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Case report

Excretion of technetium 99m hexakismethoxyisobutylisonitrile in milk

Sietske M. Rubow, Annare Ellmann, Jannie le Roux, and Johannes Klopper

Department of Nuclear Medicine, C10A, Tygerberg Hospital and the University of Stellenbosch, Tygerberg, 7505, Republic of South Africa

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Abstract. The amount of radioactivity excreted in breast milk following the administration of technetium 99m hexakismethoxyisobutylisonitrile (^{99m}Tc-MIBI) to a patient referred for cold spot myocardial scintigraphy was determined. During the first 24 h after administration, only 41.2 kBq ^{99m}Tc (0.0084% of the injected dose) was excreted in 448 ml milk with the highest concentration of 0.49 kBq/ml in the first sample. The images obtained show a high concentration of ^{99m}Tc-MIBI in the lactating breasts contrary to the very small percentage excreted in the milk. Comparison with various recommendations regarding nursing after administration of radiopharmaceuticals seems to indicate that the administration of ^{99m}Tc-MIBI does not necessitate an interruption of breast-feeding.

Key words: Technetium 99m hexakismethoxyisobutylisonitrile (^{99m}Tc-MIBI) – Radioactivity in breast milk

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Introduction

The excretion of technetium 99m in breast milk after the administration of various radiopharmaceuticals has been reported (Ahlgren et al. 1985; Rose et al. 1990), but no information regarding the excretion of technetium 99m hexakismethoxyisobutylisonitrile (^{99m}Tc-MIBI) is available as yet. Recently, we had the opportunity to determine the ^{99m}Tc concentration in milk after ^{99m}Tc-MIBI cold spot myocardial scintigraphy.

Offprint requests to: S.M. Rubow

Case report

A 40-year-old woman presented with dyspnoea and heart failure 6 months post-partum; she was still breast-feeding her infant. Although no obvious clinical evidence suggesting a myocardial infarction was present, the electrocardiogram (ECG) showed Q-waves in the V2–V6 precordial leads. The possibility of a post-partum cardiomyopathy was also considered. A ^{99m}Tc-MIBI cold spot scan was requested to exclude a myocardial infarction. The patient was injected with 490 MBq of ^{99m}Tc-MIBI, and appropriate standards of the injected dose were kept. Breast-feeding was discontinued for 24 h and milk samples were obtained at approximately 4-h intervals with the aid of a breast pump.

The volume of each milk sample was determined, and the radioactivity was measured by counting aliquots of the expressed milk and a standard in a scintillation well counter.

Results

The radioactivity measured in the milk samples is shown in Table 1. The total activity measured in the 448 ml milk collected in the first 24 h after injection was

Table 1. Measurements of technetium 99m hexakismethoxyisobutylisonitrile (^{99m}Tc-MIBI) in milk

Time after injection (h)	Volume (ml)	Concentration (kBq/ml)	Percentage of injected dose
3.3	85	0.4879	0.0040
6.8	42	0.1762	0.0015
10.8	78	0.1564	0.0014
14.8	75	0.0922	0.0008
20.1	136	0.0719	0.0006
23.3	32	0.0171	0.0001
Total	448		0.0084

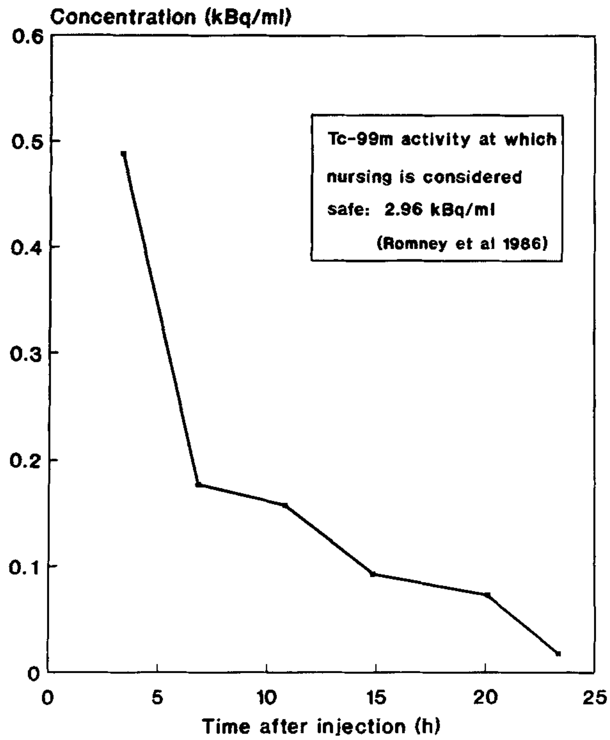

Fig. 1. Concentrations of ^{99m}Tc-MIBI measured in breast milk

41.2 kBq or 0.0084% of the dose injected to the mother. Figure 1 shows the decrease in activity concentration in milk with time.

