Indium-111 in Breast Milk Following Administration of Indium-111-Labeled Leukocytes

TO THE EDITOR: There have been only two published reports of the level of radioactivity secreted in breast milk following administration of indium-111 (^{111}In) leukocytes to lactating mothers (*1,2*). In each case, the maximum concentration observed was below 1 nCi/ml of breast milk and the question arises of the necessity of interrupting breast feeding. Mountford and Coakley (*1*) rightly raise the need for further studies before such a recommendation can be made.

We have recently measured the excretion of ^{111}In in breast milk following administration of indium-labeled leukocytes over a period of 102.4 hr, which is over twice the duration of previous studies.

A 25-yr-old woman gave birth to a full term infant by an emergency lower segment caesarian section, necessitated by foetal distress. The patient subsequently developed a fluctuating temperature and leukocytosis which persisted on antibiotic treatment. She also drained fluid rectally and a pelvic abscess was suspected. Eight days after delivery, the patient's leukocytes were labeled with [^{111}In]oxine and 0.11 mCi (4 MBq) reinjected. Images at 4 and 20 hr demonstrated abnormal accumulation of white cells between the uterus and sacrum. Antibiotic treatment was continued and since the abscess was draining spontaneously, no further intervention was performed. The patient made an uneventful recovery. The patient was requested to cease breast feeding for 24 hr immediately after injection of the radiopharmaceutical and to express the milk by pump. Thereafter breast feeding recommenced but the patient provided samples of milk (10 ml), again expressed by pump, for measurement of activity. A total of seven samples over a period of 102.4 hr following injection was obtained. The activity concentrations are shown in Table 1. The highest concentration (0.068 nCi/ml) was found 16 hr after injection and then decreased with a half life of ~140 hr.

TABLE 1
Concentration of ^{111}In in Breast Milk Following Administration of 0.11 mCi of Indium-Labeled Leukocytes

Time after injection (hr)	Volume of milk Sample (ml)	Activity (nCi/ml)	Fraction of injected activity per ml of milk
5.6	102	0.026	2.4×10^{-7}
16.0	102	0.068	6.2×10^{-7}
22.5	87	0.065	5.9×10^{-7}
29.6	10	0.059	5.4×10^{-7}
56.9	10	0.058	5.3×10^{-7}
87.9	10	0.049	4.5×10^{-7}
102.4	10	0.041	3.7×10^{-7}

Identification of the chemical form in which the radioactivity was secreted were hampered by the very low concentration. Centrifugation of the 16-hr milk sample at 2,000 *g* for 15 min showed that more than 85% of the radioactivity was present in the protein-rich, fat-free layer. Further analysis of the precise degree and nature of protein binding was not possible. Attempts to identify radioactivity associated with intact cells were unsuccessful.

The results were compared with those of Mountford and Coakley (*1*) and Butt and Szaz (*2*) by expressing the concentration of radioactivity secreted in breast milk per unit activity administered. The activity concentrations in this study, when expressed in this way are approximately twice those previously reported. It is possible that variations in labelling technique may be responsible for some of this difference. As in this study, Mountford and Coakley (*1*) used [^{111}In]oxine whereas Butt and Szaz (*2*) used [^{111}In]tropolone for labeling the leukocytes. In none of the studies was either gradient purification of the cells or differential cell count of the final injection performed. A different number of labelled erythrocytes, platelets and other cellular components and free indium will therefore have been injected. Differences in their biodistribution and the rates of release of ^{111}In will influence the activity concentration in breast milk, and therefore the rate at which radioactivity is secreted. In addition variation between individuals is likely to have an influence on the shape of the secretion curve.

The activity ingested by the infant between 24 and 102.4 hr after injecting the mother was calculated. It was assumed that 100 ml of breast milk was consumed per feed. From the feeding chart and secretion curve it was calculated that the infant (2.58 kg) ingested 81 nCi (3 kBq). If breast feeding had not been interrupted for 24 hr and the infant had consumed five feeds of 100 ml during this time, the ingested activity would have risen further by an estimated 26 nCi (1 kBq) to a total of 107 nCi (4 kBq). [The annual limit of intake of ^{111}In for a radiation worker is 2×10^5 KBq (*3*)].

This case shows that a diagnostic study has successfully been performed by administering as little as 0.11 mCi of ^{111}In-labeled leukocytes. The use of such lower activities in lactating mothers should be considered to reduce the radioactive dose ingested by a breast-fed infant (*4*).

References

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following maternal radiopharmaceutical administration. *Nucl Med Commun* 1986; 7:399–401.

