

Procedures of Choice in Renal Nuclear Medicine

TO THE EDITOR: In a recent paper written by Blafox (1) on the procedures of choice in renal nuclear medicine, it was said that "in many areas there may be a lack of consensus."

As a matter of fact, it is probably in the field of uronephrology that the greatest number of different views, methods, and algorithms are encountered in nuclear medicine and it is certainly to the author's credit to have presented a comprehensive synthesis in this field.

There is, however, one point on which it is, in our opinion, impossible to agree, namely, the problem of background correction.

The author considers that background correction is unnecessary for the evaluation of individual renal function. This is based on two arguments:

1. There is no way to choose the true background because it is not known where the true background region is. As a matter of fact, although there is no area that perfectly represents the intrarenal background, much work has been done recently to understand and to evaluate separately the different components of renal background and there is currently a consensus about the way this background should be evaluated (2-8).
2. Background correction is responsible for an important variability in the clearance estimation when the test is repeated in the same patient. The reproducibility of the measurements should be better when no background correction is applied, in case of relative good function. In our opinion, this is not true. Particularly for ^{99m}Tc -DTPA, the background component during the second minute of the renogram is important and can easily represent 50%-80% of the total non-corrected renal activity (6). That means that if the integral method is used without background correction the "individual renal function" will increase or decrease simply because the renal area includes more or less pixels. There is no way to reproduce exactly the renal regions of interest when repeating a test in the same patient. Moreover, since the background component represents the main part of the activity included in the renal field of view, it is clear that moderate variations of the clearance will be completely masked by the background component. One can hope, by using a radionuclide test for the evaluation of the renal function, to be able to recognize changes in this function and not simply to be satisfied with a "reproducible test."

In conclusion, we do not agree with the author's opinion that background correction "introduces more problems than it solves."

REFERENCES

1. Blafox MD. Procedures of choice in renal nuclear medicine. *J Nucl Med* 1991;32:1301-1309.
2. Rutland MD. A comprehensive analysis of renal DTPA studies. Theory and normal values. *Nucl Med Commun* 1985;6:11-30.
3. Russel CD. Estimation of glomerular filtration rate using ^{99m}Tc -DTPA and the gamma camera. *Eur J Nucl Med* 1987;12:548-552.
4. Peters AM. Quantification of renal haemodynamics with radionuclides. *Eur J Nucl Med* 1991;18:274-286.
5. Piepsz A, Dobbeleir A, Ham HR. Effect of background correction on separate Tc-99m-DTPA renal clearance. *J Nucl Med* 1990;31:430-435.
6. Decostre P, Salmon Y. Temporal behaviour of peripheral organ distribu-

tion volume in mamillary systems. Application to background correction in separate glomerular filtration rate estimation in man. *J Nucl Med* 1990;31:1710-1716.

7. Tondeur M, Piepsz A, Dobbeleir A, Ham HR. Tc-99m-MAG3 gamma camera clearance calculations: methodological problems. *Eur J Nucl Med* 1991;18:83-86.
8. Granerus G, Moonen M. Effects of extra-renal background subtraction and kidney depth correction in the measurement of GFR by gamma camera renography. *Nucl Med Commun* 1991;12:519-527.

**P. Decostre
Y. Salmon**

*Hôpital Civil de Jumet
Jumet, Belgium*

**H.R. Ham
A. Piepsz**

*Hôpital Saint Pierre
Brussels, Belgium*

REPLY: I appreciate the comments of Drs. Decostre, Salmon, Ham and Piepsz. I do not believe that there is any real disagreement between us, but rather that the authors of the letter have misinterpreted my statements concerning background correction. In fact, the quotation in their letter is a rearrangement of the wording in my article. I wrote "it is not known what the best background region is, and there probably is no way to choose the true background." I am familiar with the authors' work which is prominently quoted near that statement. Unfortunately, a typographical error in the reference assigns it to the year 1989, when in fact it should be 1990. The remainder of my statement that in patients with relatively good levels of renal function, the integral method is reproducible without background subtraction, is simply a statement of the author's personal experience and may or may not be at variance with the experience of others.

There certainly is no disagreement that in patients with significant impairment of renal function, background represents a very high proportion of the total renal activity. The problem lies in choosing the true background. I will stand by my statement that it is virtually impossible, short of removing the kidney, to determine the true background contribution in any given individual at any given time. Although Dr. Decostre et al. argue that a simple change in the area chosen to represent renal function will lead to a significant change in the apparent measurement because of the inability to exactly reproduce these regions, so too does the background contribution change as regions of interest change and so too does the relative contribution of background to the total renal function. Once again, the authors misquote me in their conclusion since it has quite a different meaning to say that background correction "introduces more problems than it solves" than to say what was actually stated in the text "our study suggests that the use of background subtraction introduces more problems than it solves at relatively good levels of renal function."

Dr. Decostre et al. state that in patients with good renal function, background during the second minute of the DTPA renogram easily represents 50%-80% of the total non-corrected renal activity. In our experience background in 42 patients with a mean GFR of 118 ml/min averaged $53\% \pm 8\%$, with a range of 39-84. In patients with impaired renal function, the background is higher. It should be stressed that what all of us are calling background is the relative count rates in the regions of interest chosen. The error in this operation is very great and the subtraction of larger background correction from total counts

introduces additional errors due to statistical noise. This probably worsens accuracy rather than improving it. Dr. Decostre et al. underestimate the importance of a reproducible test. It is true the purpose of the test is to recognize changes in renal function, but one cannot recognize a change in renal function unless one has a reproducible test so that a change in function would represent a true change rather than simply a statistical variance. Dr. Decostre et al. have published the statement "One can only hope by choosing a ROI which is a compromise between the different structures, to approximate the true background" (1). Another important difference which may affect our differing conclusions is that we use the camera technique only to estimate relative renal function and depend on blood sampling for an absolute value. Dr. Decostre et al. use a technique which also employs the externally derived blood disappearance curve. I stand by my statement that we have not yet learned what the true background is nor the best way to deal with it. I believe that the approach suggested by Dr. Piepsz et al. is promising, but it still requires broader application and confirmation as stated in my review.

