Clinical Evaluation of 360° and 180° Data Sampling Techniques for Transaxial SPECT Thallium-201 Myocardial Perfusion Imaging

TO THE EDITOR: In their article "Clinical Evaluation of 360° and 180° Data Sampling Techniques for Transaxial SPECT Thallium-201 Myocardial Perfusion Imaging" (*1*) Dr. Go and his colleagues conclude that "180° data sampling technique. . . is not a reliable technique and should be abandoned." We strongly disagree with this conclusion and wish to draw attention to weaknesses in Dr. Go's experimental design which may have led to a misleading conclusion. We should also like to describe the technique used by our group which has clearly demonstrated the superiority of the 180° data sampling technique (*2*).

We believe Dr. Go's comparative study is flawed in the following respects.

1. In processing the groups of images, attenuation correction was not applied similarly to 360° images (Group C) and 180° images (Groups A and B). Opposing images obtained during 360° rotation were arithmetically averaged (a partial correction for attenuation) while images obtained during 180° rotation were arithmetically averaged against a theoretical matrix with zero counts. This reduced the counts by half. The comparison, therefore, is not solely between 360° rotation and 180° rotation since the groups differ in other vital acquisition and processing variables, namely, the 360° images were partially corrected for attenuation and contained twice the myocardial counts of the 180° images which were not corrected for attenuation at all.

2. The 180° images were obtained for only one-half the imaging time of the 360° images. The rationale for using 180° imaging for thallium-201 (^{201}Tl) is the optimal utilization of limited imaging time for the collection of photons from the organ of interest. In our experience, using equal total imaging times, ~70% fewer counts from the myocardium are acquired during 360° rotation compared to 180° rotation. We estimate that the 180° images reported by Go and co-workers (Groups A and B) contain only ~15% of the myocardial counts obtainable in a well-designed 180° ^{201}Tl clinical SPECT study (70% penalty due to reduced imaging time and a 50% further reduction resulting from the zero matrix averaging step described above).

TABLE 1

Index	360° Rotation	180° Rotation
Uniformity index*	0.61	0.77
Contrast index*†	0.46	0.55
Performance index* †	0.28	0.42

* As function of 15 min total imaging time.
† As function of 1.2 cm radius void and 12 mm³ voxel.

We believe that our comparison of the 180° and 360° data sampling techniques (*2*) is more scientifically sound than the comparison reported by Go et al. and that the 180° technique is clearly superior. Phantom studies were performed using the Jaszazck phantom with the cardiac insert filled with the dose and distribution equivalent to a human clinical study. In the comparison of 180° compared with 360° rotation all hardware and software acquisition parameters (including collimator, total imaging time, size of the linear and angular samples) were maintained constant except for the size of the angle of rotation. Reconstruction parameters were also identical. In comparing the 180° and 360° slices, uniformity, contrast (as a function of the void diameter) and a performance index (as a function of the void diameter) (*3*) were computed and the comparative results shown in Table 1.

In 15 patients, successive redistribution images were acquired using 180° and 360° rotation while maintaining all other acquisition and process parameters identical. Figure 1 demonstrates the superiority of the 180° images. Subsequent

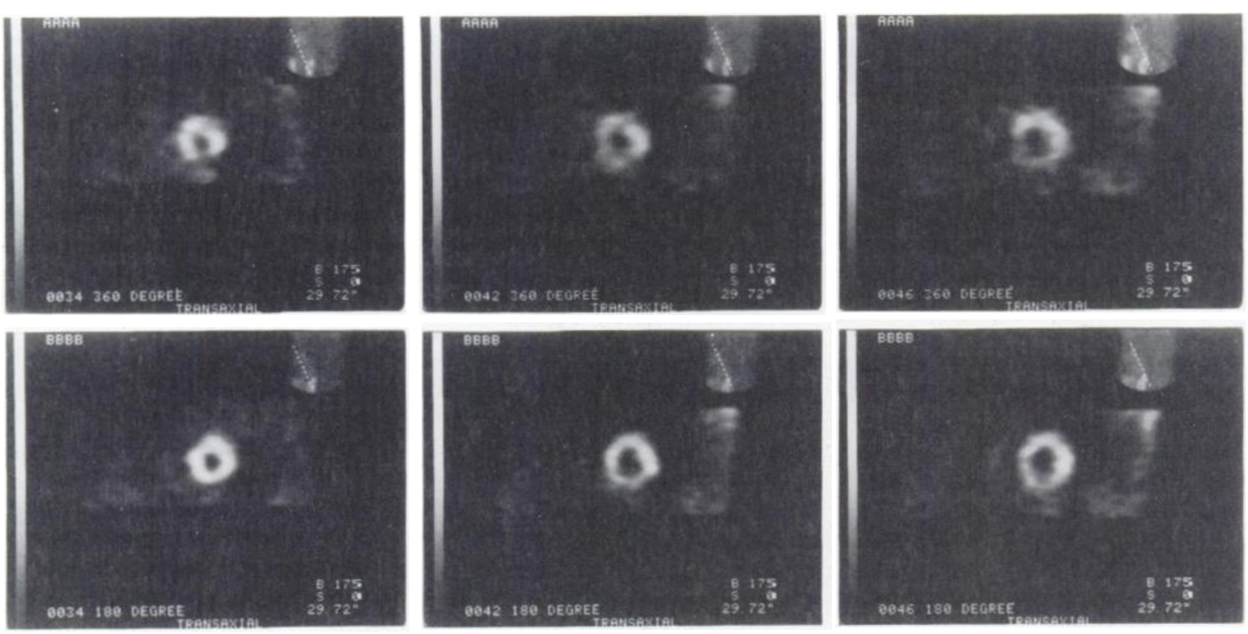

FIGURE 1
Identical anatomical slices in patient with normal redistribution study. Top: 360° rotation, Bottom: 180° rotation

clinical experience in more than 300 patients using a 180° technique has not yielded the unacceptably high false-positive result (36%) reported by Go and his colleagues.

