(Table 2 and Fig. 3) demonstrate that the 360° protocol results in less variability in the SPECT-measured contrasts. The observed variability in C_{image} results mainly from: (a) variations in the spatial resolution at different locations within the reconstructed image, and (b) variations in the Compton-scattered component at different locations. With our SPECT system and reconstruction algorithm, the 360° acquisition results in less variability in the spatial resolution throughout the reconstructed volume, compared with the 180° protocol. Furthermore, the effect of not applying an attenuation compensation to the 180° data results in a marked variability in the count densities of both the myocardium and the background, thus leading to difficulty in directly relating these count densities to absolute radionuclide activities.

We are interested in the comment that the improved images, despite fewer counts from the 180° collection, "resulted from the decrease from the background rather than a change in the absolute myocardial activity, which was only slightly affected." We have previously demonstrated (*3-6*), and Hoffman (*7*) has discussed, that the measured SPECT image contrast is dependent (even with an appropriate attenuation compensation) not only on the radionuclide uptake ratio, but also is affected by the inclusion of Compton-scattered photons, the reconstructed spatial resolution, the dimensions of the object, variabilities of the spatial resolution within the volume, and patient and/or organ motion. Thus it can be seen that the problems associated with extracting absolute radionuclide uptake ratios from SPECT-measured image contrasts are formidable. It has not yet been demonstrated whether absolute radionuclide uptake ratios can be measured accurately in vivo for the intact myocardium using SPECT-measured count densities. However, a necessary first step is that values of C_{image} for different portions of the myocardium be constant when the uptake ratio is constant. It may then be determined whether appropriate compensations can be devised for the physical factors described above, thus resulting in reasonably accurate measurements of *absolute* myocardial radionuclide uptake that can be used to describe quantitatively regional myocardial function.

We are interested in determining the real value of SPECT in Tl-201 imaging. Although the preliminary studies have suggested that SPECT imaging is superior to planar imaging, these studies have been done in highly selected patient populations. The role, if any, of SPECT imaging of Tl-201 in the evaluation of patients with chest pain using "exercise-redistribution studies," or of patients with chest pain and suspected infarction, is yet to be established.

Due to the limitations of Tl-201 for imaging, we certainly would prefer to be using a Tc-99m myocardial agent. Even if a Tc-99m agent should become available, however, careful attention to the collimators used for SPECT must be given. Furthermore, a method for making appropriate attenuation corrections for 180° data collection needs to be developed and evaluated.

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Reply

Thank you for the comments, based on many patient studies, regarding 180° and 360° data collection for Tl-201 SPECT. I do agree with your statement about better qualitative results with 180° collection, since it provides better spatial resolution and contrast with less background activity than the 360° approach.

Coleman et al., using a cardiac phantom, described the effects of attenuation in the 180° scan. The effect of attenuation, however, will be overestimated if the phantom is placed in a water tank. Accordingly we have studied a new thoracic phantom, consisting of the lung, spine, and Tl-containing heart with a defect (Fig. 1A). Its "lung" consisted of sawdust with density 0.3 g/cm^3, and a "spine" of sand with density 1.8 g/cm^3. A perfusion defect in the

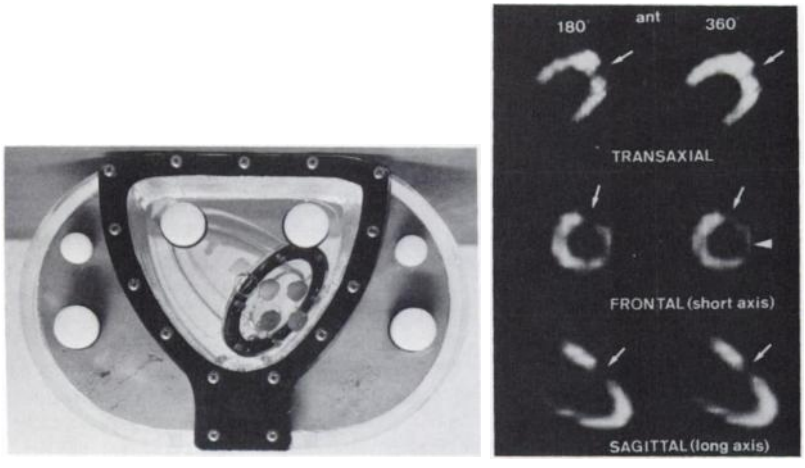

FIG. 1. Our thoracic phantom (A) and the ECT images obtained from the 180° and 360° scans (B).

