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Iodine-131 Thyroid Uptake Results in Travelers Returning from Europe After the Chernobyl Accident

TO THE EDITOR: We read with great interest the recent paper of Castronovo (*1*) reporting the results of thyroid screening measurements for iodine-131 (^{131}I) and corresponding dose assessment for 58 travelers returning from Europe to America after the Chernobyl accident. However, the results relating to the assessment of ^{131}I content in the fetal thyroids (Persons 9 and 16) and the calculation of the fetal thyroid doses do not seem to be correct.

In (*1*), Table 1, the author quoted the expression for f(t), the % of maternal ingested activity which was deposited in the fetal thyroid per gram of fetal thyroid as a function of gestational age +, in weeks. That expression should correspond to Eq. (3) from Reference (*2*) [Castronovo's reference (*8*)], namely:

$$f(t) = 5.43\,t - 0.453\,t^2 + 0.0203\,t^3 - 4.61E\text{-}04\,t^4 + 4.13E\text{-}06\,t^5 - 24.8$$

Evidently, the constant term "−24.8" was omitted and did not appear in Table 1. That resulted in a significant overestimation in f(t) for the above two pregnant travelers; the correct values in % per gram of fetal thyroid should be 5.01 and 3.76 instead of 29.81 and 28.56 (Table 5) (*1*), for Persons 9 and 16, respectively. Taking into account the mother's intake of ^{131}I, the correct values of the activities deposited per gram of fetal thyroid are 0.19 nCi (7 Bq) and 0.12 nCi (4.4 Bq) for Persons 9 and 16, respectively.

Regarding the fetal thyroid dose assessment, from Figure 4 (*2*), one finds the thyroid doses for fetal ages of 26 and 17 wk to be ~8.5 rad and 5 rad, respectively, per 1 μCi of ^{131}I deposited in the mother's thyroid. Consequently, for Persons 9 (fetal age 26 wk) and 16 (fetal age 17 wk) with mother's thyroid activities of 1.88 nCi (69.6 Bq) and 1.6 nCi (59.2 Bq), respectively, the fetal thyroid dose equivalents are equal to 16 mrem (160 μSv) and 8 mrem (80 μSv), which is different from the values 9.6 mrem (96 μSv) and 14.1 mrem (141 μSv) stated in Table 5 (*1*).

When dealing with human fetal thyroid dosimetry, one must be aware that many assumptions are always involved in metabolic modelling and calculations because of the lack of published data. Although, for this reason, large uncertainties in the results are expected, several authors (*2–4*) obtained the similar results: the estimated fetal thyroid dose equivalent for ^{131}I depends on the gestational age (13–40 weeks) and has a maximum in the range of 0.5–1.5 μSv/Bq intake by the mother.

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REPLY: I would like to thank Bašić, Kasal, Šimonović, and Jukić for alerting the scientific community of the omission of "−24.8" (Table 1) and the subsequent correction of the fetal thyroid dose equivalent (Table 5) in my manuscript.

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Measurement of Glomerular Filtration Rate with Technetium-99m DTPA: Comparison of Plasma Clearance Techniques

TO THE EDITOR: In the March 1987 issue of the Journal of Nuclear Medicine there is an article by Waller et al[1] based on their nice work comparing plasma clearance techniques for measurement of glomerular filtration with technetium-99m (^{99m}Tc) DTPA.

It seems that nobody knows our similar work on this subject that was accepted in the 21st International Annual Meeting of the Society of Nuclear Medicine Europe, Ulm/Neu-Ulm, Sept. 13–16, 1983 and published in *Nuclearmedizin.*[2]

This method is used daily in our clinical department, with similar results. Rather than assume *a priori* that the regression coefficient between clearances of chromium-51 (^{51}Cr) EDTA and [^{99m}Tc]DTPA is equal to 1, we obtained blood samples at 5, 10, 15, 20, 25, 30, 60, 90, 120, 150, 180, 210, 240 min postinjection. The results were then fitted to a biexponential with good correlation (two-pool assumption) (Cl_p).

