

The "Hot Patella" Sign: Is It of Any Clinical Significance? Concise Communication

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The presence of the "hot patella" sign was evaluated in a prospective study of 200 consecutive bone scans, and in a review of scans from 148 patients with various metabolic bone disorders and 61 patients with lung carcinoma. The incidence was found to be 31%, 26% and 31% respectively. This sign is an extremely common scan finding and may be seen in association with a wide variety of disorders. It is concluded that this sign cannot be considered to be of diagnostic value.

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The concept of the "hot patella" sign of bone scans was first introduced by Sy and Smith (1). Though they did not precisely define the sign, they suggested it was an indication of metabolic bone disease and could be useful in differentiating the scan appearances of the metabolic disorders from those of metastatic disease. More recently Kipper et al. have defined the "hot patella" sign as tracer uptake in the patella greater than that in the distal femur or proximal tibia of the ipsilateral leg (2). They suggested it could be of diagnostic value and, in a series of 100 consecutive bone scans, found it to be associated with a variety of conditions including degenerative and metastatic disease. Metabolic bone disease was not even mentioned as a possible cause of the sign in their study (2).

The present study was carried out in two parts. First, a series of consecutive bone scans was evaluated to determine the incidence of increased patellar radioactivity in a representative selection of all patients referred for radiotracer bone scanning and to evaluate interobserver variability in recognizing the sign. Second, the same group of patients, together with a population known to have metabolic bone disease and another with inoperable bronchial carcinoma, were examined to see if any etiological significance could be attributed to the focal patellar activity.

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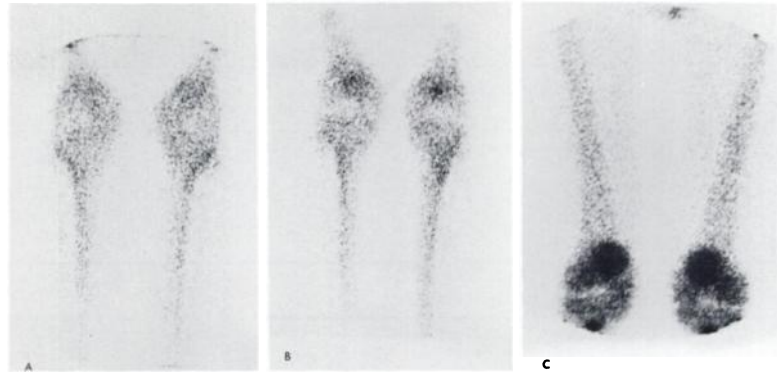
PATIENTS AND METHODS

Skeletal images were evaluated for increased patellar radioactivity in 200 consecutive adult patients referred for bone scanning between March and June 1982. All studies were obtained at approximately 4 hr following intravenous injection of 15 mCi of Tc-99m methylene diphosphonate (MDP). Two observers (IF, JHMCK) recorded the incidence of increased patellar activity, and whether it was unilateral or bilateral. The occurrence of intense ("striking") tracer uptake in the patella was also noted. Figures 1 and 2 illustrate these appearances. An additional 209 bone scans from previous studies of adult patients with either metabolic bone disease or malignancy were also reviewed. These images were evaluated by one observer only (IF). This group included 148 patients with metabolic bone disease in whom scans had been obtained with Tc-99m hydroxyethylidene diphosphonate, and 61 patients with inoperable bronchogenic carcinoma in whom scans had been obtained with Tc-99m MDP.

RESULTS

Prospective study. Observer 1 (IF) reported increased patellar radioactivity in 62 of the 200 (31%) patients and Observer 2 (JHMCK) in 64 (32%). In total the observers disagreed on the presence of the sign in 10 patients (5%). Table 1 presents a consensus view and indicates the conditions associated with the presence of a "hot" pa-

FIG. 1A. Normal view of knees. B. Increased patellar radioactivity. C. Striking increase of patellar activity.



tella. The incidence of unilateral increased patellar radioactivity is also presented. Both observers considered the sign to be strikingly positive in 10 (5%) patients. The incidence of unilaterally increased patellar radioactivity was low and was similar in the three patient groups (Table 1). The median age of patients with the patellar sign was 57 yr (range 20–78) whereas those without was 58 yr (range 22–85 yr).

Review of bone images in metabolic bone disease. In the study population of 148 patients with metabolic bone disease, increased intensity of patellar activity was noted in 39 cases (26%) and considered striking in 12 (8%). Table 2 provides an analysis of the results in the various disorders. The median age of patients with a positive sign was 57 yr (range 34–79 yr) whereas those without was 57 yr (range 20–80 yr).

Review of bone images in patients with inoperable bronchogenic neoplasm. Increased patellar activity was

noted in 19 of 61 patients (31%) and considered striking in 8 (13%). Unilateral involvement was present in only one case. In this group sequential bone-scan studies were available for 13 patients following chemotherapy, and significant changes in patellar radioactivity were noted in nine cases. In five the sign became more prominent, while in four it became less obvious. The median age of patients with increased patellar activity was 59 yr (range 49–69 yr) whereas those without was 62 yr (range 37–78 yr).

