TABLE 2
Technetium-99m Thyroid Uptake in Patients with Hyperthyroidism

Patient no.	Sex	Age	15-min ^{99m}Tc thyroid uptake
1	F	45	40.94
2	M	23	40.44
3	F	42	37.55
4	M	42	36.49
5	F	38	30.46
6	F	55	29.50
7	F	44	26.30
8	F	51	26.00
9	F	29	16.20

roid patients: 29.99 ± 2.88 (s.e.m.) versus 4.81 ± 0.31 (s.e.m.), $p < 0.00.1$ using the Mann-Whitney U-test.

Since the patients were not pharmacologically suppressed (*3*), we fail to understand the recommendation to use ^{99m}Tc-MIBI when similar diagnostic information can be obtained with ^{99m}Tc-pertechnetate at less expense.

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Dosimetry of Technetium-94m-Teboroxime

TO THE EDITOR: We wish to comment on a few issues regarding a recent paper in the *Journal* by Nickles et al. (*1*)

- The use of "substitute" or "mock" S-values for internal dose calculations should be avoided. Although S-values are not published for all radionuclides that might be encountered in a study, calculating S-values from decay data and published absorbed fractions is straightforward. Alternatively, our center is happy to provide such information as needed. We recalculated many of the authors' estimates, using their residence times and S-values that we calculated from data in the recent MIRD decay data compilation (*2*) and absorbed fractions for the adult male phantom of Cristy and Eckerman (*3*). Our dose estimates were 0 to +75% different for ^{94}Tc, −24% to +8.5% different for ^{94m}Tc, −44% to +57% different for ^{95}Tc, +13% to +85% different for ^{95m}Tc, and +5.5% to +120% different for ^{96}Tc (Table 1). In almost all cases, our values were lower than those of Nickles et al. It is good that the published values are conservatively high, but the differences are significant in many cases, and this could have been avoided.
- The paper did not clearly show all of the residence times employed in the calculations. Although the authors stated that a remainder of the body residence time was calculated, it was not shown in the tables. Authors should *clearly* show all residence times and the methods used, if the results are to be useful to others.
- The authors neglected to calculate the radiation dose to the gallbladder wall, believing that it is small, but they did not explain how this was determined. They stated they had used the *ICRP 30* tract model (*4*), but this model does not include a liver or gallbladder. The gallbladder is a relatively small organ and can receive a significant radiation dose with even a relatively small residence time.

Table 1
Comparison of Dose Estimate Values by Nickles et al. and RIDIC

Isotope	Organ	Residence Time (hr)†	Radiation dose* (mrad) Nickels et al.	RIDIC	% Difference‡
^{94}Tc	Liver	0.18	35	20	+75
	SI	0.18	49	33	+48
	ULI	0.21	57	44	+30
	LLI	0.15	51	40	+28
	Gonads (ovaries)	—	44	29	+52
	Marrow	—	17	17	0
	Remainder	4.62	—	—	—
^{94m}Tc	Liver	0.174	236	225	+4.9
	SI	0.084	212	223	−4.9
	ULI	0.024	157	154	+1.9
	LLI	0.002	64	59	+8.5
	Gonads (ovaries)	—	52	68	−24
	Marrow	—	52	61	−15
	Remainder	1.06	—	—	—
^{95}Tc	Liver	0.18	55	35	+57
	SI	0.5	94	78	+21
	ULI	1.17	125	105	+19
	LLI	1.18	133	120	+11
	Gonads (ovaries)	—	45	80	−44
	Marrow	—	50	46	+8.7
	Remainder	24.5	—	—	—
^{95m}Tc	Liver	0.125	15	8.1	+85
	SI	0.0625	17	14	+21
	ULI	2.5	17	12	+42
	LLI	5.0	17	15	+13
	Gonads (ovaries)	—	17	15	+13
	Marrow	—	17	13	+31
	Remainder	1800	—	—	—
^{96}Tc	Liver	0.182	409	186	+120
	SI	0.545	552	379	+46
	ULI	1.78	630	408	+54
	LLI	2.75	752	511	+47
	Gonads (ovaries)	—	425	403	+5.5
	Marrow	—	343	273	+26
	Remainder	118	—	—	—

* Radiation dose from amounts of isotope assumed to appear with 1 mCi of ^{94m}Tc (100 μCi ^{94}Tc, 170 μCi ^{95}Tc, 0.8 μCi ^{95m}Tc, 77 μCi ^{96}Tc).
† Residence time as stated in Nickles et al (*1*).
‡ % difference of Nickles et al. from RIDIC.