For a simplified method with the two-plasma samples (one-

pool assumption), (Cl_f), we used the equation derived from the correlation of the two methods, and not the one for [^{51}Cr] EDTA by Brøchner-Mortensen. We found the parabolic equation to have a better correlation coefficient ($Cl_p = 2.46 + 0.85\ Cl_f - 0.0005\ Cl_f^2$, $r = 0.987$, $p < 0.001$) with a s.e.e. ± 4.71 but for simplicity in the daily routine we use the linear one $Cl_p = 6.14 + 0.75\ Cl_f$, $r = 0.986$ $p < 0.001$ with a s.e.e. ± 4.72.

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REPLY: We would like to thank Drs. Gotzamani-Psarrakos and Psarrakos for their comments and apologise for the lack of recognition of their work (*1*) of which we were unaware. We would further like to comment on the comparison between the regression equations derived for the correction of one-pool estimation of glomerular filtration rate (GFR) using EDTA (*2*) and diethylenetriaminepentaacetic acid (DTPA) (*1*). These equations provide an empirical estimate of true GFR (C_t) from the values obtained using the simplified one-pool technique (C_o). The comparison between the estimated true values from a range of one-pool values using the two quadratic regression equations is illustrated in Figure 1. The correction equations are shown to be similar, the r.m.s. difference between the estimated true GFR values over the range $C_t = 0$ to 150 ml/min being 2.73 ml/min. It is not immediately obvious whether this small difference is statistically significant. Using graphical estimation of the DTPA data values from reference (*1*), the residual errors given by the two curves shown in Figure 1 were compared using the chi-squared statistic. The EDTA equation gave a significantly higher residual error ($p < 0.001$), indicating that the two equations are different. There are two possible explanations for this difference: (a) that the compartmental dynamics of EDTA and DTPA differ slightly or (b) that differences in radiopharmaceutical purity or experimental technique have affected the results. In either case, for practical purposes, the difference between the two equations is considerably smaller than the experimental error on individual GFR measurements. Therefore, no important practical difference results from assuming the EDTA equation as we have done in the paper under discussion.

We note that neither the linear nor the quadratic correction equation proposed by Drs Gotzamani-Psarrakos and Psarrakos passes through the origin. Since it seems physically reasonable to constrain the correction equation to pass through the origin, we tried fitting their data to an equation of the form:

$$C_t = a\ C_o + b\ C_o^2.$$

Application of the chi-squared statistic showed that this fit gave residual errors that were not significantly different from the equations given by Drs Gotzamani-Psarrakos and Psarrakos, showing that a fitting equation with a non-zero intercept is not demanded by their data.

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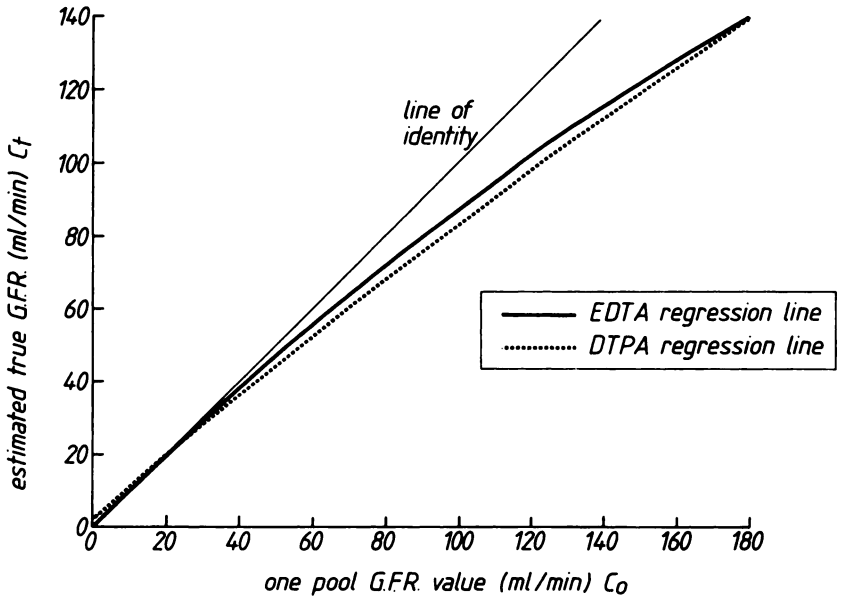

FIGURE 1
Graph showing the regression lines for the estimation of true GFR from the one-pool value for EDTA and DTPA