We submit that for clinical ^{201}Tl SPECT using current detectors and software, the 180° rotation technique is theoretically, experimentally, and clinically superior to the 360° rotation. We believe this is the technique of choice for clinical studies and that further properly designed comparative clinical studies will validate this conclusion.

References

1. Go RT, MacIntyre WJ, Houser TS, et al: Clinical evaluation of 360° and 180° data sampling techniques for transaxial SPECT thallium-201 myocardial perfusion imaging. *J Nucl Med* 26:695–706, 1985
2. Rahimian J, Contino J, Corbus HF, et al: Quantitative evaluation of Tl-201 myocardium SPECT acquisition and processing parameters using a performance index function. *Med Phys* 11:742, 1984 (abstr)
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TO THE EDITOR: The article, "Clinical Evaluation of 360° and 180° Data Sampling Techniques for Transaxial SPECT Thallium-201 Myocardial Perfusion Imaging," by R. T. Go et al. published in *J Nucl Med* 26:695–706, 1985 makes statements concerning acquisition of 180° single photon emission computed tomography (SPECT) of thallium-201 (^{201}Tl) myocardial imaging that are not supported by the data presented. These statements are that this is not a reliable technique and should be abandoned and replaced by the 360° acquisition that appears to the authors as a technique of choice.

We differ on this major statement, as we can identify serious weaknesses in the data presented.

1. The images published appear photon deficient. If the figures displayed by the color scale correspond to counts/pixel, then their values are very low! Our experience is based on images with maximal activity of 150 to 250 counts/pixel. This deficiency may originate from only using 2 mCi of ^{201}Tl. We and many centers throughout the country are using 3 mCi. Another factor is the use of 1-pixel-thick cuts. We and most investigators display 2 pixel cuts that correspond to approximately a 9.4 mm thickness.

2. The criterion for definition of abnormal level of ^{201}Tl activity is arbitrarily set at a drop of 30% of maximal counts for both 180° and 360° acquisitions. This 30% diminution falls in the color red of the color scale used and is therefore not identifiable in the images displayed in Figs. 3 through 8. In Fig. 2, the images B′ and C′ that are displayed in a different color scale, the color orange denotes normal uptake but is poorly contrasted from yellow that defines ischemia, and that may be a misleading factor generating false-positive interpretations.

The advantages of the 360° acquisition appears shadowed by the 32-min acquisition time that is long enough to take us into the redistribution phase, as the acquisition should not be started before 5 min of maximal exercise and injection of ^{201}Tl. It is not clear what effect the relative increase of background activity of the 360° acquisition has on the sensitivity of the procedure. An abstract from the same group (*J Nucl Med* 25: P61, 1984) using 360° and short axis display reports a sensitivity of 97% and specificity of 88% for patients with stenosis > 70%, and 92% and 86% in stenosis > 50%, respectively. This performance is not significantly different from reports by centers employing the 180° acquisition.

We want to comment on imaging findings only on results of series B, as the series A of images is obviously an exercise in futility, as nobody that we know of would use this mode of acquisition.

Figure 2. These are coronal cuts. The call of anterior defect is soft. Only a slight irregularity of contour is evident, that we would have described within normal limits.

Figure 3. There is agreement of normality of Fig. b.

Figure 4. Coronal cut. The author is describing a defect that should be described as a subepicardial ischemia? We do not know of such an entity.

Figure 5. Sagittal and coronal cuts. The defects depicted are in color orange denoting approximately a 73% level of maximum. The irregularity of contour may denote low counts in this image.

Figure 6. It is not clear why the authors with the same criterion used for Fig. 2 do not call an anterior and anteroseptal defect.

We use General Electric and Technicare cameras, the same computer and similar software of the authors, and so do many other investigators. We have improved the color scale and define the level of abnormality by diminution of 40% of the maximal counts. Bertrand et al. have reported a 10% of false-positive studies in 10% of 126 patients, the majority in the inferior wall. (Amor, Karcher, Balaud, et al: Diagnosis of chronic coronary insufficiency by exercise SPECT. *Eur J Nucl Med* 8:A1, 1984). They report a sensitivity of 95% and specificity of 90%). We have similar experience and have long ago discarded displaying coronal and sagittal images. We prefer for our interpretation the short axis, long axis, horizontal and vertical. This strategy takes care of different presentations of heart position that may be responsible for many false positives.

Maybe Go et al. are pointing us to the correct way to approach the diagnosis of coronary artery disease with ^{201}Tl SPECT. However, such a significant departure from our routine procedures is not justified by the data presented to us in the article in question.

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