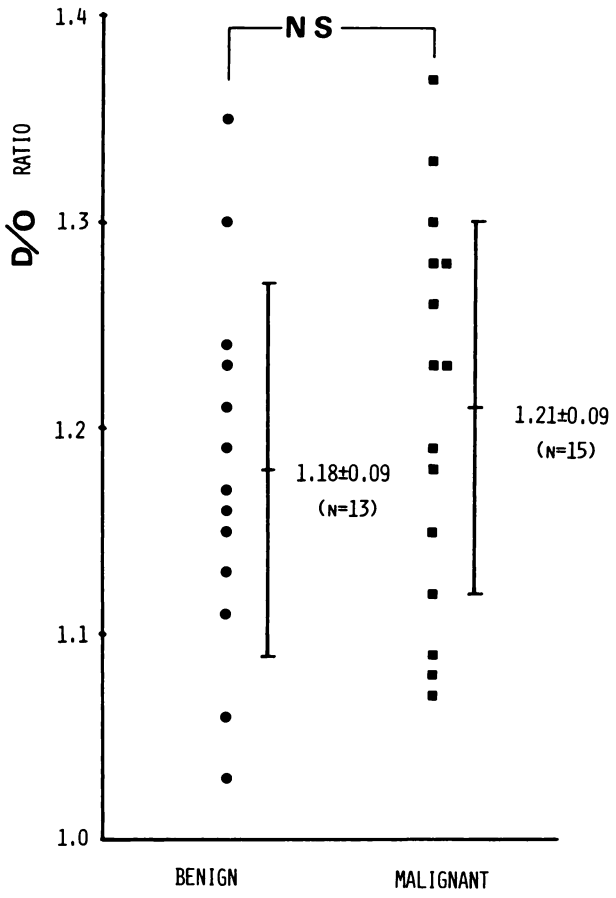

FIGURE 1
Values of delayed-to-ordinary study ratio (D/O) defined as L/N 24 hr/L/N 3–5 hr in bone scans. (L/N:lesion-to-nonlesion ratio) Difference between benign bone diseases and malignant bone tumors in D/O values was not statistically significant

the usefulness of a 24-hr image in assessing osteomyelitis in patients with peripheral vascular disease. Other investigators (*3,4*) have shown that quantification is even more sensitive than visual examination, and the trend in bone scintigraphy is toward quantification of the three-phase or four-phase, including a 24-hr delayed image, bone scintigraphy. We wonder, however, if the delayed uptake of [^{99m}Tc]MDP at 24 hr would truly be useful in differentiating osseous metastasis from benign bone disease.

In order to assess the validity of this method, bone scan was performed in 20 patients, of whom ten had metastatic bone tumors, one had osteosarcoma and nine had benign bone diseases, that is, arthrosis deformans, spondylosis deformans, chondroma, osteochondroma, fracture, acute and chronic osteomyelitis. Twenty-eight areas of abnormal concentration on the bone scans in 20 patients were analyzed. Both the ordinary static images and the delayed static images were taken at 3–5 hr and 24 hr after the injection, respectively. Each 5-min image was acquired on a 128 × 128 computer matrix. Data were displayed and a rectangular region of interest (ROI) was taken over the bone lesion. The same ROI was placed over a normal bone in the adjacent or contralateral region. The lesion-to-nonlesion ratio (L/N) was calculated for the ordinary and delayed studies. The delayed-to-ordinary study ratio (D/O) was defined as L/N 24 hr/L/N 3–5 hr. The average D/O values for benign bone diseases and malignant bone tumors were 1.18 ± 0.09 (n = 13), 1.21 ± 0.09 (n = 15), respectively. There was a considerable overlapping of the results in individual patients. The difference in the D/O values was not statistically significant (Fig. 1).

In conclusion, a 24-hr image in bone scanning was invalid for the differentiation between malignant bone tumor and benign bone disease. We wish to use lesion-specific bone scanning agents with quantification in the foreseeable future, in order to open new prospects in the research of oncology and miscellaneous bone diseases.

