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A Comparison of Bone Scanning and Radiology in the Assessment of Patients with Symptomatic Paget's Disease

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Abstract. Bone scans and X-rays from 23 subjects with symptomatic Paget's disease were evaluated. One-hundred and twenty-seven sites of Pagetoid involvement were found, of which 120 (94.5%) were recognised on the bone scan as compared to 94 (74%) on X-ray. The anatomical distribution and relationship of lesions on scan and X-ray to the patient's symptoms are also discussed.

It is concluded that the bone scan is more sensitive than radiology in detecting Paget's disease and only rarely will a lesion that is seen on X-ray not be visualised by scanning.

Introduction

Paget's disease affecting the skeleton is common with an incidence of approximately 4% in hospital patients over the age of 40 years (Collins, 1956). The bone scan appearances in this condition are often characteristic (Serafini, 1976) and it is well recognised that the scan is more sensitive than radiographic examination in the detection of metabolically active disease (Serafini, 1976; Shirazi et al., 1974; Khairi et al., 1974; Lavender et al., 1977; Vellenga et al., 1976).

In the present study, Technetium-99m diphosphonate bone scans and radiological skeletal surveys were obtained in 23 patients with symptomatic Paget's disease. The incidence, anatomical distribution and relationship of lesions on scan and X-ray to the patient's symptoms are discussed.

Patients and Methods

Twenty-three patients with symptomatic Paget's disease were studied. Clinical details are shown in Table 1.

Bone Scans. Bone scans were obtained in each patient 4 h after the intravenous injection of 15mCi of Technetium-99m hydroxyethylidene diphosphonate (HEDP). Details of the technique employed have been described elsewhere (Fogelman et al., 1978).

Radiological Skeletal Surveys. In all patients, the radiographic skeletal survey comprised antero-posterior and lateral views of the skull, antero-posterior and lateral views of the cervical, dorsal

Table 1. Paget's disease

Patient	Age and sex	Alkaline phosphatase (normal 80–280 U/l)	Predominant clinical complaints
1. GH	69 F	380 U/l	Pain lumbar spine and pelvis
2. SA	61 F	942 U/l	Pain femur
3. WO	51 M	717 U/l	Pain tibia
4. JC	42 F	626 U/l	Pain lumbar spine, pelvis and femur
5. JMcI	57 M	781 U/l	Pain femur
6. MMcD	60 F	448 U/l	Pain sacrum, pelvis and femur
7. AB	49 M	325 U/l	Pain tibia
8. FMcC	41 M	2,255 U/l	Pain thoracic spine
9. ME	65 F	2,268 U/l	Pain tibia
10. JO'B	62 M	2,967 U/l	Pain tibia
11. JG	55 M	639 U/l	Pain tibia
12. IO	60 F	494 U/l	Pain lumbar spine
13. ET	48 M	3,171 U/l	Pain tibia
14. MR	66 F	786 U/l	Headache
15. DL	56 M	2,012 U/l	Pain in chest
16. JC	73 F	1,506 U/l	Pain thoracic, lumbar spine and femur
17. CF	78 F	2,318 U/l	Pain lumbar spine, pelvis and femur
18. FM	69 F	1,413 U/l	Pain lumbar spine and tibia
19. JM	72 M	2,928 U/l	Pain lumbar spine and sacrum
20. MF	74 F	1,693 U/l	Pain lumbar spine and tibia
21. JD	73 F	1,740 U/l	Pain lumbar spine, pelvis and femur
22. CI	73 F	5,825 U/l	Pain lumbar spine, pelvis and femur
23. JG	70 M	1,187 U/l	Pain lumbar spine, pelvis, tibia and humerus

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Table 2. Comparison of sites of involvement on bone scan and X-ray in Paget's disease