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Quantitation of Iodine-124 Contamination in Iodine-123 Radiopharmaceuticals: Characterization of a Second Dose Calibrator

TO THE EDITOR: We previously described a simple method to quantitate iodine-124 (^{124}I) contamination in iodine-123 (^{123}I) radiopharmaceuticals (*1*), supplying at that time a graph and characterization constants suitable for use with the dose calibrator manufactured by Capintec (Model CRC-10). We cautioned in that article, however, that these results were not appropriate for use with dose calibrators of different design nor with sample containers and Pb shields constructed at variance with those used to collect the data.

We have now characterized a second dose calibrator (RADCAL, Model 4045). Using the Pb shield provided for the moly breathrough test, the measured constants were found to differ very little from those reported in (*1*); T3 = 0.00663, T4 = 0.366 and D = 0.547. For convenience of the RADCAL users, the correct curve for the ^{124}I contaminant assay is shown (solid line) for comparison with that for the Capintec instrument (dashed line). Over the range shown, the curves differ by no more than 0.21 percent ^{124}I. Hence, for the purpose of assaying I-124 contamination, the two instruments and associated moly breathrough shields are seen to be essentially identical.

It is not surprising that the radiations of ^{123}I and ^{124}I produce comparable responses in these two instruments since they are of the gas ionization chamber type and have quite similar well dimensions. We caution again, however, that these curves and constants may not be appropriate for use with other dose calibrators, especially those that use NaI scintillation detectors because of their considerably different energy response functions.

References

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Adverse Reactions to Technetium-99m Methylene Diphosphonate

TO THE EDITOR: The published incidence of adverse reactions to [^{99m}Tc]MDP is low. Reported reactions in the United States indicate an incidence of 0.5 per 100.000 in 1984 (*1*). A publication from the United Kingdom covering the

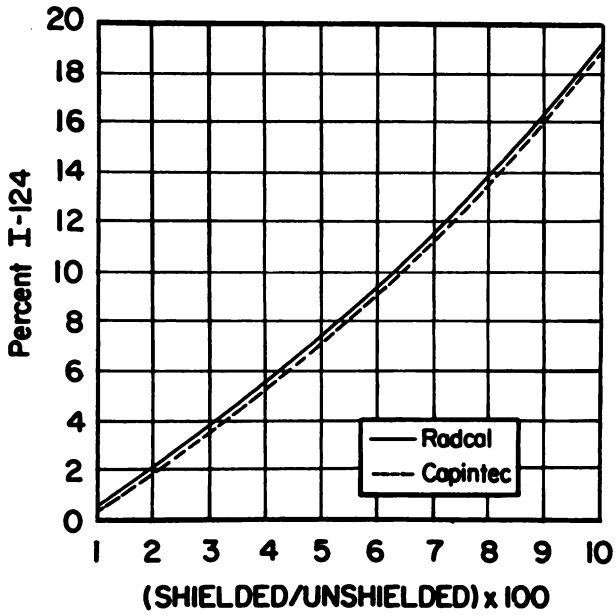

FIGURE 1
Curves for assay of percent ^{124}I contamination with two radionuclide dose calibrators. "Shielded" refers to dose calibrator readings of a vial containing ^{123}I radiopharmaceutical taken while within the moly breathrough shield with the instrument set to assay ^{123}I; "unshielded", to readings without use of the shield. Curve points were determined by the method of Reference (*1*).

period between 1977 and 1983 estimated an incidence between 1 per 1,000 and 1 per 10.000 of adverse reactions to radiopharmaceuticals (*2*). Nearly half of the more recent reports in the United Kingdom concerned reactions to [^{99m}Tc] MDP and the authors estimated that they were notified of <10% of the events including the trivial reactions. After encountering such a reaction, we attempted prospectively to determine the incidence in our bone scan patients.

A 56-year-old female came for an initial bone scan because of a painful left knee, probably arthritis. Her medical history included bilateral hip dysplasia and Parkinson's disease. She did not take medication. Approximately 30 min after intravenous administration of 654 MBq technetium-99m (^{99m}Tc) methylene diphosponate (MDP) (Solco Nuclear, Birsfelden, Switzerland) the patient experienced severe headache with photophobia, nausea, dizziness and sensation of warmth. She had not had those symptoms before and rarely had headache. The symptoms gradually disappeared 2 hr after onset. She reported these complaints when she returned for imaging 4 hr after administration. No therapy was given. There were no late manifestations in the days after the examination.

After this event every patient who came for bone scan to our department was asked for complaints in the interval between injection and imaging. Four patients out of 400 reported, only when asked, transient and moderate headache, dizziness and nausea ~30 to 60 min after injection. Late reactions did not occur. Two of these patients had carcinoma of the breast. One patient used the oral anticoagulant acenocoumarol and the other patient took no medication. The third patient had carcinoma of the lung and used ibuprofen. The fourth patient had probably reflex sympathetic dystrophy and used naproxen. None of the five patients with reactions had