Single Sample GFR Assessment

TO THE EDITOR: In your recent and very welcome Report of the Radionuclides in Nephrourology Committee on Renal Clearance (*1*), you were kind enough to recommend the method of Christensen and Groth (*2*), as simplified by Watson (*3*), as the method of choice for routine single sample GFR assessment. As presented in the report, the method was constrained to apply only to blood samples taken at exactly 3, 4 or 5 hr. In clinical practice, it is often impossible to take the blood samples at exactly the right time and so the method has been extended to apply to any time between 3 and 5 hr (*4*). All that is required is to replace the values of a and b in Equation 3 of the above report by:

$$a = t(0.0000017t - 0.0012)$$

and

$$b = t(1.31 - 0.000775t),$$

where t is the time in minutes between dose injection and blood sampling. With this modification, the method becomes much easier to use in clinical practice as the formulae for a and b can be incorporated into a simple computer program to calculate the clearance for a given sample time.

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Advertising Nuclear Medicine

TO THE EDITOR: In a recent *JNM Newsline* article entitled "Sports Nuclear Medicine: An Emerging Field" by Deborah Kotz (*J Nucl Med* 1996;37:17N–23N), Kotz described the role of the bone scan in diagnosing athletic injuries. Furthermore, by using several case reports, she compared this nuclear medicine procedure with anatomical imaging modalities, such as CT and MRI. In her article she also acknowledges that the use of bone scintigraphy on athletes is not new: "For the past two decades, nuclear physicians have been performing bone scans on athletes. . . " Despite many years of clinical experience, why then is sports nuclear medicine still being considered an emerging field? The article mentioned the lack of anatomical resolution as being the bone scan's major clinical drawback and the main reason for not being used more often. However, I believe the main reason sports nuclear medicine is still an emerging field (despite vast clinical experiences) is that nuclear medicine physicians are not promoting it to our clinical colleagues. We have been improving our field with new and better radiopharmaceuticals and instrumentation, such as SPECT, but we have failed to tell the primary care physicians how we can help their patients. I recently attended a regional internal medicine conference and presented a lecture entitled, "Nuclear Medicine Imaging in Suspected Exercise-Induced Musculoskeletal Injuries." After the lecture ended, the general consensus among the attendees was that they learned more about musculoskeletal injuries in that hour than throughout their residencies. Furthermore, after this meeting many of the primary care physicians commented that they had not previously realized how helpful the "dark and unclear medicine specialty" could be in resolving certain diagnostic dilemma within their clinical practices.

I believe there are many things a nuclear medicine physician can do to export his useful medical concepts and diagnostic tools into other specialties. One of the ways we can compete and survive in this age of medical reform and containment is by (precisely) increasing our specialty's exposure. The following are a few suggestions of how we can both educate clinicians and advertise the nuclear medicine field to the clinical community:

1. We must increase our exposure locally by offering useful and clinically oriented lectures to our neighbor primary care physicians.
2. We must sponsor correlative imaging/disease conferences among the subspecialties that closely work with us. These include cardiology, endocrine, oncology and orthopedics. Comparing scan results with patients' outcomes is a way of increasing and maintaining our credibility within the other fields.
3. Large hospital-based nuclear medicine departments must actively participate in various academic activities such as morning reports and cancer conferences. (By being there, a nuclear medicine physician can give his expert opinion whenever a diagnostic dilemma arises and nuclear medicine can be of help.) In addition, we must volunteer to give basic clinically oriented nuclear medicine lectures to medical students and residents during their yearly general lecture series.
4. We must tell other non-nuclear medicine physicians about our clinically proven diagnostic and therapeutical tools by presenting more abstracts at their medical meetings and by publishing articles in several of their specialty journals.
5. Opening a web page in the Internet is another way of presenting nuclear medicine material to the clinician. Through it physicians around the world can quickly review cases and nuclear medicine notes without having to search in a medical library. In addition, clinicians will be able to ask any nuclear medicine questions by using the electronic mail option.
6. We must be always available, flexible and communicative in our practice when dealing with our referred patients.
7. None of the above recommendations will work if we do not strive to be true experts in our field.

