COLLIMATOR SELECTION FOR SCINTILLATION CAMERA BRAIN SCANNING

Collimator selection for use with the scintillation camera was a topic in the December issue of *The Journal of Nuclear Medicine*. The article by Westerman *et al* (*1*) presented results of imaging a ^{99m}Tc source phantom using 4,500-square-hole and 1,090-round-hole collimators. Many people mistook these collimators for the 4,000-square-hole and 1,000-round-hole collimators available with the Nuclear-Chicago scintillation camera. The 4,500-hole, 1.75-in.-thick collimator is equivalent to the Nuclear-Chicago 4,000-hole, 1.75-in.-thick collimator. The 1,090-hole, 1.5-in.-thick collimator *is not equivalent* to the 1,000-hole, 3-in.-thick Nuclear-Chicago collimator.

We have performed studies using the 4,000-hole and 1,000-hole collimator provided with the Nuclear-Chicago Pho-Gamma III scintillation camera and a ^{99m}Tc source similar to that used in the referenced investigation. The radioactive source test phantom was prepared using ^{99m}Tc in a 12-cm-diameter tank that was 15 cm deep; the concentration was 0.2 μCi/ml. Three pseudotumors were used. The pseudotumors were 0.7 cm, 1.0 cm and 1.5 cm in diameter and each contained ^{99m}Tc at a concentration of 2.0 μCi/ml. The diluent was water.

An Anger scintillation camera was used. The camera was adjusted to accept pulses generated by gamma rays in the 125–155-keV energy range. The collimators were those that are provided as standard equipment.

The recording of the resultant image on the oscilloscopes was accomplished with the Fairchild Polaroid film camera and a special enlarger attachment designed at this hospital to provide a one-to-one subject-image size ratio. Each collimator was used to image three pseudotumors individually at 1-cm and 4-cm depths in the phantom. The images were recorded at 25,000 counts, 50,000 counts, 100,000 counts and 500,000 counts. The collimator face was 8 cm from the surface. The 0.7-cm-diameter pseudotumor situated 1 cm below the phantom surface was faintly visualized with the 4,000-hole collimator after an accumulation of 500,000 counts. All other attempts with both the 1,000-hole and the 4,000-hole collimators failed to demonstrate the 0.7-cm pseudotumor.

Using the 4,000-hole collimator, the 1-cm-diameter pseudotumor 1 cm below the phantom surface was faintly visualized after an accumulation of 25,000 counts. The pseudotumor was readily visualized at the subsequent accumulations of 50,000 counts, 100,000 counts and 500,000 counts. The 1-cm-diameter tumor was not visualized with the 1,000-hole collimator in the 25,000-count scintiphotograph. Subsequent scintiphotographs, using the 1,000-hole collimator, showed a poorly visualized area of concentration at the site of the pseudotumor after an accumulation of 50,000 counts and good visualization of the pseudotumor at the 100,000 and 500,000 integral count levels.

Both collimators clearly imaged the 1.5-cm-diameter pseudotumor when it was placed 4 cm below the surface of the phantom. The 4,000-hole collimator presented a clearer configuration image than the 1,000-hole collimator.

The apparent sensitivity of the 1,000-hole and the 4,000-hole collimators were equal for the ^{99m}Tc source used in this study.

In summary, scintillation camera imaging of pseudotumors at ^{99m}Tc concentrations 10 times that in a background phantom indicates that the commercially available, 4,000-square-hole collimator is superior to the 1,000-round-hole collimator for visualizing this type of tumor.

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REFERENCE

1. WESTERMAN, B., SHARMA, R. AND FOWLER, J.: Relative importance of resolution and sensitivity in tumor detection. *J. Nucl. Med.* 9:638, 1968.

SIMPLIFIED GFR METHOD?