	Skull	Spine[a]				Pelvis[b]	Femur	Tibia	Scapula	Humerus	Miscella-neous	Total
		C	D	L	S							
Lesions seen on X-ray	6	–	7	15	1	27	22	9	–	4	3	94
Lesions seen on bone scan	9	1	12	17	2	25	22	10	7	5	10	120
Lesions seen on X-ray only	–	–	–	–	1	4	2	–	–	–	–	7
Lesions seen on bone scan only	3	1	5	2	2	2	2	1	7	1	7	33
Patients with symptomatic sites	1	–	2	12	2	8	8	9	–	1	3	46

Lesions in the long bones and scapula are counted as two when bilateral

[a] Involvement of any area of spine in a single subject is counted as one lesion while the number of affected vertebrae in that area is not considered

[b] The pelvis is considered as two separate areas, ie. right and left hemi-pelvis

Table 3. Sites of involvement in 23 patients with Paget's disease

Spine	– 18 patients (78.3%)
Cervical	– 1 (4.4%)
Thoracic	– 12 (52.2%)
Lumbar	– 17 (73.9%)
Sacrum	– 3 (13.0%)
Pelvis	– 16 patients (69.6%)
Femur	– 15 patients (65.3%)
Tibia	– 10 patients (43.6%)
Skull	– 9 patients (39.1%)
Scapula	– 6 patients (26.1%)
Humerus	– 4 patients (17.4%)
Clavicle	– 2 patients (8.7%)
Rib	– 2 patients (8.7%)
Metacarpal	– 2 patients (8.7%)
Patella	– 1 patient (4.4%)
Forearm	– 1 patient (4.4%)
Mandible	– 1 patient (4.4%)

and lumbar spine. A postero-anterior radiograph of chest, antero-posterior views of the pelvis, and views of the long bones and hands were also obtained.

Comparison of Results. The bone scans and X-rays from the present study were included with others obtained from patients with various metabolic bone disorders (Fogelman and Carr, 1980). All the studies were assessed independently and in a random order by 2 observers (Scans-IF, X-rays DC) who were unaware of the clinical diagnoses. All abnormalities noted were charted on skeletal maps.

Results

Twenty-three patients with Paget's disease were studied and 127 sites of involvement were found. One-hundred and twenty (94.5%) sites were recognised on the bone scan as compared to 94 (74%) on X-ray. There was agreement between the bone scan and X-ray in 87 (67.5%) sites. Four (17.4%) patients had monostotic Paget's disease, in 2 cases affecting the tibia, in 1 the femur and in 1 the skull.

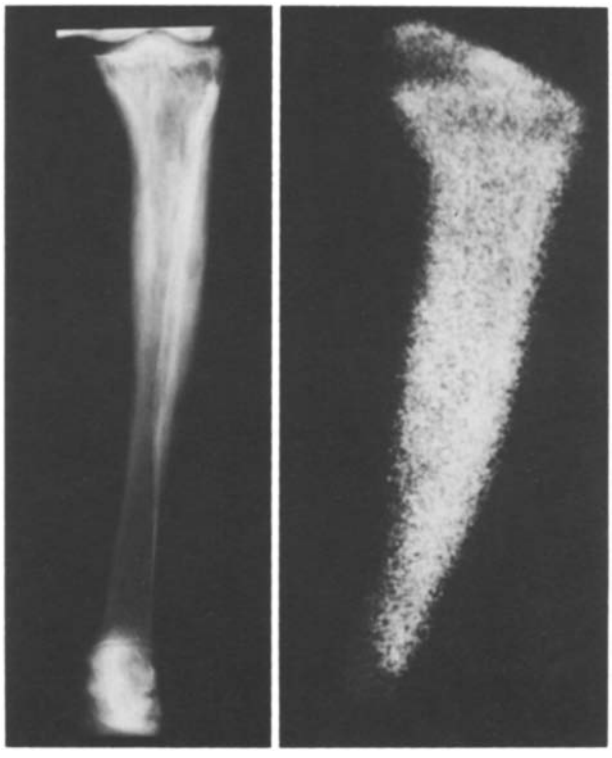


Fig. 1. X-ray (**A**) and bone scan (**B**) showing Pagetoid involement of the left tibia

