LETTERS TO THE EDITOR

Re:Radiation Absorbed Dose from Tc-99m Diethylenetriaminepentaacetic Acid (DTPA)

With reference to the recent MIRD Dose Estimate Report No. 12, on the radiation absorbed dose from Tc-99m diethylenetriaminepentaacetic acid (DTPA) (*1*), the authors make the important point that the report applies only for Tc-99m DTPA formed by the method they described. On the other hand, the clinical categories of the 11 patients, on whose whole-body retention data the report is based, are not defined. These patients appear to comprise an arbitrary group with some degree of renal impairment, since the average total-body retention equation includes a 40% component with an elimination half-time of more than 9 hr, suggesting a glomerular filtration rate of the order of 20 ml/min. Our own data observed in normal volunteers show a markedly different retention pattern, with more rapid excretion of Tc-99m DTPA prepared by the method described in the MIRD report. With the increasing awareness of the legal requirements relating to the use of diagnostic radiopharmaceuticals in both patients and volunteers, it is becoming customary to distinguish between normal and abnormal physiology in the estimations of radiation absorbed dose. Impaired renal function can have a pronounced influence on the dosimetry of dynamic renal radiopharmaceuticals, since they are excreted rapidly in the normal case. Elliott et al. (*2*), for example, have illustrated the effects of various renal diseases on the dosimetry of radioiodine-labeled hippurate. While it is appreciated that the short physical half-life would limit the extent of such effects using Tc-99m DTPA, it is suggested that the value of the MIRD Dose Estimate Report No. 12 could have been increased if a distinction had been made between normal and diseased states, as has been the practice with some of the previous MIRD dose estimate reports.

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2. ELLIOTT AT, BRITTON KE, BROWN NJG, et al: Dosimetry of current radiopharmaceuticals used in renal investigation. In *Radiopharmaceutical Dosimetry Symposium—Proceedings Conf Oak Ridge.* HEW Publication (FDA) 76-8044, 1976, pp 293-303

Reply

The patients whose data constituted the basis for MIRD Dose Estimate Report No. 12 (*1*) were under study for hypertension. They are the same group who were reported by Klopper et al. (*2*). The total-body data in MIRD Dose Estimate Report No. 12 indicate two components with fractional distributions of 0.579 and 0.421, and biological rate constants of 0.690/hr and 0.075/hr respectively. These values compare fairly well with those reported by Klopper et al., where the fractional distributions were 0.695 and 0.266, and the rate constants were 0.401/h and 0.075/h. The differences arise because in the paper by Klopper et al. the results were obtained by pooling the original data, whereas in the MIRD Dose Estimate Report the results are derived from the mean of the individual data.

The disappearance constants for plasma are very different from those for total-body retention. In the paper by Klopper et al. the plasma disappearance rates are 2.70/hr and 0.329/hr for the two components, neglecting a much shorter mixing component. Calculation of glomerular filtration rate (GFR) from the plasma disappearance rates in each individual gave values of 87.9 ± 24.3 ml/min for Tc-99m DTPA and 98.8 ± 23.0 ml/min for I-125 iothalamate. These values are reasonably normal.

The difference between glomerular filtration rates as calculated from plasma disappearance rates and from total-body retention is difficult to explain. There may be some delay in equilibration of the concentration of the GFR agents throughout the extracellular space.

Dr. Smith is correct in his concern over doses incurred when organ function is not normal, and also that in this case the short physical half-life of Tc-99m DTPA would limit any major effect. Actually, if renal function is absent, the bladder dose, (representing the highest dose in our calculations) would be reduced, and other tissues would be little changed. For example, assuming uniform total-body distribution, the dose estimate for the total body would be 0.017 rad/mCi instead of the 0.0075 rad/mCi in MIRD Dose Estimate No. 12, and all other organs would receive the same dose as the total body.

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