of those rejected, two were manufactured by cast and three by foil technique. This would indicate that poor quality control, rather than the manufacturing technique, may be the main culprit.

Although the techniques described by Busemann-Sokole (*2*) and Chang et al. (*3*) provide a more accurate mapping of collimator hole angulation over the entire field of view, we have found that the technique of Cerqueira et al. has the advantage of being simple and quick to perform, does not require any specialized test equipment, and provides a readily comprehensible indicator of collimator quality for SPECT. From our experience and the results of Cerqueira et al., it would appear that there are a large number of collimators in use on tomographic systems which are unsuitable for SPECT acquisition.

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Michael K. O'Connor
William M. Oswald
Mayo Clinic
Rochester, Minnesota

Automated Body Contour for Liver SPECT Using Photopeak Data

TO THE EDITOR: Recently Hosoba et al. (*1*) proposed a new method for detecting body surface contours for single photon emission computed tomography (SPECT) attenuation correction which uses only photopeak window data. Although alternative methods of external body contour determination have been described (*2,3*), the Hosoba method offers simplicity of implementation for routine clinical SPECT studies. We therefore attempted to apply the method to liver SPECT in combination with first order Chang attenuation correction, assuming uniform attenuation.

The Hosoba method employs a threshold search technique to determine edges in the projection images, which are then backprojected to define convex boundary points in the transaxial plane. The boundary points are fit with a fourth order Fourier series to yield smooth analytic contours which can be iteratively refined by adjusting the projection threshold until the major axis of the contour agrees with a directly measured value. The method works well for an Alderson body phantom containing background activity and a simulated liver (*1*), but we have found that it performs rather poorly for clinical liver SPECT as a result of a lack of peripheral activity in many of the transaxial sections of interest. We therefore abandoned the original approach of generating a separate contour for each individual slice, and instead attempted to determine a single representative contour for each study (acquired as 64 × 64 word images in 64 views) from the projection data corresponding to an eight pixel wide slice centered on the spleen. A typical result for the "raw" boundary points obtained prior to fitting with the Fourier series is shown in Figure 1A.

The figure illustrates a general problem which exists in the anterior quadrant above the spleen, namely that a lack of activity in this region causes the boundary points there to fall inside the patient surface. Our first attempt to address the problem involved eliminating these points from the ensuing fitting procedure. It was not completely successful since some of the fitted contours continued to exhibit marked deformation in the anterior quadrant above the spleen. Eliminating the undesirable boundary points and further applying the constraint of bilateral symmetry rectified the problem, however. The symmetry constraint can be expressed as $R(-\theta) = R(\theta)$, where $R(\theta)$ describes the contour as a function of polar angle θ, measured from the vertical with origin at the geomet-

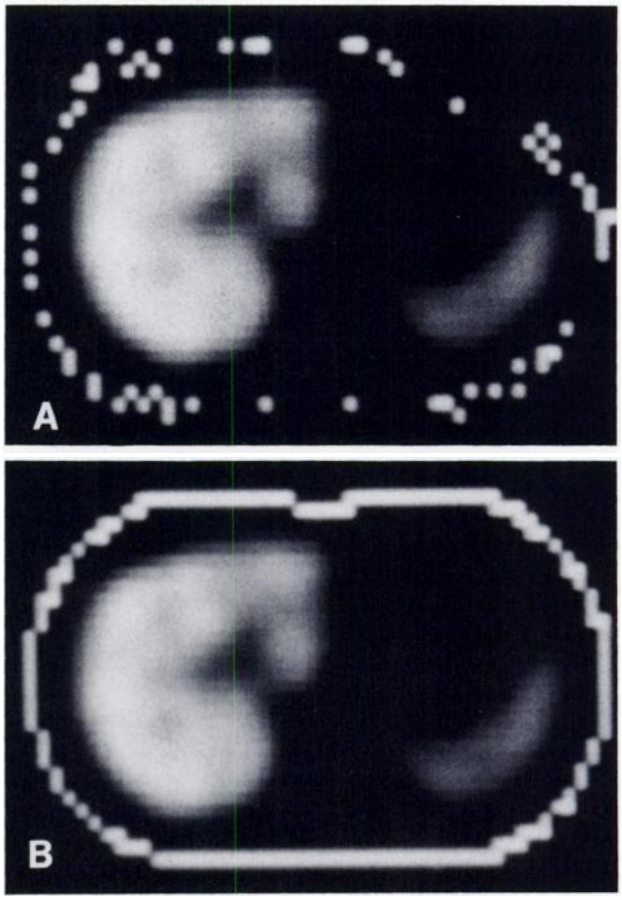

FIGURE 1
A: Transaxial body contour boundary points obtained by backprojecting edges determined from projection data using a modification of the method of Hosoba et al. (*1*).
B: Contour obtained by fitting the boundary points in A, exclusive of those in the upper left quadrant, with a fourth order polar Fourier series constrained to reflect bilateral symmetry. Note that the contour does not appear to be perfectly bilaterally symmetric because the origin of the polar coordinate system used for the fit does not coincide with the center of a pixel.