- The authors did not seem to employ the remainder of the body residence time correction (*5*) in their dose calculations.

We are concerned, as we have been in the past, that dosimetry articles are not always receiving a sufficiently rigorous review process. The problems described here do not seriously affect the validity of the paper, but involve very well known procedures and literature and should have been addressed during the review process.

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REPLY: We appreciate the thoughtful comments by the ORISE group concerning dosimetry corrections to our recent paper (*1*). The dosimetry calculations were a small, but necessary, aspect of that paper and faced the following obstacles:

1. At the time of publication, no S-factors or absorbed dose fractions were available for any of the cyclotron-produced technetium isotopes, forcing us to do a first-order ("mock-Tc") estimation based on simple continuity arguments. Comparison of our S-values to those kindly provided by the ORISE group last month show very good agreement, to within 10%.

2. The origin of the dosimetry differences arise from differing approaches to the kinetics of the technetium agents. As stated in the paper, the ICRP gastrointestinal model was run as a STELLA (High Performance Software, Lyme, NH) program, directly resulting in the time course of the activity a(t), and its direct numerical integral A(t), the cumulative activity of each technetium isotope in each source organ. With this approach, we can avoid the use of "residence time," $\tau = \int A(t)dt/A_0$, that suggests instantaneous delivery to downstream gastrointestinal compartments.

With conservative first-order dose estimates in hand, IRB approval was granted, and our initial PET imaging studies provided quantitative human data for the transport kinetics of Tc-teboroxime. In particular, the liver acts as a major node point, filtering the bloodborne agent and releasing it into the gastrointestinal tract through the gallbladder, which briefly peaks at about 30 min in the lower slices of some studies.

3. The dosimetry becomes straightforward when pure ^{94m}Tc + ^{94}Tc is made from enriched ^{94}Mo, as we are doing now (*1-4*). This makes our published labors an historical anecdote.

Our first-order approximations, and the second-order corrections, properly pointed out by the ORISE group, serve to stress the importance of using real, data-driven kinetics as the basis for any dosimetry calculation. Now with whole-body PET and pure ^{94m}Tc agents at hand, a voxel-by-voxel "dose image"(*5*) is almost within reach. By using the transmission images for density and attenuation and the quantitative emission images of the actual biodistribution as the source kernel, a realistic photon transport calculation would result in an adsorbed dose distribution image without the need of any approximations. Such an advance will be welcome, particularly in the area of radionuclide therapy, where tracer ^{82}Sr could follow the deposition of ^{89}Sr (Metastron) to provide a rational strategy for the administration of that promising agent.

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Mickey Mouse Sign in Paget's Disease

TO THE EDITOR: The authors of the clinicopathological conference on Paget's disease in a patient with breast cancer (*J Nucl Med* 1993;34:1214–1216) described the finding of the "Mickey Mouse sign" in the vertebrae on bone scintigraphy of patients with Paget's disease. They mention that this sign has not been described previously.

I wish to draw your attention to the fact that my group has already described this finding in 1989 in an article appearing in the *South African Medical Journal* (*S Afr Med J* 1989;75:280–283). An illustration of the finding can be found on page 283 of our article. We informally dubbed this sign, caused by increased uptake of the radiopharmaceutical in the vertebral body and spinous process, the "T-sign" or "champagne glass" sign.

Our study was performed to investigate the value of pinhole scintigraphy in the evaluation of vertebral pathology of diverse etiology. Of the 58 patients in our study group, four had Paget's disease, all of whom exhibited this sign. We have subsequently noticed this sign in numerous patients with this disease.

The finding of the Philadelphia group supports our own conclusion that this sign appears to be very specific for Paget's disease of the vertebrae.

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