DISCUSSION

The incidence of the “hot patella” sign in this study (approximately 30%) in the prospective and retrospective analyses was considerably higher than that reported (15%) by Kipper et al. (2). The study found the sign more frequent in both malignant disease and metabolic bone disease compared with patients with benign disease. The diagnostic value of this finding, however, is limited by the occurrence of the sign in almost 20% of patients with benign disease. Similarly our data do not suggest that it has any value in the differentiation between malignant disease and metabolic bone disease. The occurrence of striking increased patellar radioactivity was seen only in patients with malignant or metabolic bone disease but once again did not allow these two groups to be distinguished from one another. Our results, therefore, do not support the contention of Sy and Smith (1) that the “hot patella” is a metabolic feature.

The mechanism of increased concentration of bone tracer in the patella is not clear. In malignant disease it is unlikely to be due to direct metastatic involvement, as most patients showing the sign did not have imaging evidence of metastases elsewhere in the skeleton. It would be attractive to postulate that some common factor accounts for the appearance of the sign in all the groups of patients. The simplest explanation would be local disease such as osteoarthritis, and although there was no age difference between groups of patients with and without this sign we do not have radiographs of the knees to exclude this possibility. The bone scan is sensitive for the detection of osteoarthritis, however, (3) and



FIG. 2. Unilateral increased intensity of patellar activity.

TABLE 1

Disease group	Number of patients	"Hot patella" sign	Striking "hot patella" sign	Unilateral "hot patella" sign
Carcinoma	134	44 (32%)	6	8
Metabolic bone disease	19	9 (47%)	4	1
Other benign disorders	47	9 (47%)	—	3

TABLE 2

Disease	Number of patients	"Hot patella" sign	Striking "hot patella" sign	Unilateral "hot patella" sign
Osteoporosis	28	6	2	2
Osteomalacia	18	8	1	—
Renal osteodystrophy	26	5	2	—
Primary hyperparathyroidism	20	4	1	—
Thyrotoxicosis	7	7	3	—
Paget's disease	28	5	3	3
Acromegaly	20	4	—	—
Hypophosphatasia	1	—	—	—
Total	148	39	12	5

the majority of patients had no evidence of degenerative disease elsewhere. Furthermore, only a small proportion of patients with degenerative disease show increased



FIG. 3. Increased patellar radioactivity with patchy increased tracer uptake in cortices in patient with bronchogenic neoplasm and hypertrophic pulmonary osteoarthropathy.

patellar radioactivity. In patients who show a strikingly "hot patella", the possibility of a humoral factor leading to increased bone turnover should be considered. We note that Ali et al. (4) reported increased patellar uptake of bone tracer in 50% of patients with bronchial carcinoma and hypertrophic pulmonary osteoarthropathy (Fig. 3), which may itself be due to a humoral factor (5). However, this explanation is weakened by the fact that metabolic bone-scan features characteristic of increased bone turnover (6) are rarely seen in patients with malignant disease.

The presence of increased patellar radioactivity may also vary in an individual subject. Where sequential studies were available in patients with bronchogenic neoplasia receiving chemotherapy, marked differences in the prominence of the patella were seen, with either increased or decreased activity in the follow-up scan. It is not clear at present whether such alterations in scan appearance may occur spontaneously in individuals not receiving therapy.

Our study suggests that the "hot patella" sign as defined by Kipper et al. (2) has no diagnostic value as it does not appear to be associated with any particular group of disorders. A "striking" increased patellar activity sign was seen only in association with malignant or metabolic bone disease, but its clinical usefulness is limited because it does not allow these two groups of conditions to be distinguished, and is present only in a very small proportion of the patients suffering from them.

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Western Regional Chapters Society of Nuclear Medicine Hawaii Spring Conference

April 10-15, 1983

**Waiohai Hotel (Kauai)
Hawaiian Regent (Oahu)**

Kauai and Oahu, Hawaii

Announcement

Howard Parker, M.D., Program Chairman, announces plans for a Western Regional Hawaii Spring Conference to take place April 10-14, 1983 at the Waiohai Hotel on Kauai and April 14-15, 1983 at the Hawaiian Regent in Honolulu. The program will feature invited speakers covering topics of current interest, including cardiology, instrumentation, computers, NMR, and interesting clinical case studies. The meeting is sponsored by the Pacific Northwest, Southern California, Northern California, and Hawaii Chapters of the Society of Nuclear Medicine.

For further information, contact: Jean Parker, P.O. Box 40279, San Francisco, CA 94140. Tel: (415)647-0722.

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**Waiohai Hotel
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There will be a Keynote Address on Sunday evening, April 10, 1983. Speaker to be announced.

Dr. O.A. Bushnell will be a featured guest speaker on Friday morning, April 15, 1983, for "The Two Saints of Kalaupapa" (A history of the leper colony on Molokai).

Programs and registration materials may be obtained by contacting Jean Parker, PO Box 40279, San Francisco, CA 94140. Tel: (415)647-0722/1668.