Nuclear medicine and the nursing mother

When nuclear medicine investigations are requested for women who are breast feeding they present a potential hazard to the infant both from radiation and from pharmaceuticals transmitted in the breast milk. Cases have been described of babies drinking radioactive milk and have probably gone unreported. On the other hand, undue anxiety about the problems may deter clinicians from requesting investigations. How great are the hazards, and what can be done to reduce them?

Many radiopharmaceuticals may be detected in breast milk. These substances differ from other drugs in that for diagnostic purposes they are used in tracer quantities and do not produce demonstrable pharmacological changes in the mother or infant. Patients may also be given non-radioactive drugs to induce changes in the distribution of the radiopharmaceuticals, and some of these, too, appear in milk. Drugs used in this way include frusemide, potassium perchlorate, iodides, and cholecystokinin. Iodides are selectively concentrated in breast milk, and some consider them contraindicated during lactation. Assessment of risks from the other agents is difficult because of lack of data, though the amounts of frusemide that appear in milk seem unlikely to be pharmacologically important.

The more obvious topic of concern is with radiation, which may be transmitted directly from the mother when cuddling and at feeding or be ingested in the milk. There are no standards for evaluating a radiation hazard specifically in infants. The measures used in practice are the dose equivalent limit and one tenth of the annual limit of intake, corrected for the infant's weight or surface area. Despite the obvious importance of transmitted radiation there are no relevant data. A recent report of radiation protection procedures for compounds containing technetium-99m concluded that an infant is unlikely to receive transmitted radiation in excess of the dose equivalent limit from a single investigation, though repeated investigations could result in this concentration being raised if no advice was given to the mother.

The importance of ingestion hazards was recognised when high concentrations of iodine-131 were measured in the milk of patients undergoing thyroid uptake studies, and was confirmed for iodinated compounds used for other investigations. This selective uptake may result in iodine concentrations in milk being 40 times those in plasma. Iodides, and probably potassium perchlorate, administered to block the maternal thyroid, will also appear in milk, however, and modify the dose to the infant. The most widely used radiopharmaceuticals, and of these sodium pertechnetate has the highest excretion in milk. The quantity excreted varies with other technetium compounds and is lowest with the diethylene triamine penta-acid, which is rapidly excreted by the kidneys. These differences are big enough to be important: with pertechnetate one tenth of the annual limit of intake could be exceeded in certain circumstances with a single feed, whereas this concentration would not be approached when conventional doses of macroaggregated albumin or diethylene triamine penta-acid were used even with uninterrupted feeding. Other radiopharmaceuticals show wide variation in the amount excreted in milk of particular note is the high content of gallium-67 citrate, probably because of its affinity for lactoferrin.

Evaluation of the risk from ingested milk is complicated by several factors. Nearly all the available data take the form of case reports, and for some compounds no such reports are available. Excretion in breast milk shows wide biological variation and most of the studies have been conducted on milk expressed by a breast pump, which may not accurately reflect suckling. The chemical forms of radioisotopes in milk may not be known. Dosimetric calculations of ingested activity extrapolated from adult data have to rely on large assumptions.

Nevertheless, much can be done to reduce radiation to infants. Firstly, the clinician must be sure that the investigation is essential: a basic principle of radiation protection is to avoid unnecessary tests, and this rule needs to be applied rigorously to the nursing mother. On occasions the doctor may not know that a patient is nursing or has young children: signs should be displayed in the waiting areas of diagnostic departments requesting these mothers to identify themselves. The dose should be reduced to the minimum compatible with obtaining a diagnostic result. Sometimes the radiopharmaceutical may be changed to one with less concentration in milk or with other, more favourable dosimetric properties. Examples include the use of diethylene triamine penta-acid instead of pertechnetate or gluconate for brain scanning, indium-111 labelled leucocytes instead of “Gentim” for localising pus, and the substitution of I for I. A period of interruption of breast feeding, expression of milk, and reduction of close contact with the infant is usually recommended for mothers who have a nuclear medicine investigation. The inconvenience and disadvantages of interrupting breast feeding have to be balanced against the
potential risk to the infant: the prolonged interruption of feeding advocated for some agents is often impracticable. 14 15 Interruption for 24 hours (as recommended by some authors) for 99mTc compounds is excessive for doses used in Britain. Twelve hours leaves a wide range of safety for pertechnetate. No interruption is needed for 99mTc-macroaggregated albumin and 99mTc-diethylenetriaminepenta-acetic acid in order to remain below one tenth of the annual limit of intake—but in practice mothers are often reassured by a short interruption.19 When an investigation is needed for which no data on breast milk secretion are available the mother should be advised to stop breast feeding until measurements made on the expressed milk show it safe to return.

The list of problems is long, but in practice the risk to the infant is small from most radiopharmaceuticals now in use. Simple precautions will allow most investigations to be performed with little inconvenience. The recommended precautions must err on the side of safety, but as more information becomes available such advice should be able to become less restrictive, particularly with regard to interruption of breast feeding.

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