Accidental Ingestion of Tc-99m in Breast Milk by a 10-Week-Old Child

Rumble et al. (*1*) have estimated radiation dosage to various organs in a 10-week-old baby who was breast-fed by the mother a few hours after a [^{99m}Tc] pertechnetate brain scan. The authors have not emphasized two factors that may have introduced errors in the dosimetry calculations for this patient.

First, they assume that 50% of the orally ingested pertechnetate was absorbed, and they have referenced that inference to work of Hays (*2*). In her article, Hays does not give firm numerical data regarding absorption of orally administered pertechnetate. In fact, she makes the point that plasma levels of pertechnetate after oral administration are extremely erratic, varying from patient to patient and even from session to session in some patients.

The second point is only a conjecture but probably a logical one. The mother of the patient had a pertechnetate brain scan, so she must have received sodium or potassium perchlorate just before the study. Since it is known that iodide and pertechnetate are secreted in milk during lactation, it is probably safe to assume that perchlorate also is. The level of perchlorate will alter the organ distribution of pertechnetate considerably, with less of it getting to the thyroid gland (3).

The whole-body counting measured the total radioactivity present in the baby, but the above-mentioned factors suggest that the radiation dose to the thyroid gland was probably overestimated and to the gastrointestinal tract underestimated.

The case report emphasizes that a patient's history and physical examination are an essential part of the services we offer as nuclear medicine consultants. In the two institutions that I have been associated with, no patient is injected with any radiopharmaceutical before a nuclear-medical physician has examined the patient and/or gone through his hospital records. I suggest one more precaution to join the three mentioned in the report. No woman in the child-bearing age should receive iodine-131 therapy without a pregnancy test.

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Reply

We have received the comments regarding our article, and greatly appreciate the re-emphasis of the difficulties inherent in dosimetry calculations for a small child, as noted in the text. Human dosimetry calculations involve many variables, some of which require biologic data that are either unavailable or limited. Because of these uncertainties, it is necessary to select conservative best estimates (those that maximize the calculated radiation doses) wherever a choice of values exists.

Although it is true that the range of plasma values reported by Hays (*1*) is highly variable, we were able to derive an absorption number from her data. Hays reported plasma values after oral administration that ranged from a few percent to nearly 140% of those after i.v. administration. Our estimate of 50% was derived by correcting Hays' average plasma ratio value of 0.75 by taking as 100% absorption her maximum value of nearly 1.4 on the assumption that absorption could not exceed 100%.

The point about perchlorate's altering the tissue distribution of pertechnetate is certainly a reasonable conjecture. In this case, however, the patient was scanned without perchlorate in order to visualize pertechnetate localization in the region of the nose (*2*).

In light of the above discussion, we believe that the dose estimates in our article are reasonable within the limitations of the biologic information available.

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Single-Slice Contrasted with Multiple-slice Positron Tomographs

A recent discussion of the factors that relate to the single-slice contrasted with multiple-slice design choice (*1*) is both misleading and incomplete. The authors support their choice of a single-slice system by comparing it with a hypothetical multislice device with a sensitivity per slice only 20% of that of a single-slice system. It is unreasonable to postulate, a priori, that the sensitivity per slice of a five-slice system would be one-fifth that of a one-slice system. For example, if five sets of detectors were placed side by side in the ORTEC ECAT configuration, it would be illogical to assume that the sensitivity of each slice would automatically decrease to one-fifth of the original value. Of course, there are many factors that influence the sensitivity of a multislice system, but it has been our experience that a properly designed system should yield much higher overall sensitivity than would a comparable single-slice system. Thus the example presented of a five-slice system and a single-slice system that have the same overall sensitivity is an extreme case, and is misleading.

The cost of a multislice system compared with a single-slice system may be discussed ad infinitum. It has been our experience with PETT III and PETT IV that a multislice system has been constructed for approximately 30% increase in cost over a single-slice system. The major differences in cost arise from