The nuclear physicians' dream should consist of many fully developed and applicable nuclear medicine fields instead of having several chronically emerging fields. To reach this goal, we must work hard and let the clinician know about our specialty. Our image as a specialty needs to become the "light and clear medicine," instead of the "dark and unclear medicine."

The opinions or assertions contained herein are the private views of the author and are not to be constructed as official or as reflecting the views of the Department of the Army or the Department of Defense.

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Technetium-99m-Ethylenedicysteine: An Alternative Agent to Detect Renovascular Hypertension

TO THE EDITOR: The recent article by Taylor et al. (*1*) provides a useful overview of ACE inhibitor renography. The article describes several important aspects of captopril renography including radiopharmaceuticals used to detect renovascular hypertension. However, the authors did not mention captopril scintigraphy with ^{99m}Tc-ethylenedicysteine (EC) that we and others have recently reported to be useful in the detection and

follow-up of renovascular hypertension (*2–5*). The diagnostic criteria of EC captopril scintigraphy are similar to those of other tubular agents including ^{99m}Tc-MAG3. Worsening in renographic grade or visual evidence of parenchymal retention, after captopril intervention, compared to baseline scan suggests high probability for renal artery stenosis (Figs. 1-3). Increase in time-to-maximum activity, time-to-half-maximum activity and residual cortical activity values can be used as additional quantitative parameters. Both the same day and 2-day protocols can be used effectively to detect renal artery stenosis. In the last 2 yr, we have evaluated 72 patients with angiographic correlation. Twenty patients were found to have significant renal artery stenosis (>50%). Sensitivity and specificity of EC captopril test to detect renal artery stenosis were found to be 95% and 98%, respectively (*6*). We have observed false-positive results in patients with periarteritis nodosa who had normal renal arteries, but microanevrismas in small arteries. Currently, EC is the routine renal agent for captopril scintigraphy in our institution. The advantages of EC compared to ^{99m}Tc-DTPA is its better renal uptake in patients with poor renal function. The major advantage of EC over MAG3 is the easy labeling at room temperature and low hepatobiliary uptake. EC has also higher renal clearance compared to MAG3 (*7*).

A clinical study comparing EC with DTPA, which is still in progress, suggests in its initial results that they both have equal sensitivity to detect renal artery stenosis, but the results are more demonstrative and easy to interpret with EC. Although optimal radiopharmaceutical for ACE inhibitor renography remains to be determined, based on our experience, we believe EC captopril scintigraphy is a reliable and powerful technique to detect renovascular hypertension.