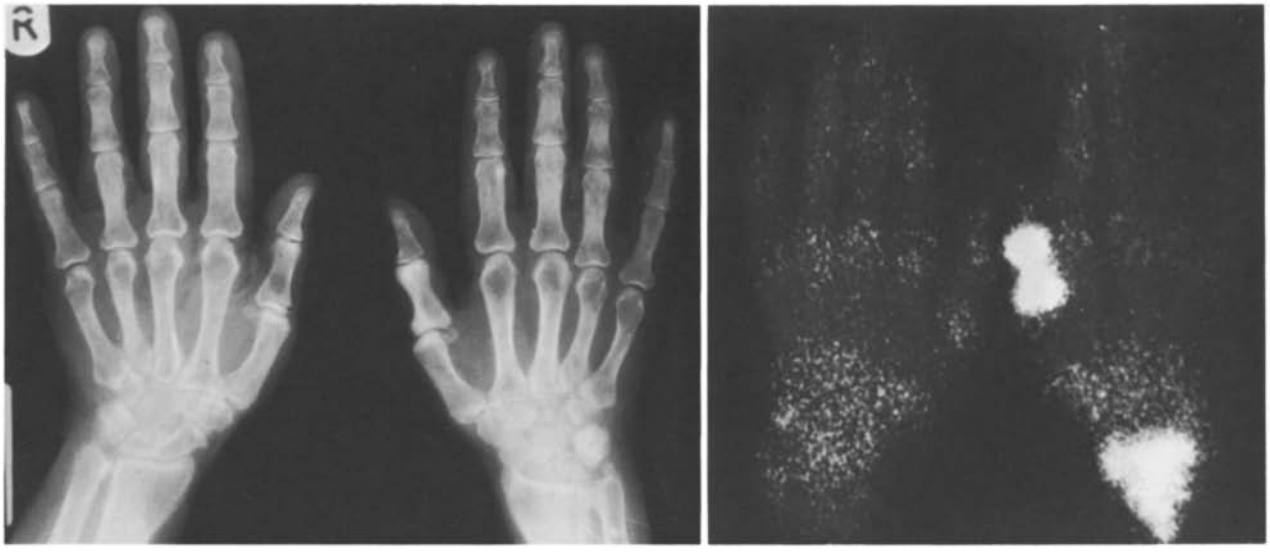


Fig. 2. X-ray (**A**) and scan (**B**) showing Pagetoid involvement of the left 1st proximal phalynx and distal radius

The comparison of the distribution of sites of Pagetoid involvement seen on bone scan and X-ray is shown in Table 2, while the relative incidence of sites affected in individual patients in shown in Table 3.

Discussion

The main feature on the bone scan in Paget's disease is markedly increased uptake of tracer, which is usually uniformly distributed throughout most or all of the affected bone. Distortion or expansion of the bone is commonly seen (Figs. 1, 2). When polyostotic Paget's disease is present, there is seldom any doubt as to the correct diagnosis, so much so that it is often possible to differentiate co-existing Paget's disease and metastatic disease (Citrin and McKillop, 1978). When monostotic Paget's disease is present it may be difficult to differentiate this from other pathology and particularly from a sclerotic lesion in the spine, eg. from carcinoma of the prostate, but usually even the appearance of a single lesion is so characteristic as to be highly suggestive of Paget's disease (Fig. 3).

In Paget's disease it has been shown that bone scanning is more sensitive than radiology in the detection of lesions (Shirazi et al., 1974; Khairi et al., 1974) and our study confirms these findings. In 23 patients with symptomatic disease we have found 127 sites of Pagetoid involvement and 12 (94.5%) of these sites were detected by the bone scan whereas 94 (74%) were seen on X-ray. In addition, in 6 patients the extent of disease affecting a long bone was underestimated by radiology. Although 33 sites were not present on X-ray (Table 2), approximately one-third of these involved areas which are difficult to evaluate with standard radiographic views, eg. scapulae, ribs (Fig. 4) and sternum (Milstein et al., 1974) and the bone scan was particularly valuable in detecting such