References

1. Israel O, Front D, Frenkel A, et al: 24-hour/4-hour ratio of technetium-99m methylene diphosphonate uptake in patients with bone metastases and degenerative bone changes. *J Nucl Med* 26:237–240, 1985
2. Alazraki N, Dries D, Datz F, et al: Value of a 24-hour image (four-phase bone scan) in assessing osteomyelitis in patients with peripheral vascular disease. *J Nucl Med* 26:711–717, 1985
3. Pitt WR, Sharp PF: Comparison of quantitative and visual detection of new focal bone lesions. *J Nucl Med* 26:230–236, 1985
4. Drelichman A, Decker DA, Al-Sarraf M, et al: Computerized bone scan: A potentially useful technique to measure response in prostatic carcinoma. *Cancer* 53:1061–1065, 1984

Shigeru Kosuda
Jinsei Satoh
Atsushi Kubo
Shozo Hashimoto
Okura National Hospital and Keio University School of Medicine
Tokyo, Japan

REPLY: We read with interest the letter of Kosudo et al. We are pleased that they made use of our method of the 24–4-hr lesion to nonlesion ratio (T/F ratio) (*1*). We regret, however, that when selecting their study population, they did not take into consideration the physiologic basis of the technique. When pathologies such as those selected by the authors are compared, the results are expectedly disappointing.

The T/F ratio technique was not proposed as a theoretical or practical method to differentiate malignant from benign bone lesions. It was suggested as a method for differentiating lesions containing lamellar from those with woven bone (*1*). Uptake of a bone seeking radiopharmaceutical continues longer in new woven bone (e.g., metastasis) than in lamellar bone (e.g., normal skeleton, degenerative disease) where it decreases progressively between 4 and 24 hr (*2*). What we suggested was a "method for separating metastatic from degenerative lesions in the vertebrae" (*1*). In such cases the method showed a reasonably high sensitivity and specificity. We are continuing these measurements as a routine diagnostic procedure and the data for 60 additional patients confirm our initial results.

Extrapolating that the method should be used to differentiate malignant bone lesions from a basket containing a whole variety of benign lesions including ". . . arthrosis deformans, spondylosis deformans, chondroma, osteochondroma, fracture, acute and chronic osteomyelitis . . ." is erroneous. Such lesions contain both lamellar and woven bone, hence the overlap in the results obtained is not surprising.

Differential diagnosis should be attempted only when there is a clear separation between lamellar and woven bone. We have found indeed that the T/F ratio values in untreated osteomyelitis were similar to those found by Kosuda et al. in "benign" lesions and that the T/F ratio decreased significantly after successful treatment (unpublished data). We believe that monitoring treatment which results in woven bone changing into lamellar bone, and not necessarily differential diagnosis, will be the main indication for using the T/F ratio.

We conclude by again stressing the point that there is a difference in uptake of technetium-99m-labeled phosphates between lamellar and woven bone and that this difference should be discriminately explored by nuclear medicine techniques.

References

1. Israel O, Front D, Frenkel A, et al: 24-hour/4-hour ratio of Tc-99m methylene diphosphonate uptake in patients with bone metastases and degenerative bone changes. *J Nucl Med* 26:237–240, 1985
2. Arnold JS: Mechanisms of fixation of bone imaging radiopharmaceuticals. In *Studies of Cellular Function Using Radiotracers*, Billinghurst ME. Boca Raton, Florida, CRC Press, 1980, pp 115–144

Ora Israel
Dov Front
Alex Frenkel
Uriel Kleinhaus
Rambam Medical Center
Haifa, Israel

Correction: NMR Physics and Instrumentation Diplomates

The following diplomates certified by the American Board of Science in Nuclear Medicine, Inc. "NMR Physics and Instrumentation" were inadvertently omitted from a list appearing in *J Nucl Med* 27:302–303, 1986: John R. Ferrell, Roberta C. Locko, and Albert L. Wiley.