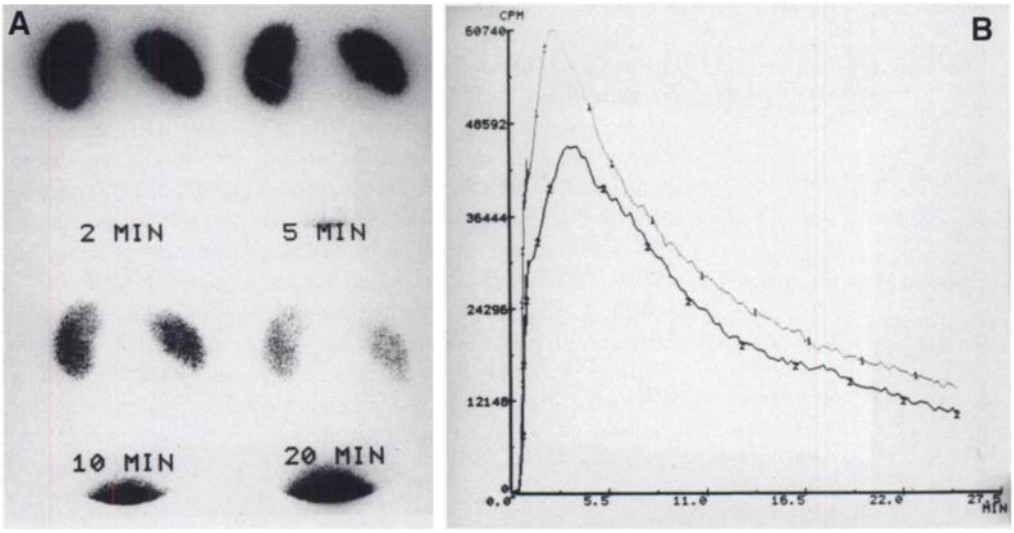

FIGURE 1. (A) Baseline renal scintigraphy and (B) renogram curves of both kidneys were normal.

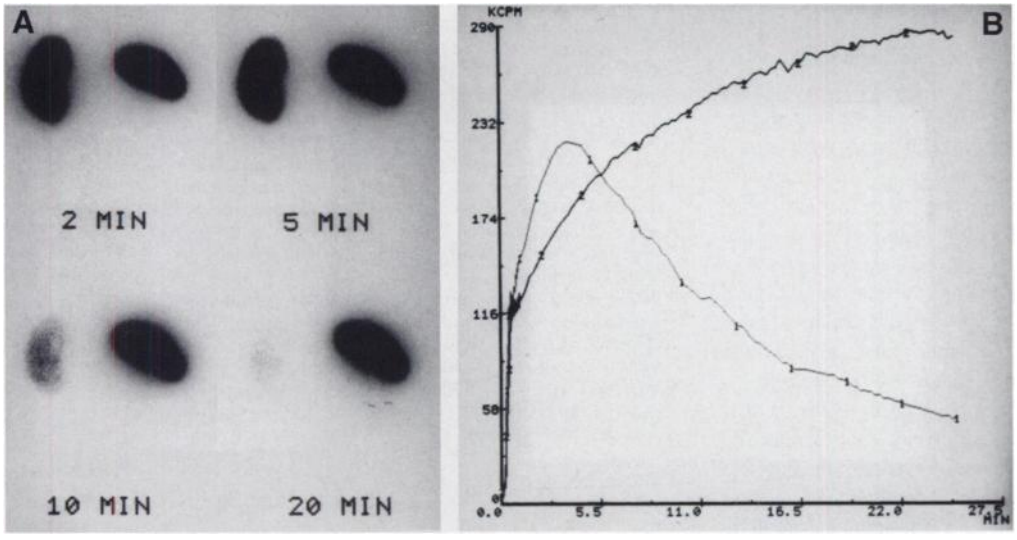

FIGURE 2. (A) Postcaptopril study revealed increased parenchymal retention and (B) rising type of renogram curve in right kidney.

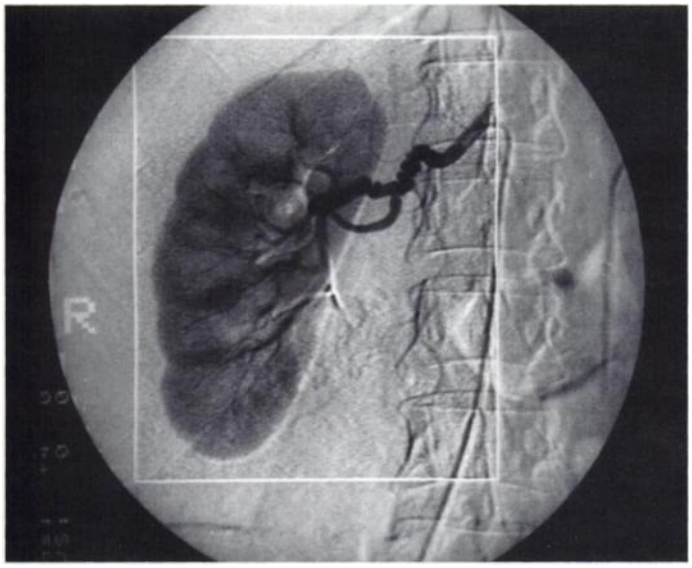

FIGURE 3. Angiography confirmed the scintigraphic findings by showing high grade renal artery stenosis in right kidney.