Discussion

Guidelines regarding radionuclide administration to nursing mothers were published in 1986 by Romney et al. According to these workers, nursing can be resumed when the ^{99m}Tc concentration in milk is lower than 2.96 kBq/ml. As seen in Table 1, the samples obtained never contained such high concentrations. Thus, no interruption of breast-feeding would have been necessary.

More recently, Mountford and Coakley (1989) have also discussed the interruption of feeding. In their calculations, the effective dose equivalent (EDE) per unit activity of ^{99m}Tc ingested is taken to be 0.28 mSv/MBq. Furthermore, it is advised that the EDE to the baby from ingestion of milk should be kept below 1 mSv.

The total activity measured in the samples obtained was 41.2 kBq. This would lead to an EDE of 0.01 mSv, far below the advised limit of 1 mSv. Several authors base their assessments of radiation dose on the actual milk samples obtained (Rose et al. 1990; Miller and Weetch 1955; Pittard et al. 1979, 1982). It is, however, doubtful if mechanical or manual emptying of the breasts truly reflects the milk intake of the infant (Lentner 1981). Therefore, in spite of mechanical emptying of the breasts, it should be assumed that the baby would have ingested a larger volume of milk than the 448 ml collected. For a 6-month-old infant, daily milk intake can be assumed to be about 850 ml, especially if it is receiving other food in addition to breast milk as in our case. This figure correlates well with findings published by the World Health Organization (1986).

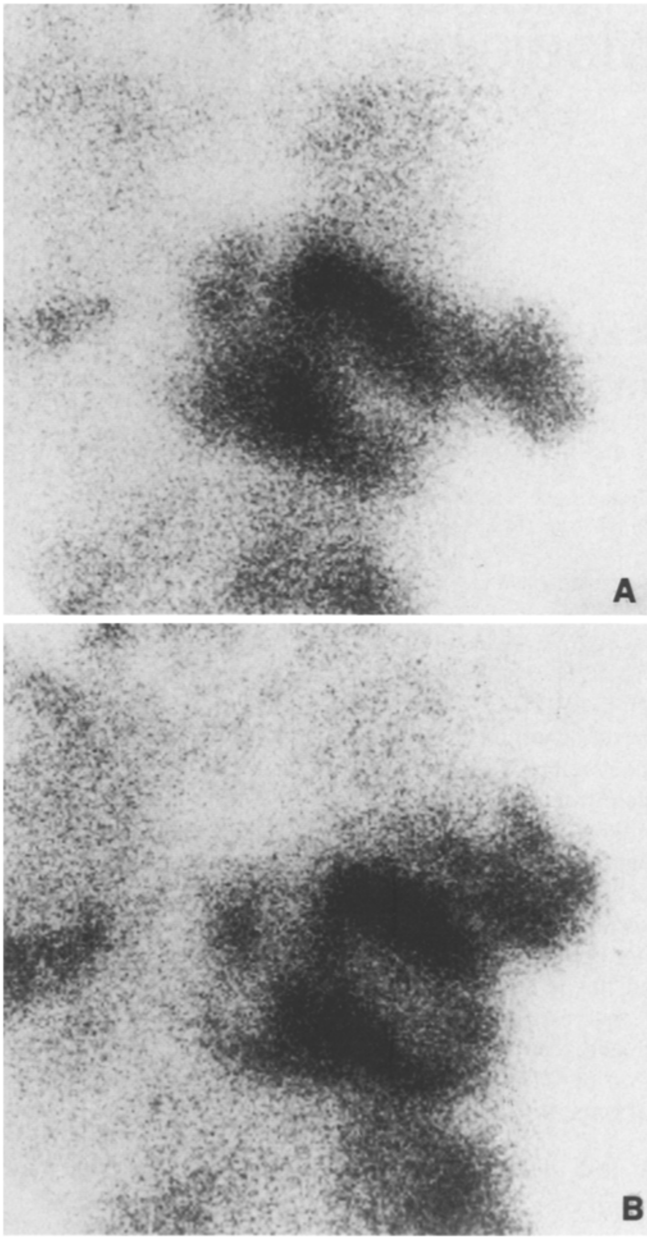

Fig. 2. A Anterior chest image 3 h after injection shows intense uptake of radioactivity in the breast close to the myocardium. **B** After emptying both breasts, activity in the breasts remains virtually unchanged

Assuming a milk intake of 850 ml divided over six feeds at the intervals of our milk samples, the total activity intake based on activity concentrations in Table 1 has been estimated to be 142 kBq, resulting in an EDE of 0.04 mSv, which is still far below the 1 mSv EDE limit.