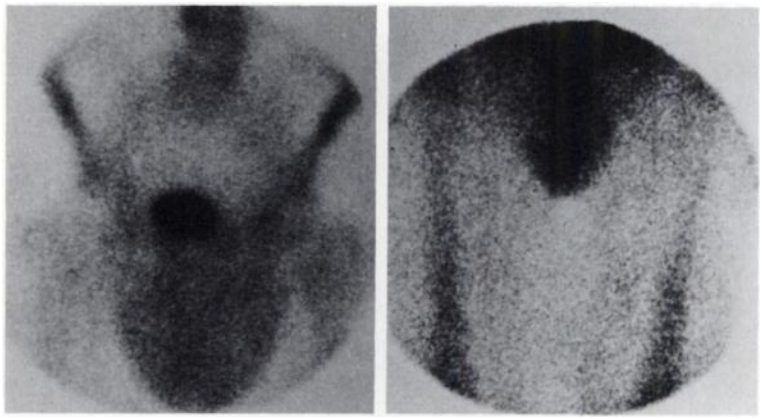

FIG. 1. Tc-99m MDP image before radiation therapy (left) and repeat image with bone agent following radiation therapy and surgery (right).

anterior wall was better delineated in the 180° scan (Fig. 1B). The effect of attenuation was not significantly different between the two scans. With 360°, decreased uptake was noted in the posterolateral wall, probably due to attenuation and scatter by the "spine".

In clinical cases, moreover, the effect of attenuation does not seem to be much different between them, so perhaps the 180° approach may not prejudice qualitative assessment of a perfusion defect, even in the basal portion of the myocardium.

As for quantitative assessment of Tl-201 SPECT imaging, we have to consider two points: infarct sizing, and estimation of Tl concentration. Infarct sizing can be performed as far as the SPECT images are geometrically reliable. In this sense, I believe a 180° scan permits infarct sizing as accurately as, or even better than, a 360° scan, because of better spatial resolution without apparent geometrical distortion. Estimation of Tl concentration, on the other hand, is quite difficult in the 180° scan. It is one of the formidable problems to be solved in the field of SPECT. But if an ideal method of attenuation and scatter correction should become available for SPECT, the 360° scan should be used for a better quantitative assessment of Tl SPECT imaging, since the 360° data may be necessary for these corrections.

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Soft-Tissue Uptake of Tc-99m MDP in Secondary Scrotal Lymphedema

Bone scintigraphy has proven valuable in both osseous and nonosseous conditions. We report a case of increased scrotal soft-tissue activity in a patient with secondary scrotal lymphedema.

A 77-yr-old man with a history of stage C adenocarcinoma of the prostate and a negative pelvic node dissection was referred to the nuclear medicine department for a metastatic evaluation. A TC-99m MDP bone image revealed a large scrotum (Fig. 1, left) consistent with the clinical diagnosis of scrotal lymphedema secondary to surgery. The patient received definitive cobalt radiotherapy of 5040 rad (CGy) to the whole pelvis and additional 1640 rad (CGy) to the prostate gland through a smaller field. Scrotal size increased and small amounts of lymphatic drainage were noted. He subsequently underwent reduction scrotoplasty with excellent results. The reduction of the scrotal size was noted on a follow-up bone scan (Fig. 1, right).

Although secondary scrotal lymphedema is primariy diagnosed by clinical examination, the nuclear physician, however, should be aware of this relatively rare complication and occasionally may be the first one to recognize this condition.

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