2. Marx J. DNA repair comes into its own. *Science* 1994;266:728–730.
3. Koshland Jr DE. Molecule of the year: the DNA repair enzyme. *Science* 1994;266:1925.
4. Culotta E, Koshland Jr DE. DNA repair works its way to the top. *Science* 1994;266:1926–1929.
5. Sancar A. Mechanism of DNA excision repair. *Science* 1994;266:1954–1956.
6. Hanawalt PD. Transcription-coupled repair and human disease. *Science* 1994;266:1957–1958.
7. Modrich P. Mismatch repair, genetic stability and cancer. *Science* 1994;266:1959–1960.
8. Yalow RS. Concerns with low-level ionizing radiation. *Mayo Clin Proc* 1994;69:436–440.
9. Cohen BL. Test of the linear-no threshold theory of radiation carcinogenesis for inhaled radon decay products. *Health Phys* 1995;68:157–174.
10. Zaworowski Z. Hormesis: the beneficial effects of radiation. *21st Century Science and technology* 1994;7:22–27.
11. Luckey TD. *Radiation hormesis*. Boca Raton, FL: CRC Press; 1991.

Disseminated Bone Marrow Metastases from Primary Breast Cancer: Detection and Follow-up by Radioimmune Bone Marrow Scintigraphy

TO THE EDITOR: We read with interest the article of Rieker et al. (*1*) concerning the use of radioimmune bone marrow scintigraphy in patients with disseminated bone marrow metastasis. Indeed, radioimmune bone marrow scintigraphy is extremely useful to exclude bone marrow metastasis, especially in patients with an equivocal bone scan showing features of metabolic bone disease or of a "sub"-superscan as described by Podoloff and Kim (*2*). We want to make three comments based upon our experience of 92 radioimmune bone marrow scintigrams performed in 58 patients.

1. Radioimmune bone marrow scintigraphy as follow-up parameter should be used cautiously. In one patient who had hormonally treated adenocarcinoma of the prostate, the initial bone marrow scintigram demonstrated almost complete destruction of the hematopoietic marrow (Fig. 1), as described in the case report of Rieker et al., whereas bone scintigraphy was not suggestive of disseminated bone metastasis. During follow-up, however, the patient developed spinal cord compression originating from vertebral body of T6-7, which was confirmed on MRI. Although bone scintigraphy would have demonstrated the metastatic lesion, bone marrow scintigraphy would certainly have missed this metastatic extension in the completely destructed bone marrow. Each of these modalities (radioimmune bone marrow scintigraphy, bone scintigraphy and MRI) provide specific physiological or anatomical information unique to that method. These modalities are complementary and, depending on the clinical context, one should choose the most relevant imaging technique.

   Therefore, we do not agree with Rieker et al. that bone marrow immunoscintigraphy can replace bone scintigraphy and MRI in follow-up.
2. Rieker et al. suggest that the increased uptake in the liver and spleen seen in the follow-up study could be due to a HAMA reaction (*1*). Our previous experience as well as that of Joseph et al. (*3*) found that a HAMA reaction is encountered in 10% of patients having repeated injections of the monoclonal antibody BW 250/183. In these patients, radioimmune bone marrow scintigraphy can still evaluate tumors, except in the thoraco-lumbar spine (T8-L1), which is obscured by activity from the liver and spleen. In their article, however, Rieker et al. stated that HAMA in the serum was slightly elevated (*1*). In addition, tracer uptake in liver and spleen is limited and is comparable with uptake seen on the initial radioimmune bone marrow scintigram of the patient previously mentioned (Fig. 1). Rieker et al. should still consider extramedullary hematopoiesis as a possible explanation for increased liver and spleen accumulation.
3. Finally, the suggestion that bone marrow immunoscintigraphy may be used to monitor therapeutic response should certainly be validated in a larger patient group and be compared with less expensive and more readily available techniques.

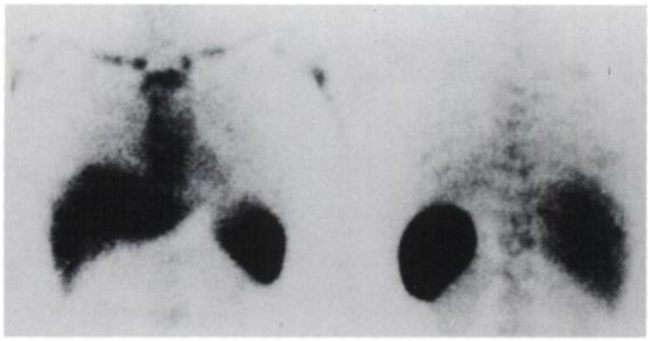

FIGURE 1. Initial bone marrow scintigram obtained 3 hr postinjection of ^{99m}Tc-labeled BW 250/183 demonstrates minimal tracer uptake in the axial skeleton, reflecting the destruction of the hematopoietic tissue, peripheral marrow expansion in the upper arms and increased liver and spleen uptake, probably due to extramedullary hematopoiesis, which does not obscure the thoraco-lumbar spine.

REFERENCES

1. Rieker O, Grünwald F, Layer G, et al. Disseminated bone marrow metastases from primary breast cancer: detection and follow-up by radioimmune bone marrow scintigraphy. *J Nucl Med* 1994;35:1485–1487.
2. Podoloff DA, Kim EE. "Sub"-superscan—manifestation of bone marrow metastases. *Clin Nucl Med* 1989;14:597–602.
3. Joseph K, Höffken H, Bosslet K, Schorlemmer HU. In vivo labeling of granulocytes with ^{99m}Tc anti-NCA monoclonal antibodies for imaging inflammation. *Eur J Nucl Med* 1988;14:367–373.

Jan Roland
Jean Servais
Pierre Scalliet
Johan Vandevivere
Middleheim General Hospital
Antwerp, Belgium

Boudewijn Brans
UZA
Antwerp, Belgium

REPLY: We appreciate the comments of Roland et al., who report another example of a false-negative bone scan and a true-positive radioimmune bone marrow scan due to disseminated bone marrow metastases. We agree with Roland et al. that radioimmune bone marrow scintigraphy should not generally replace bone scintigraphy in patients with suspected bone metastases. Our case (*1*) was taken from an unpublished prospective study that compared the accuracy of bone scintigraphy, radioimmune

bone marrow scintigraphy and MRI in the initial work-up and follow-up of patients with breast carcinoma. Radioimmune bone marrow scintigraphy was not superior to bone scintigraphy, except for bone superscans due to disseminated bone marrow metastases. Skeletal MRI was accurate in diagnosing metastases but suffered from a limited field of view when compared to whole-body scanning.

We agree with Roland et al. when they state that bone marrow scintigraphy is unable to predict vertebral fracture. We do not think that Roland et al. would have been able to predict vertebral collapse by repeat bone scintigraphy in their case of superscan. Conventional x-ray tomography, CT and MRI of the spine are alternative techniques to evaluate the risk of vertebral fracture in known vertebral metastases.

Olaf Rieker
H.J. Biersack
University of Bonn
Bonn, Germany