REFERENCES

1. Piepsz A, Dobbeleir A, Ham HR. Effect of background correction on separate technetium-99m-DTPA renal clearance. *J Nucl Med* 1990;31:430-435.

M. Donald Blaufox

Albert Einstein College of Medicine
Bronx, New York

Breakage of Technetium-99m-Sestamibi Vial with the Use of a Microwave Oven

TO THE EDITOR: A microwave oven heating method was first proposed by Gagnon et al. (1) as an alternative heating technique to prepare ^{99m}Tc -sestamibi. We have confirmed that it takes 10 sec heating time in a microwave oven to label ^{99m}Tc -sestamibi maintaining an average radiochemical purity (RCP) of 97% over the 24-hr storage period (2). Based upon the report of Gagnon et al. (1) and our previous observations (2), we believe that the microwave oven heating method is a rapid and reliable way to make ^{99m}Tc -sestamibi available for either routine or emergency use. However, two recent incidents of breakage of ^{99m}Tc -sestamibi vials during the microwave heating process prompt us to caution the nuclear medicine community on adopting this new method. The consequences of such an "accident" are not only very costly (averaging \$300 per vial) but could also delay and jeopardize patient care, especially in emergency cases, due to contamination of the microwave oven, which is rendered unsuitable for use. Two out of 84 ^{99m}Tc -sestamibi vials have been broken since we began utilizing a microwave oven to prepare ^{99m}Tc -sestamibi for clinical studies. Although the incidence rate ($2/84 = 2.38\%$) is not very high for any individual institution, it does pose a much more serious problem when a similar "accident" rate is applied to the nuclear medicine community nationwide or even worldwide.

Two vials of ^{99m}Tc -sestamibi burst while being heated in a commercial microwave oven (Fig. 1). In both instances, the labeling procedures for ^{99m}Tc -sestamibi using a microwave oven heating method that we described previously (2) were carefully followed. As shown in Figure 1, both vials were broken from the

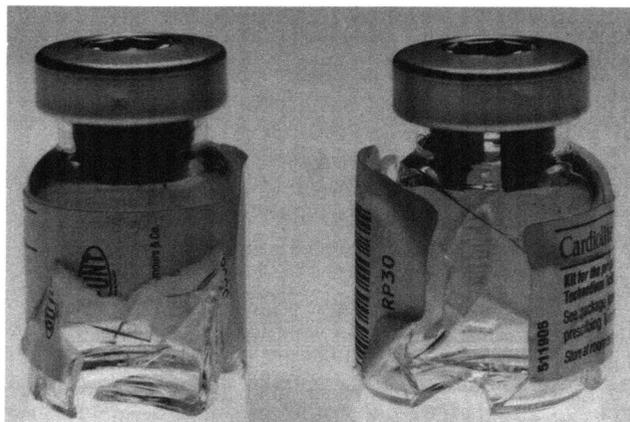


FIGURE 1. Two shattered vials of ^{99m}Tc -sestamibi prepared with the microwave oven heating method.

side wall and the base, while the vial top including the metal cap and rubber stopper remained intact. Previous experiments indicate that excessive pressure may build up inside the vial and can cause ejection of the rubber stopper if the vial is not vacuummed (2). After carefully examining the broken vials, we noticed that both bases of the vials of the Cardiolute® (E. I. du Pont de Nemours & Co., N. Billerica, MA) kits were much thinner than the ones that we had previously used (2) (Fig. 2).

Table 1 presents the average measurement of the empty vial weight (without the metal cap and rubber stopper) and the thickness of the vial's thinnest portion for two different types of Cardiolute® kits (i.e., black and red labels where the lot numbers were imprinted). The black-label kits were the same type of vials that we had used for evaluating the microwave oven heating process (2), and the red-label Cardiolute® kits were utilized to prepare ^{99m}Tc -sestamibi for patient studies. Table 1 indicates that there were not only major differences between the weights of each type of vial (difference = 0.43 ± 0.05 g, $p < 0.001$), but there was also a noticeable 1.5-fold difference ($p < 0.001$) in thickness of

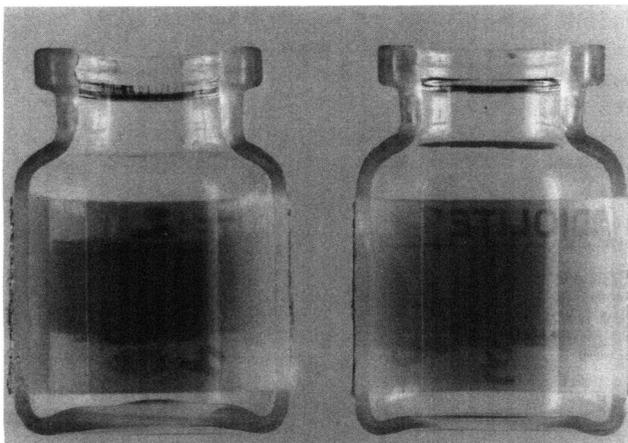


FIGURE 2. Cross-section view of two Cardiolute® kits: a black-label vial (left) and a red-label vial (right). There is a significant difference in the base thickness between the two types of vials.