## $^{203}$Pb FOR BONE SCANNING

In their Letter to the Editor, Rao and Goodwin (*1*) reported the potential applicability of $^{203}$Pb radionuclide for skeletal imaging. This radionuclide was investigated in many centers in the United States and the radiation dosimetry based on biologic distribution in animals was highly discouraging for the use of $^{203}$Pb acetate. The critical organs for $^{203}$Pb acetate are the RES (reticuloendothelial system) organs, particularly the spleen. For example, the authors reported the image of a rabbit taken 3 days after intravenous administration of 800 $\mu$Ci of $^{203}$Pb-acetate. Usually a rabbit weighs about 5 kg. Even assuming a maximum weight of 7 kg, the dose administered was 800 $\mu$Ci. The corresponding tracer dose to a 70-kg human would be 8 mCi. Scanning may have to be done 3 days after administration of $^{203}$Pb in order to obtain a high target-to-nontarget ratio and for which the tracer dose administered will be 8 mCi. According to the authors' own calculations the whole body and skeleton would receive an estimated radiation dose of 0.03 and 0.06 rads, respectively, from 100 $\mu$Ci of $^{203}$Pb. For an 8 mCi dose the estimated radiation dose to the whole body would be 2.4 rads and the skeleton receives 4.8 rads.

Using the nuclear parameters of $^{203}$Pb presented in Table 1, radiation dose estimates to several organs were made. The whole-body dose was 3.09 rads/8 mCi. Assuming a 50% deposition in the skeleton, the skeleton receives 6.74 rads/8 mCi administered dose. Assuming 8% of the injected dose (8 mCi) goes to the liver (*2*), the radiation dose to the liver was estimated to be 6.0 rads. However, when a 70-kg patient receives an 8 mCi dose, the radiation dose to the spleen is high (29.2 rads) even assuming only 5% of the lead acetate goes to this organ.

In the case of a rare-earth metal the activity in the liver, spleen, and kidneys is reduced by approximately 50% with HEDTA chelate compared with a weak chelate such as citrate (*3*). As the radiation dose to the RES organs, particularly spleen, is more than 29 rads with $^{203}$Pb acetate, the use of $^{203}$Pb HEDTA will not result in a relatively low radiation dose to the patient.

**TABLE 1. NUCLEAR PARAMETERS OF $^{203}$Pb**

| Radiation (i) | Mean number/ disint. ($\eta_i$) | Mean energy (MeV) ($\bar{E}_i$) | $\Delta_i$ $\left(\frac{\text{gm-rad}}{\mu\text{Ci-hr}}\right)$ |
|---|---|---|---|
| Electron capture | — | — | * |
| Gamma—1 | 0.8077 | 0.2792 | 0.4803 |
| K int. con. electrons | 0.1316 | 0.1936 | 0.0543 |
| L int. con. electrons | 0.0397 | 0.2649 | 0.0224 |
| M int. con. electrons | 0.0124 | 0.2762 | 0.0073 |
| Gamma—2 | 0.0382 | 0.4013 | 0.0326 |
| K int. con. electrons | 0.0055 | 0.3158 | 0.0037 |
| L int. con. electrons | 0.0009 | 0.3870 | 0.0007 |
| M int. con. electrons | 0.0003 | 0.3984 | 0.0003 |
| Gamma—3 | 0.0084 | 0.6805 | 0.0122 |
| X-rays: K$\alpha$ | 0.6859 | 0.0719 | 0.1053 |
| K$\beta$ | 0.1993 | 0.0840 | 0.0354 |
| L$\alpha$ | 0.1787 | 0.0103 | 0.0039 |
| L$\beta$ | 0.1675 | 0.0122 | 0.0044 |
| L$\gamma$ | 0.0225 | 0.0143 | 0.0007 |
| Auger | | | |
| Electrons: KLL | 0.0221 | 0.0570 | 0.0027 |
| KLX | 0.0127 | 0.0683 | 0.0018 |
| KXY | 0.0020 | 0.0796 | 0.0003 |
| LMM | 0.5842 | 0.0084 | 0.0104 |
| MXY | 1.7681 | 0.0029 | 0.0109 |

* For reference only—does not contribute to dose.

I. BIJLI SYED
Wesson Memorial Hospital
Springfield, Massachusetts

REFERENCES

*1.* RAO DV, GOODWIN PN: $^{203}$Pb: A potential radionuclide for skeletal imaging. *J Nucl Med* 14: 872, 1973

*2.* SPIERS FW: *Radioisotopes in the Human Body*, New York, Academic Press Inc, 1968, p 67

*3.* ROSOFF B, SIEGEL E, WILLIAMS GL, et al: Distribution and excretion of radioactive rare-earth compounds in mice. *Int J Appl Radiat Isot* 14: 129–135, 1963

## THE AUTHORS' REPLY

We appreciate the interest of Syed regarding $^{203}$Pb dosimetry. First of all, when we injected 800 $\mu$Ci in the rabbit to obtain a quick image, we did not mean that a proportionate dose should be given to a patient. We feel that 2 mCi or less would be sufficient to obtain a good scan on a normal patient.