I have read with interest the paper in the November issue of the *Journal* by Eberstadt, Alvarez and Ungay entitled, "Simplified method for determining glomerular filtration rate with ^{131}I-sodium iothalamate" (*1*). I believe that the publication of such a method warrants a very strong statement of caution to those who would adopt its use directly. A simplified method infers that it has been adapted from something more complex. It is indeed true that single-injection clearance methods are available in the literature and various simplifications have been presented. However, it is necessary to obtain a

sound theoretical basis for any methodology before simplification can be carried out, and I note with regret the authors' statement "we plan to do careful compartmental analysis in the future." It would seem more appropriate that before such a paper is written the careful compartmental analysis should be carried out. There are very well established methods for measuring glomerular filtration rate in the literature, and it is essential to compare a new and experimental method with a well known and accepted method rather than with estimates of expected renal function which can vary considerably from individual to individual and from moment to moment.

The use of the plasma volume in a given individual is in itself a highly variable entity, and most people who have had any significant experience with the measurement of plasma volume will attest to the great variation from individual to individual which makes an accurate prediction for any one person on the basis of height and weight alone well near impossible.

The authors have adopted a method that appears to be a compromise between the continuous-infusion technique and the single-injection technique with the gradual administration of the radiocompound so that a plateau is reached before the exponential portion of the curve is measured. For the single-injection technique a rapid bolus is essential so that mixing can take place rapidly, and this rapid bolus is essential to all mathematical assumptions in the technique. On the other hand, it is possible to achieve an equilibrium level by a gradual infusion, but for this to be an accurate method one must be sure that the material infused is distributed throughout its entire volume of distribution. The volume of distribution of sodium iothalamate probably is closer to the extracellular fluid than to the plasma volume.

Let me conclude by saying that attempts to apply radionuclides to the study of renal function require a firm foundation in renal physiology and tracer kinetics (*2,3*). The methodologies should be carefully tested out against well established techniques and should have a firm theoretical basis in fact. Methodology that makes use of the coincidental agreement of two sets of values can lead only to multiple errors in its application and to a general discontent for the use of radionuclides in the study of renal function.

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REFERENCES

1. EBERSTADT, PETER, ALVAREZ, JORGE AND UNGAY, FAUSTO A.: Simplified method for determining glomerular filtration rate with ^{131}I-sodium iothalamate. *J. Nucl. Med.* 9:582, 1968.

2. BLAUFOX, M. D.: Dynamic function studies in nuclear medicine. In *Year Book of Nuclear Medicine.* Year Book Medical Publisher, Chicago, 1968, p. 7.

3. SHEPPARD, C. W.: *Basic Principles of the Tracer Method.* John Wiley & Sons, New York, 1962.

THE AUTHOR'S REPLY

The general impression gathered from this letter is that Dr. Blaufox is being a bit too dogmatic in his statements and is demanding in some respects an absolute accuracy that is applicable only to theoretical mathematics. By the same token even compartmental analysis, based on mathematical models which is itself a simplification, if rigorously confronted with the behavior of a living membrane of selective permeability, is to be dismissed on the same grounds. As in any other biological and medical problem, good judgment is essential and ample knowledge of the fundamental physiological facts is the prerequisite, as well as a good sense of proportion.

The first simplification is of a theoretical nature and based, as can be recognized easily on the principle of orders of magnitudes; to be more precise, the passage of an inulin-like substance into the interstitial space is of a much smaller magnitude than its passage through the renal glomeruli. For this reason, in the short time interval of observation the passage into interstitial space was considered small —in fact, negligible. No doubt, the latter assumption caused concern; admittedly it is a possible oversimplification in accord with the criteria now voiced by Dr. Blaufox.

I have talked over the facts with my colleagues in the physiology department at the Medical School concerning the possibilities of exploring in nephrectomized dogs the passage of sodium ^{131}I-iothalamate from the intravascular into the interstitial space. They justifiedly raised very serious objections about the validity of the results obtained. In spite of everything, successful studies in this direction (to be presented soon) have recently been possible. In a patient in whom both kidneys had to be removed (now under control with an artificial kidney) such a study was done by taking advantage of her arti-