

for internal dosimetry in most cases, especially for radiolabeled antibody agents. Would "tumor-to-marrow" absorbed doses or some other ratio be more indicative of the efficacy from a dosimetry standpoint?

REFERENCES

1. Breitz H, Fisher DR, Weiden PL, et al. Dosimetry of rhenium-186-labeled monoclonal antibodies: methods, prediction from technetium-99m-labeled antibodies and results of phase I trials. *J Nucl Med* 1993;34:908-917.
2. Snyder W, Ford M, Warner G, Watson S. "S," absorbed dose per unit cumulated activity for selected radionuclides and organs. *MIRD pamphlet no. 11*. New York: Society of Nuclear Medicine; 1975.
3. Thomas S, Stabin M, Chen C-T, Samarantunga R. A dynamic urinary bladder model for radiation dose calculations. *MIRD pamphlet no. 14*. *J Nucl Med* 1992;33:783-802.

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REPLY: I reported tumor-to-whole-body dose ratios as a means of comparing relative cumulative activity of different radiolabeled antibodies in tumors, not as a direct measure of efficacy (1). Whole-body dose is the absorbed dose that is estimated most consistently by all investigators. I agree that whole-body dose does not correlate reliably with any radiobiological effect but the tumor-to-whole-body ratio does seem to be useful for comparing localization of different radiolabeled antibodies.

In my paper I reported the tumor-to-liver, tumor-to-lung and tumor-to-kidney dose ratios. However, derivation of data for these ratios varies regarding exactly how regions of interest are drawn and how background is subtracted. Tumor-to-marrow dose ratios are not an accurate assessment of efficacy, because even if the marrow dose is accurate, the patients' marrow reserve is also important in determining the therapeutic index. Tumor-to-marrow dose ratios seem to be the least valuable as a comparison at this stage, because the methods used to estimate marrow dose are continually changing as we learn more about marrow dosimetry.

Another reason for reporting tumor-to-whole-body dose ratios was to compare them with those derived from theoretical modeling of radiolabeled antibodies (2). These ratios have also been developed in animal models in an attempt to predict clinical results (3).

REFERENCES

1. Breitz HB, Fisher DR, Weiden PL, et al. Dosimetry of ¹⁸⁶Re-labeled monoclonal antibodies: methods, predictions from ^{99m}Tc-labeled antibodies and results of phase I trials. *J Nucl Med* 1993;34:908-917.
2. Wessels B, Rogus RD. Radionuclide selection and model absorbed dose calculations for radiolabeled tumor associated antibodies. *Med Phys* 1984; 11:638-675.
3. Yorke ED, Beaumier PL, Wessels BW, Fritzberg AR, Morgan AC. Optimal antibody-radionuclide combinations for clinical radioimmunotherapy: a predictive model based on mouse pharmacokinetics. *Nucl Med Biol* 1991;18: 827-835.

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Samarium-153-EDTMP Dosimetry

TO THE EDITOR: In a recent paper, Eary et al. (1) addressed the issue of the biodistribution and dosimetry of samarium-153-

EDTMP. I would like to make a few comments about the dosimetry aspects of this article. In particular, I would like to comment on the statement reproduced below:

Radiation dose estimates for soft tissues were similar to those estimated by Logan et al. (2) and Heggie (3), which were human doses scaled from rat biodistribution data. Skeletal doses were several-fold higher, ranging from 20,000 to 32,000 mrad/mCi (5300-8800 Gy/MBq).

First, although the absorbed dose data of Logan et al. (2) is based on the rat model, the dosimetry in my article (3) makes no assumptions about biodistribution. Indeed, I calculated the bone and red marrow absorbed doses with respect to unit activity taken up by the *bone surfaces*. In that respect, it is not clear whether the bone dosimetry results of Eary et al. (1) refer to *administered* unit activity or unit activity on the bones. I suspect the former but it is not clear from their Table 4. In the absence of data reflecting the uptake to bone, direct comparison between my data and theirs is difficult. Assuming a bone uptake of 50% of injected dose (in line with data in Eary et al., Table 2), my calculations would suggest values of 0.93 mGy/MBq and 2.43 mGy/MBq for the absorbed dose to the red marrow and endosteal surfaces, respectively. These values are indeed lower, but not *severalfold lower*, than those estimated by Eary et al. (1). Incidentally, the SI dosimetry values shown in Table 4 and throughout the text of their work have been erroneously converted from traditional units; they are shown as being approximately a factor of a million larger than they should be.

The reason for the absorbed dose discrepancy between their work and my own is undoubtedly due to their adoption of the ICRP model of bone. As previously noted (3), the validity of the ICRP-30 dosimetry model for bone must be questioned on two counts. First, it was developed for *radiation protection* purposes and not accurate dosimetry. As such, it overestimates the absorbed fractions for electrons to the red bone marrow and the endosteal layer. Second, it uses bone structural data that is at odds with the work of Beddoe et al. (4) and others. Specifically, the adopted model underestimates the area of the endosteal surface layer associated with trabecular bone.

In the context of therapeutic treatment of bone metastases with ¹⁵³Sm-EDTMP, the success or failure of the treatment hinges on an accurate determination of the absorbed dose to the red bone marrow, since it is the red bone marrow absorbed dose which limits the amount of radioactivity that can be safely administered. In view of this, it would be instructive to use the biodistribution data of Eary et al. (1) with my previously published S-factors (3).

REFERENCES

1. Eary JF, Collins C, Stabin M, et al. Samarium-153-EDTMP biodistribution and dosimetry estimation. *J Nucl Med* 1993;35:1031-1036.
2. Logan K, Volkert W, Holmes R. Radiation dose calculations in persons receiving injection of Sm-153-EDTMP. *J Nucl Med* 1987;28:505-509.
3. Heggie JCP. Radiation absorbed dose calculations for samarium-153-EDTMP localized in bone. *J Nucl Med* 1991;32:840-844.
4. Beddoe AH, Darley PJ, Spiers FW. Measurements of trabecular bone structure in man. *Phys Med Biol* 1976;21:589-607.

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REPLY: We appreciate Dr. Heggie's (1) comments about our paper on ¹⁵³Sm distribution and dosimetry. He makes several