These calculations confirm our earlier conclusion based on Romney's guidelines that no interruption of breast feeding was necessary.

It is interesting to compare these data with pertechnetate concentrations in milk. Ahlgren et al. (1985) reports that 10.8% of the injected dose of 115 MBq $^{99m}TcO_4^-$ was excreted in milk. We have found in one patient (unpublished data) that 11.1% of the injected dose, or 9.12 MBq, was measured in 706 ml of milk. Even without volume corrections, these figures lead to EDEs of 3.48 mSv and 2.55 mSv, respectively. These figures contrast strongly with our measurements of ^{99m}Tc-MIBI in milk.

In Fig. 2a the anterior chest image 3 h after injection is shown with intense uptake of radioactivity in the breast close to the myocardium. Immediately after completion of the scintigrams, both breasts were emptied (85 ml milk obtained), and another anterior chest image was obtained. This, however, did not show less activity (Fig. 2b). (A comparison of counts per pixel confirmed this visual impression.) Apparently ^{99m}Tc-MIBI is concentrated in lactating breasts, although only a small percentage of the compound is actually excreted in the milk.

As Rose et al. (1990) rightly mention, the close contact dose to the child should also be considered in estimating the total absorbed dose. This has been shown to be <1 μSv/MBq for several technetium 99m radiopharmaceuticals (Mountford 1987). Assuming that the close contact dose to an infant from ^{99m}Tc-MIBI is comparable with that from ^{99m}Tc bone agents, a dose of approximately 0.2 mSv should be added to the calculated dose for ingested activity. In the case of ^{99m}Tc-MIBI it appears that the EDE from close contact exceeds that from ingestion of breast milk.

Advice to nursing mothers following the injection of radiopharmaceuticals should be carefully considered for each individual patient. Mountford and Coakley (1986) are of the opinion that an interruption in feeding of 4 h, even when the possible ingested dose does not really necessitate it, may provide some reassurance to the mother. This recommendation can be applied to patients who have received ^{99m}Tc-MIBI. Limiting close contact between mother and child should also be considered. In our case the patient was a black woman with no knowledge of any language but her own, which led to difficulties in communication. For such a patient in a totally unfamiliar environment with limited understanding of all the procedures she was undergoing, we decided not to limit close contact time formally. Her absences from the ward for diagnostic procedures and the loving attention paid to the child by the nursing staff resulted in fairly limited close contact on the day of radionuclide administration. In such a situation, the emotional trauma of enforced separation of mother and child, which is ill understood, should be weighed against the very low radiation risk to the infant.

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References

Ahlgren L, Ivarsson S, Johansson L, Mattson S, Nosslin B (1985) Excretion of radionuclides in human breast milk after the administration of radiopharmaceuticals. J Nucl Med 26:1085–1090

Lentner C (ed) (1981) Geigy scientific tables, vol 1, 8th edn. Ciba Geigy, Basel

Miller H, Weetch RS (1955) The excretion of radioactive iodine in human milk. Lancet 269(II):1013

Mountford PJ (1987) Estimation of close contact dose to young infants from surface dose rates on radioactive adults. Nucl Med Commun 8:856–863

Mountford PJ, Coakley AJ (1986) The radiation dose to an infant following maternal radiopharmaceutical administration. Br J Radiol 59:957–958

Mountford PJ, Coakley AJ (1989) A review of the secretion of radioactivity in human breast milk: data, quantitative analysis and recommendations. Nucl Med Commun 10:15–27

Pittard WB, Bill K, Fletcher BD (1979) Excretion of technetium in human milk. J Pediatr 94:605–607

Pittard WB, Merkatz R, Fletcher BD (1982) Radioactive excretion in human milk following administration of technetium Tc-99m macroaggregated albumin. Pediatrics 70:231–234

Romney BM, Nickoloff EL, Esser PD, Alderson PO (1986) Radionuclide administration to nursing mothers: mathematically derived guidelines. Radiology 160:549–554

Rose MJ, Prescott MC, Herman KJ (1990) Excretion of iodine-123-hippuran, technetium-99m-red blood cells, and technetium-99m-macroaggregated albumin into breast milk. J Nucl Med 31:978–984

World Health Organization (1985) The quantity and quality of breast milk. WHO, Geneva