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Fractionated Cold-Kits: Address the Critical Issues to Obviate Problems

TO THE EDITOR: The recent letter on fractionated cold-kits by Decristoforo and Riccabona (*1*) was interesting. It was surprising to note the unexpected high rate of failure with fractionated MAG3 kit after storage for 6 days, especially when eluate from different generators were used.

We have been using fractionated MAG3 for the last 3 yr without a single incidence of failure. A whole MAG3 kit was reconstituted in 2.6 ml of saline for injection and fractionated into five aliquots (0.5 ml) in N_2-filled Amersham vials using 27 G insulin syringe. These vials were stored in −20°C freezer. The fractionated kits were reconstituted with 600–1300 MBq of ^{99m}Tc-pertechnetate in 1.5 ml saline (final volume 2.0 ml), boiled for 10 min and cooled for 15 min before use. The radiochemical purity was >96% on the day of fractionating or after storage at −20°C for 2 yr.

The rapid fall in the radiochemical purity from 97% to 63.6% ± 48% within 6 days of storage at −10°C was surprising as described by Decristoforo and Riccabona (*1*). The problem might be attributed to high volume of saline (2.5 ml) in the fractionated kit; 0.5 ml aliquots seem to offer better stability over a 2-yr period of storage. The arguments used by the authors regarding the higher amounts of dissolved oxygen oxidizing tin (II) is the major issue. The fractionation method using smaller reconstitution volume (0.5 ml of saline, preferably N_2-purged) and smaller gauge needles (27 G) would minimize the possibility of oxygen assimilation during storage and seem to offer better radiochemical purity (>90%).

Various methods were described to fractionate cold-kits such as HMPAO (*2,3*), MIBI (*4,5*), ECD (*6*), MAG3 (*7*) and Ultratag (*8*). The following factors are of considerable importance when kits are fractionated: (a) use a small volume to reconstitute the kit, the ideal volume for fractionation is 0.1–1.0 ml; (b) store in N_2-filled vials at temperatures at or below −20°C; and (c) use right amount of tin (II) augmentation where required. The resultant fractionated product seem to give radiochemical purity of >90% irrespective of the length of storage time. The underlying factor seem to be the preservation of an optimum concentration of tin (II) which plays a central role in the stability of technetium-labeled radiopharmaceuticals. The ligand concentrations seem to be present in adequate quantity in the whole kit or after fractionation.

In the case of HMPAO, concentration of tin (II) is a critical issue. It has only 7.6 μg tin (II) compared to 25 μg tin (II) present in MIBI kit. We fractionated HMPAO into five aliquots (0.1 ml) after stannous PYP augmentation. The fractionated kits after storage for 18 mo at −70°C seem to give radiochemical purity >90%; higher amounts of tin (II) interacts with HMPAO and produces secondary HMPAO after reconstituted with ^{99m}Tc-pertechnetate, whereas lower amounts of tin leads to free pertechnetate (*3*). A MIBI kit fractionated into five 0.5 or 1-ml aliquots in saline and stored frozen could be used after stannous augmentation (10–20 μg) after months of storage (*5*); up to 10 GBq of ^{99m}Tc-pertechnetate could be added per fractionated kit with radiochemical purity >96%. In our study, a whole MIBI kit could be reconstituted with 20 GBq of ^{99m}Tc-pertechnetate in 5 ml saline which was stable for >8 hr postreconstitution (radiochemical purity >96%) indicating that sufficient amount of tin (II) is present as the reducing agent, suggesting a stabilizing role for tin (II).

While I appreciate that fractionated procedures are a variation to the recommended original protocols, the unexpected results could be overcome by adapting the right strategy to preserve optimum tin (II) levels during fractionation. Besides legal consideration, a good radiopharmacy practice is to standardize the fractionation methodology which is proven in your own laboratory, especially to establish stability over a period of storage and to use the fractionated products that satisfy quality control requirements before using them for patients.

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