). This is about 2% of the total body dose that staff working with radiation are allowed to be exposed to yearly.

RESULTS

Twenty-one patients with acute pain and tenderness over bony areas at sites other than the anatomical snuff box were referred for isotope bone imaging. Seven had a history of trauma and 14 presented with spontaneous onset of pain. To be referred patients had to be symptomatic and have bony tenderness when they returned to our follow-up clinic three to seven days after initial presentation. The only exception to this rule were the patients with suspected subcapital fractures of neck of femur. These patients were imaged on the day of presentation provided this was at least three days after the onset of the pain. The areas imaged are listed in Table 1. Overall, 61% of the images were positive. Imaging undertaken after trauma was positive on 71% of occasions and that undertaken after spontaneous onset of pain was positive in 54% of cases. Wrists were the commonest area imaged. All five patients with a history of wrist trauma had positive results. The appearances found were interpreted as two fractures of the triquetral area, one each of the capitate, radial styloid and a cortical infracture of the distal ulna. In the five non-traumatized patients only one image was positive. This was compatible with fractured scaphoid.

Two patients with post-traumatic painful hip were imaged to exclude an impacted subcapital fracture of the neck of femur. Neither had a detectable abnormality. The remaining nine patients imaged were all in the non-trauma group. Five had painful feet. The findings were two stress fractures of the second metatarsal, one stress fracture of the navicular and one case of osteomyelitis of the first metatarsal. The other investiga-

Table 1 Areas imaged and results

<table>
<thead>
<tr>
<th>Area</th>
<th>Total no. imaged</th>
<th>Total no. + ve</th>
<th>Trauma no. + ve</th>
<th>Non-trauma no. + ve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Foot</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tibia</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Hip</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Back</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
tion was normal. Three patients with painful tibiae were imaged. Two had stress fractures and one had a normal scan. Finally one patient with acute back pain and clinical diagnosis of carcinoma of prostate had multiple secondaries in his lumbar spine.

All the radiographs were reviewed in the light of the results obtained from bone imaging. No additional positive findings were found.

DISCUSSION

Isotope bone imaging is a useful technique for the detection of injuries which do not initially show on plain radiographs (Deutsch & Gandsman, 1983). Various types of bone pathology will have increased focal uptake of the labelled compound (Subramanian et al., 1972). This is not specific to fractures but will also occur in a region of periosteal reaction (Rosenthal & Lisbona, 1980) and also possibly with ligamentous injury. Without later confirmation by radiography it is impossible to be absolutely certain that a fracture is present. However, an abnormal bone image that correlates with clinical findings will often lead to a presumptive diagnosis of a fracture. The use of this technique is well established for the early diagnosis of scaphoid fractures and the results from this unit were previously reported (Rolfe et al., 1981). Fractures of the other carpal bones are less common but often just as difficult to detect on plain radiographs.

In this study five fractures around the wrist were diagnosed by bone imaging. The early detection of these fractures led to the patients being treated by splinting in plaster of Paris. Bone imaging is also very helpful in the evaluation of elderly patients who after a fall have an acutely painful hip and are unable to bear weight. Some 2% who later are shown to have a fractured neck of femur may initially have a negative radiograph. Such fractures can be demonstrated early by the use of bone imaging (Fairclough et al., 1987). We referred two such patients for bone imaging. Both results were negative and hence the patients were confidently mobilized and were spared an unnecessary period of bed rest while awaiting a second radiograph.

Bone imaging has also been shown to be useful in the diagnosis of acute bone pain in non-traumatic conditions (Kim et al., 1979). One of the commonest problems of this type seen in the A&E department are stress fractures (Giselin et al., 1976). We diagnosed five stress fractures, two each of the tibia and the second metatarsal and one of the navicular. Early detection and treatment of stress fractures are important as this will reduce morbidity (Markey, 1987). Since many of these patients were sportsmen it allowed an early return to training. Other problems detected were a case of osteomyelitis of the first metatarsal and multiple secondaries in the lumbar spine.

We can refer patients for isotope bone scans on every week-day. Patients are usually imaged on the day of referral. This study demonstrates the usefulness of ready access to isotope bone imaging from the A&E department, especially in the traumatic radiograph-negative wrist and in back pain. However, negative results are as useful as positive ones; if a bony injury can be excluded patients can be treated appropriately and often they will be spared return visits and radiographs at a later stage. Although a bone scan is two to three times as expensive as a plain radiograph, if the patient can be discharged early from follow up, the eventual total cost to the health service may be
lower. Since we did not perform a long-term follow up of these patients it is impossible to say if there is any significant change in the outcome. To evaluate this it would be necessary to perform a prospective randomized trial of the use of isotope bone scans against traditional management.

REFERENCES