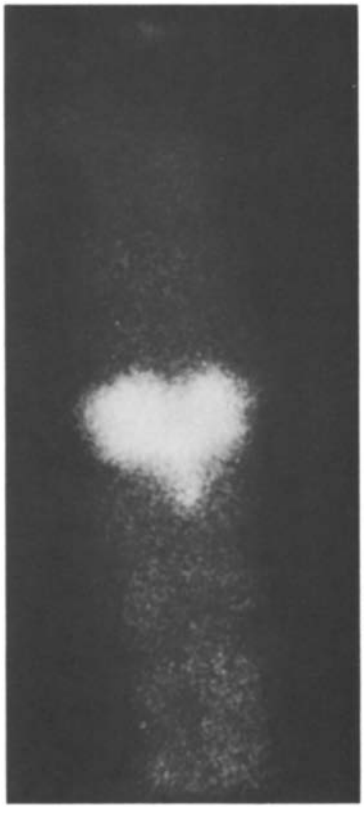


Fig. 3. Bone scan showing Pagetoid involvement of a single mid-thoracic vertebrae. Note the uniform distribution of tracer throughout the whole of the affected vertebrae and that the spinous process is clearly seen

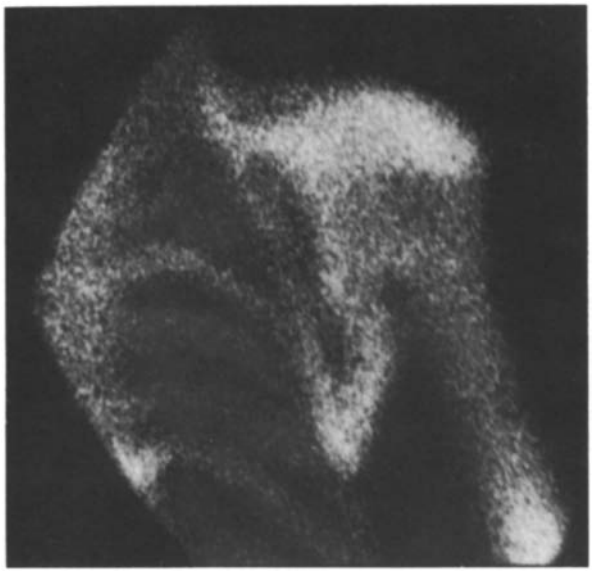


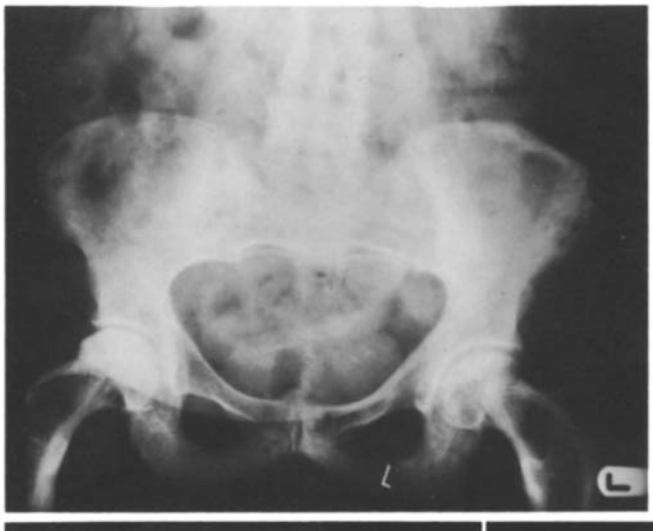
Fig. 4. Bone scan view of posterior right shoulder showing Pagetoid involvement of scapula and two ribs

lesions. Other X-ray negative sites included the spine, pelvis, femur, tibia and humerus.

It is often difficult to classify Paget's disease into lytic, blastic and sclerotic phases by radiology as has been suggested by other workers (Khairi et al., 1973) as there is usually a mixed picture present in any patient and occasionally this is the case even in the same bone. While we did not initially classify the radiological features, we did revise those X-rays from patients where lesions were missed on the bone scan and in all cases, sclerotic changes were found (Fig. 5).

