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SECRETION OF $^{99}Tc^{m}$ IN BREAST MILK AFTER INTRAVENOUS INJECTION OF MARKED MACROAGGREGATED ALBUMIN

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The administration of radiopharmaceuticals to women during lactation involves a risk that a breast-feeding child may be exposed to radiation due to activity secreted in the milk.

In a recent case the question arose as to whether a nursing mother who was subjected to a lung scan with technetium-marked albumin should interrupt breast feeding to her 3-month-old child and, if so, for how long.

The 26-year-old patient was referred for a lung scan because of possible lung embolism. The patient received approximately 74 MBq (2 mCi) of $^{99}Tc^{m}$ macroaggregated albumin intravenously. She was advised to interrupt breast-feeding and she was requested to pump out milk at the times when feeding normally took place and to send milk samples for analysis.

Methods

The $^{99}Tc^{m}$ activity was measured in a NaI (Tl) $3'' \times 3''$ (7.62×7.62 cm) well crystal connected to a multi-channel analyser. The calibration constant used had been obtained with a previous calibration with a $^{99}Tc^{m}$ solution. The smallest detectable quantity 3σ above background was 90 Bq/10 ml (2.4 pCi/10 ml) for a 30 min measurement.

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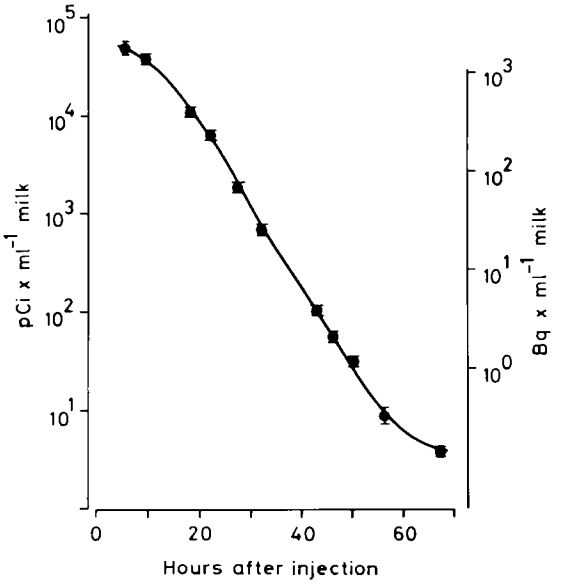

Fig. 1. $^{99}Tc^m$ concentration in breast milk expressed in mCi/ml and Bq/ml of milk 5.5–67.5 h after intravenous injection of approximately 74 MBq (2 mCi) of $^{99}Tc^m$ macroaggregated albumin. The errors in the counting statistics and the uncertainties in the time specifications have been given ($\pm 1\ \sigma$).

Results

The results of the measurements of the $^{99}Tc^m$ concentration in 11 milk samples taken between 6 and 68 h after the injection appear in Fig. 1. Apart from some deviations at the beginning and end of the observation period, the concentration diminished almost exponentially with an effective half-life of 4 hours. The physical half-life of 6 was therefore the dominant effect.

The measurement values corrected for the physical decay and expressed as fractions of the administered activity show this deviation clearly (Fig. 2). With this presentation the maximum technetium concentration in the milk is found 15 h after the $^{99}Tc^m$ injection. Towards the end of the observation period the rate of secretion levels out. The results show the biologic half-life to be approximately 10 h.

Discussion and Conclusions

Reports in recent years have appeared on the secretion of activity in breast milk after the administration of $^{99}Tc^m$ to a nursing mother (VAGENAKIS et coll. 1971, BERKE et coll. 1973, WYBURN 1973, CARMODY & HIGHMAN 1975, O'CONNEL & SUTTON 1976). However, only one of these reports (BERKE et coll.) deals with the $^{99}Tc^m$ macroaggregated albumin which was used in this case. That report also refers to whole-body measurements of five children after injection of $^{99}Tc^m$ for brain scanning, resulting in an estimated whole-body dose of 22 μGy/MBq (0.81 mrad/μCi) to a 6-month-old child. According to HINE & JOHNSON (1970) the corresponding value for adults is 3–5 μGy/MBq (0.01–0.02 mrad/μCi). On the basis of these values the radiation dose to the 3-month-old child has been estimated to be 43 μGy/MBq (0.16 mrad/μCi). (1 mCi = 37 MBq, 1 mrad = 0.01 mGy = 10 μGy, 1 mrad/μCi $\simeq$ 270

