Misleading Figure of Focal Activity in the Liver

TO THE EDITOR: I read with great interest the article by Rubin et al. (*1*) in the April issue of the *Journal*. The importance of radionuclide imaging for the diagnosis of hepatic lesions was well presented, although only a brief mention was made on the ability of SPECT to increase sensitivity. I believe this deserves much more emphasis because SPECT can detect focal abnormalities of the liver even though the planar scan is normal or inconclusive (*2*). My main concern about the Rubin et al. article is the confusion regarding Figure 4, which demonstrates a ^{99m}Tc-sulfur colloid anterior planar scan. This high quality scan shows inhomogeneous distribution of activity in the liver, but is described in the figure legends as a coronal SPECT scan showing a focal area of increased activity in the anterior aspect of the lateral segment of the left lobe of the liver. This is misleading.

REFERENCES

1. Rubin RA, Lichtenstein GR, Alavi A. Hepatic scintigraphy in the evaluation of solitary solid liver masses. *J Nucl Med* 1993;34:697–705.
2. Aktolun C, Bayhan H. Detection of focal nodular hyperplasia with liver colloid single photon emission computed tomography: a case report and review of the literature. *Br J Radiol* 1991;64:64–66.

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REPLY: We appreciate Dr. Aktolun's comments regarding the ability of SPECT to enhance the sensitivity of radionuclide imaging for the diagnosis of hepatic lesions. In this particular case report, SPECT in fact confirmed the left lobe lesion seen initially on ultrasound and ^{99m}Tc-labeled sulfur collid scan. Unfortunately, as was discussed, for diminutive lesions (especially those smaller than 1–2 cm), the improved sensitivity of SPECT may be accompanied by some loss of specificity.

We apologize for the confusion concerning the labeling of the radiologic images. Figures 1, 2 and 3 show the ultrasound, CT portogram and coronal T2-weighted MR image of the hepatic lesion, respectively. Figure 4 demonstrates a ^{99m}Tc-labeled sulfur collid scan showing increased activity with a photopernic center in the anterior aspect of the left lateral lobe, corresponding to the hepatic adenoma.

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The Ambulatory Renal Monitor

TO THE EDITOR: I was impressed by the quality of the data reported recently in the *JNM* by Rabito et al. (*1*) using their renal ambulatory monitor (ARM) to measure glomerular filtration rate (GFR). Their paper substantiates earlier reports of measuring GFR by external scintillation probe counting and a single timed blood sample to calibrate the probe count rate in units of MBq of injected tracer (*2,3*). This paper is timely in that it coincides with a recent suggestion by Peters (*4*) [following the much earlier one by Brochner-Mortensen (*5*)] that instead of normalizing an absolute value of GFR for body surface area (BSA), the measurement of GFR as a rate constant should be left as such, since the rate constant closely approximates the ratio, GFR to extracellular fluid volume (ECV), or in other words, GFR normalized for ECV (as opposed to BSA). This suggestion gains support from the paper of Rabito et al., whose gold standard, iothalamate clearance, correlated very closely with the rate constant recorded by ARM when it was normalized for BSA but not so well without normalization for BSA, implying that the rate constant itself does not require normalization—it already represents normalized GFR.

In their paper, Rabito et al. perhaps did not sufficiently stress this important aspect of their work, even though they argued that the rate constant is equal to the ratio, GFR:V_1, where V_1 is the volume of the extracellular fluid (ECF) space, or more precisely, the *virtual* volume. Although GFR:ECV is close to the rate constant, it is not identical to it. Thus, because after equilibration of tracer between plasma and interstitial fluid, a concentration difference exists between the two, it is not true to say that the quantity of tracer in the ECF is equal to the product of ECF concentration and ECV. It was pointed out by Ladegaard-Pedersen several years ago (*6*), that for a tracer which gives a bi-exponential plasma clearance curve, the mean transit time, T, of the tracer through its distribution volume, the ECF in the case of ^{99m}Tc-DTPA, is equal to:

$$\frac{\frac{A}{\alpha_1^2}+\frac{B}{\alpha_2^2}}{\frac{A}{\alpha_1}+\frac{B}{\alpha_2}},$$

where A and B are the zero time intercepts of the two exponentials and α_1 and α_2 their respective rate constants. α_2 is the rate constant recorded by ARM. The relationship between 1/T and α_2 is nonlinear (*4*). It is analogous to the relationship between GFR calculated from both exponentials of the plasma clearance curve and approximate GFR based only on the second exponential, a relationship that several authors have attempted to quantify for the purpose of converting GFR approximated in this way to true GFR (*7,8*). Similarly, one can use the relationship between 1/T and α_2 to convert α_2 to GFR/ECV (*4*).

A surprising finding in Rabito's paper is the achievement of a monoexponential decrease in ARM counts from as early as 15 min after injection. The ARM simultaneously detects counts in the plasma and interstitial fluid compartments and should give a monoexponentially decreasing count rate (with rate constant α_2) only after complete mixing of the tracer has occurred between these two compartments. Once mixing is complete, the relative size of the two compartments within the ARM's field of view becomes irrelevant. It is well known to those who routinely measure GFR from multiple blood sampling that the ^{99m}Tc-DTPA plasma clearance curve does not reach its terminal exponential until 1–2 hr after injection. It is difficult to explain how the ARM produces a monoexponential curve within 15 min.

Rabito et al. have made a valuable contribution with their resurrection of a relatively old technique, although the full impact