The sites of Pagetoid involvement are shown in Table 3. The relative incidence is similar to that reported in other series (Shirazi et al., 1974; Vellenga et al., 1976) but we have found the spine rather than pelvis to be the most commonly involved site. We were somewhat surprised at the frequency of involvement of the scapula (26%) but this finding is in agreement with other reported series (Shirazi et al., 1974; Wellman et al., 1977). We believe that the incidence of scapular involvement remains largely unrecognised because this area is seldom symptomatic and will often be missed on routine radiology (Miller et al., 1974). Monostotic Paget's disease was found in 4 patients (17.4%) but this may not accurately reflect the general incidence in the population as we are dealing with a selected series of patients referred with symptomatic disease.

The areas of symptomatic Paget's disease are summarised in Table 2. The most common sites were spine in 13 patients, tibia in 9 patients and pelvis and femur both 8 patients, i.e. in the weight bearing areas (Wellman et al., 1977). Although headaches have been reported to be a characteristic feature of Paget's disease (Ibbertson et al., 1979) of the 9 patients with skull involvement, only one specifically complained of this. Overall there was good accordance between



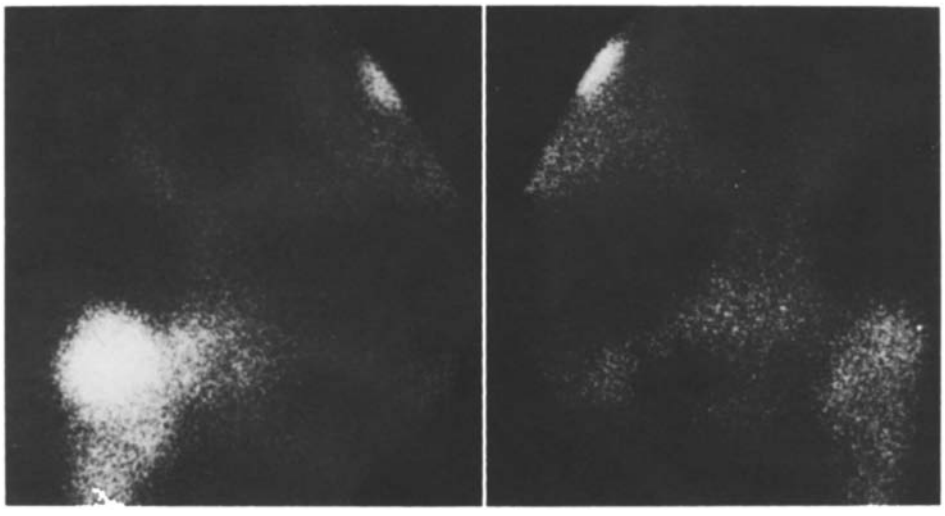


Fig. 5. X-ray (**A**) and scan (**B**) of anterior pelvis. There is striking Pagetoid involvement which is apparent on X-ray but not seen on scan

the sites of patients' pain and X-ray and scan findings, although in 4 of the 23 patients no correlation was found. There seems to be general agreement that symptomatic lesions usually appear strongly positive on the bone scan (Shirazi et al., 1974; Khairi et al., 1973) but only 36% of the lesions seen in the present study were found to be symptomatic. We have found that all 4 sites visualised on one study only (33 on the bone scan, 7 on X-ray), were asymptomatic. However, Khairi studied 27 patients with Paget's disease and found that all 19 lesions visualised on X-ray but not on the bone scan were asymptomatic but that 15 of the 21 lesions seen on the scan and not on X-ray were symptomatic (Khairi et al., 1974).

In conclusion, we have shown that the bone scan is more sensitive than radiology in detecting Paget's disease and only rarely will a lesion that is seen on X-ray not be visualised on scanning. This phenomenon was limited to the sclerotic lesion in agreement with other groups (Shirazi et al., 1974; Khairi et al., 1973). In addition to its sensitivity, the bone scan provides adequate visualisation of the whole skeleton and is easier to perform and interpret than a radiological skeletal survey.

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