Excretion of Radioiodine in Breast Milk

TO THE EDITOR: Recently Dydek and Blue (*1*) reported excretion data for iodine-131 (^{131}I) in breast milk following a therapeutic administration of 9.6 mCi of [^{131}I] sodium iodide. The concentration of ^{131}I in breast milk in μCi/ml (C) was described by the following equation:

$$C(t) = 6.35\ EXP(-1.49t) + 0.15\ EXP(-0.12t), \quad (1)$$

where t is the time in days post administration of the radioiodine. The contribution of physical decay can be removed from Eq. (1) by multiplying the right hand side by the factor EXP (λt) where λ is the decay constant of ^{131}I (0.086 day^{-1}). This yields:

$$C(t) = 6.35\ EXP(-1.40t) + 0.15\ EXP(-0.034t). \quad (2)$$

Equation (2) describes the biologic elimination of radioiodine in the breast milk independent of physical decay. The total activity excreted in the breast milk (A) over a 106-day period is given by:

$$A = \sum_{t=1}^{106} C(t)\ V, \quad (3)$$

where V is the daily milk volume and is equal to 1,500 ml. For the first day three equal volume excretions are assumed to occur at 6 hr, 12 hr, and 24 hr with concentrations corrected for physical decay of 3.99 μCi/ml, 2.81 μCi/ml, and 2.01 μCi/ml, respectively (*1*). Subsequent concentrations corresponding to Day 2 through Day 106 are calculated using Eq. (2). If physical decay did not occur, the total activity excreted in the breast milk would be 11.3 mCi which is 18% more activity than was administered to the patient. In this model given by Eq. (2) excretion of radioiodine in the breast milk has become the dominant pathway for biologic elimination to the point of exclusion of renal clearance. This conclusion is in error since a large fraction of the administered activity is known to be excreted in the mother's urine (*2*).

Because the model of Dydek and Blue (*1*) greatly overestimates the activity in the breast milk, their recommendation to avoid iodine-123 (^{123}I) in those patients who wish to resume nursing is not appropriate. Romney (*3*) and Hedrick et al. (*4*) have independently recommended a 3-day cessation of nursing following administration of ^{123}I. In the latter case the contribution of ^{124}I and ^{125}I contaminants has been considered in the evaluation of the dose estimates to the infant.

References

1. Dydek GJ, Blue PW. Human breast milk excretion of iodine-131 following diagnostic and therapeutic administration to a lactating patient with Graves' disease. *J Nucl Med* 1988; 29:407–410.
2. Weaver JC, Kamm ML, Dobson RL. Excretion of radioiodine in human milk. *JAMA* 1960; 173:872–875.
3. Romney BM, Nickoloff EL, Esser PD, Alderson PO. Radionuclide administration to nursing mothers: Mathematically derived guidelines. *Radiology* 1986; 160:549–554.
4. Hedrick WR, Di Simone RN, Keen RL. Radiation dosimetry from breast milk excretion of iodine-123. *J Nucl Med* 1987; 28:544–545.

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REPLY: Our subject collected one 100-cc aliquot of milk per sample throughout the duration of the study, and the concentrations recorded are the values from these samples. As Hedrick points out, the use of 1,500 cc ingested volume at this same milk concentration results in a calculation of 118% of the dose excreted via milk. As we mentioned, we used this higher value as a conservative figure. It must be assumed that at higher milk volumes, however, the tracer concentration would be somewhat less than that determined from the 100 cc aliquots we collected.

In Hedrick's study (*1*) he assumed a daily milk volume of 850 cc. If we apply this to our data rather than the 1,500 cc we used, 6.4 mCi Na^{131}I (67%) would be excreted by the breast over 106 days, leaving 33% for renal excretion. Weaver (*2*) reported one euthyroid patient producing 1266 cc milk over 2 days who excreted 27% of the administered dose via milk and 50% via urine. The other five patients in his study did not produce significant quantities of milk (*2*). Since the major part of the ingested dose that is excreted into the urine appears as iodide during the first 48 hr and since our subject was hyperthyroid (RAIU (24 hr) = 44%), less iodide would be available for urinary excretion in such patients with high uptakes. Similarly, in hypothyroid and other patients with low uptakes (e.g., hyperthyroid subacute thyroiditis) initial urinary excretion could be expected to be increased.

Table 1 presents the required nursing delay for a 100, 250, 500, and 850 cc assumed daily milk ingestion for 30 μCi and 100 μCi doses of iodine-123 (^{123}I) sodium iodide as well as our 9.6 mCi, 8.6 μCi, and 100 nCi iodine-131 sodium iodide doses. The calculations are based on Hedrick's radiation dosimetry for ^{124}I and ^{125}I and our model. The data shows that for all volumes and levels of contaminants whether ^{123}I(p,2n) or ^{123}I(p,5n) it would not be appropriate to begin nursing at 3 days no matter what the listed percentage of contaminant or ingested milk volume was. We include the 100 ml/day ingested volume not to suggest this as a possibility but to reflect the volume from which our data arose. However, even at this volume, 3 days is premature under all the listed conditions. Using Romney's model (*3*) which assumes no excretion after 7 days, every calculated time to safe nursing is significantly longer than ours.

Although Hedrick's analysis of our data is correct in that by assuming 1,500 ml daily milk consumption, we moderately overestimate radiation exposure, his conclusion to allow nursing by 3 days is in error. We still recommend avoiding ^{123}I in