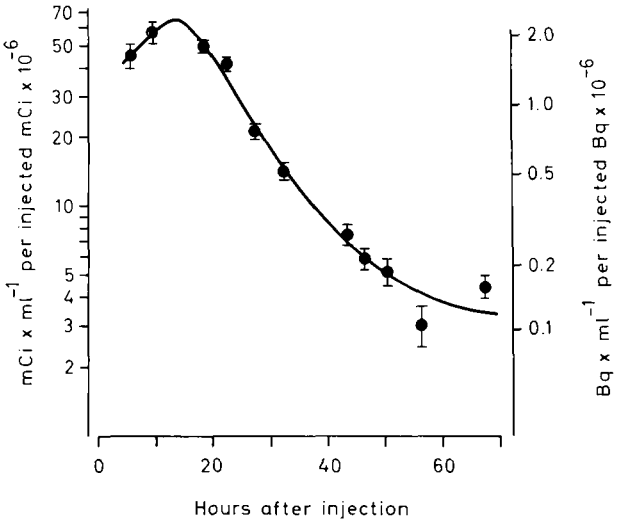

Fig. 2. $^{99}Tc^{m}$ concentration in breast milk related to the injected activity, corrected for the physical decay, 5.5 to 67.5 h after injection. The errors have been shown $\pm 1\sigma$ for the uncertainty in the counting statistics and for the uncertainty in the time specifications for the injection and sampling.

μGy/MBq.) If the child had drunk 150 ml milk/meal it would have accumulated a whole-body dose from the milk varying from 26–0.001 μGy (2.6–0.0001 mrad) (Table), if breast feeding had been resumed at the various times during the observation period shown in the Table. In addition, the child is exposed to external radiation from the mother. This dose is comparable to that obtained from the milk.

The magnitude of the radiation dose is so small that the risk to the child can be regarded as negligible even if the mother had continued breast feeding immediately after the lung scan. In the present case the mother resumed breast feeding 24 hours after the lung scan.

Table

Estimated absorbed dose in the child from breast milk

Hours	Cumulative absorbed dose in total body of the child	
	μGy	mrad
If feeding begun:		
5.5 after injection	26	2.6
9.5 „	14	1.4
18.5 „	5.0	0.50
22.5 „	2.2	0.22
27.5 „	0.64	0.064
32.5 „	0.20	0.020
43.5 „	0.048	0.0048
46.5 „	0.024	0.0024
50.5 „	0.010	0.0010
56.5 „	0.004	0.0004
67.5 „	0.001	0.0001

SUMMARY

A nursing mother received $^{99}Tc^{m}$-macroaggregated albumin intravenously for a lung scan. Milk was pumped out at the times when feeding normally took place for three days and the activity was determined. The $^{99}Tc^{m}$ concentration diminished almost exponentially with an effective half-life of about 4 h. The radiation dose (26–0.001 μGy) was estimated to be so small that the risk to the child may be regarded as negligible.

ZUSAMMENFASSUNG

Während der Laktation erhielt eine Frau $^{99}Tc^{m}$-Makroaggregat Albumin intravenös im Zusammenhang mit einem Lungen-Scan. Während drei Tagen wurde die Brustmilch zu den Zeitpunkten, an denen normalerweise das Kind genährt wurde, abgepumpt und deren Aktivität bestimmt. Die $^{99}Tc^{m}$-Konzentration fiel nahezu exponentiell mit einer effektiven Halbwertzeit von etwa 4 Stunden. Die berechnete Strahlendosis (26–0,001 μGy) war so gering, dass das Risiko für das Kind als zu vernachlässigend angesehen werden kann.

RÉSUMÉ

Une mère nourrissant son enfant au sein a reçu par voie intraveineuse des macroagrégats d'albumine marquée $^{99}Tc^{m}$ — pour une scintigraphie pulmonaire. Son lait a été prélevé aux heures où elle aurait normalement donné le sein pendant trois jours et la radioactivité a été déterminée. La concentration en $^{99}Tc^{m}$ a diminué presque exponentiellement avec une demi vie effective d'environ 4 heures. La dose de radiation (26–0,001 μGy) a été estimée si petite que les risques pour l'enfant peuvent être considérés comme négligeables.

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