rical center of the true patient contour. We estimated the latter as the midpoint of the horizontal and vertical extents of the activity distribution in the transaxial plane as obtained from the projection data. The bilateral symmetry constraint serves to eliminate odd terms from the fourth order Fourier series, resulting in nondeformed contours and coincidentally yielding a reduction in the computing time required for the fit. Figure 1B depicts the fitted contour determined from a subset of the boundary points in Figure 1A according to the procedure just described. Thus, assuming bilateral symmetry and with the limitation of generating a single contour, we have developed modifications to the Hosoba method which improve its accuracy for clinical liver SPECT studies.

In addition, the computational burden of the method can be lightened without affecting performance. Hosoba et al. (*1*) proposed that the contour size be determined by iteratively adjusting the projection threshold until the length of the major axis of the contour agrees with a direct measurement of this quantity. This approach requires repeated thresholding, backprojection, and fitting. We have observed that the shape of the contour is virtually unchanged over the range of projection thresholds encountered in liver SPECT studies (i.e., 3% - 10% of the maximum average count per eight pixel wide projection element, excluding elements containing zero) when our modified method is used to determine the contour. Consequently, the contour derived using an appropriate average value for the projection threshold can be scaled radially to agree with the length of a patient's major axis or more conveniently, with a patient's circumference. In a retrospective study involving 12 consecutive liver SPECT examinations, we determined that a threshold value of 5% yielded an average radial scaling factor of 1.00 + 0.13 (min = 0.85, max = 1.18) when the circumference of the contour was adjusted to agree with a patient measurement obtained at the level of the ninth intercostal space in the lateral aspect.

In summary, we have found that modifications to the body contour determination method proposed by Hosoba (*1*) render it suitable for incorporation in automated attenuation correction schemes for routine clinical SPECT liver studies. Easily implemented bilateral symmetry and measured circumference constraints provide robustness and computational efficiency, while retaining the practicality of the method. Generally speaking, the method is limited to applications where peripheral activity, augmented perhaps by a priori information, is sufficient to permit accurate contour determination. For liver SPECT studies, for example, the method works well even when splenic uptake is markedly decreased, although it fails if the patient has undergone splenectomy. The potential of the method for use in quantitative attenuation correction schemes is beyond the scope of the present discussion and remains to be investigated. We observe that although the accuracy required in this application is high (*3*), the present method admits further refinement to remove the restriction of a single contour through the introduction of empirically determined axially dependent scale and shape variations.

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Ronald S. Sloboda
Pasqua Hospital
Regina, Saskatchewan, Canada
Cross Cancer Institute
Edmonton, Alberta, Canada (present address)

REPLY: Sloboda's approach using fourth order Fourier series with the condition of bilateral symmetry, seems effective in detecting body contours in routine clinical single photon emission computed tomographic study, but it has not proved the accuracy of the detected contours, as the human body is not always assumed to be symmetric. For quantitative studies, we need a flexible contour detection method that allows sequential contours with different shapes from slices throughout the volume of interest. Sloboda's modification may be effective in some cases with low spleen activity, but as pointed out by Sloboda, further investigation is needed to evaluate the effect of this method for quantitative SPECT studies.

Minoru Hosoba
Medical Technology
Research Laboratory
Shimadzu Corporation
Kyoto 604, Japan

False-Positive Indium-111 Platelet Scintigraphy

TO THE EDITOR: We read with great interest the article "Indium-111 Platelet Scintigraphy" by Seabold, Conrad, Kimball et al. (*1*). The authors raise concern over "false-positive" inguinal uptake of indium-111 (^{111}In) platelets in patients without deep venous thrombosis, attributing the pattern, possibly, to "the superficial location of the femoral vein and the relative increased soft tissue attenuation proximally and distally."

We submit that the inguinal activity seen is, in fact, due to uptake in inguinal lymph nodes. This may have resulted from inadvertent labeling of leukocytes with subsequent sequestration by inflamed lymph structures. We have previously reported ^{111}In leukocyte uptake by inflamed lymph nodes (*2,3*) and have observed ^{111}In "platelet" uptake by the thyroid in a case of subacute thyroiditis, the latter presumably due to inadvertant labeling of leukocytes during a platelet separation/labeling procedure which was quite similar to the authors' method. This was readily ascertained by microscopic inspection of the final cell preparation demonstrating abundant leukocytes as well as platelets. Inadvertent leukocyte labeling by the authors is also suggested by a case demonstrating ^{111}In "platelet" uptake in a soft-tissue abscess.

We wonder if the authors can provide any data concerning the completeness of the platelet separation procedure utilized prior to labeling.