

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, back-projection, 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.

#### References

1. Hosoba M, Wani H, Toyama H, Murata H, Tanaka E. Automated body contour detection in SPECT: effects on quantitative studies. *J Nucl Med* 1986; 27:1184-1191
2. Gullberg GT, Malko JA, Eisner RL. Boundary determi-

nation methods for attenuation correction in single photon emission computed tomography. In: Esser P, ed. *Emission computed tomography: current trends*. New York: The Society of Nuclear Medicine, 1983:33-35.

3. Macey DJ, DeNardo GL, DeNardo SJ. Comparison of three boundary detection methods for SPECT using Compton scattered photons. *J Nucl Med* 1988; 29:203-207.

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**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.

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#### 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 ( $^{111}\text{In}$ ) 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  $^{111}\text{In}$  leukocyte uptake by inflamed lymph nodes (2,3) and have observed  $^{111}\text{In}$  "platelet" uptake by the thyroid in a case of subacute thyroiditis, the latter presumably due to inadvertent 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  $^{111}\text{In}$  "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.

## References

1. Seabold JE, Conrad GR, Kimball DA, Ponto JA, Bricker JA. Pitfalls in establishing the diagnosis of deep venous thrombophlebitis by indium-111 platelet scintigraphy. *J Nucl Med* 1988; 29:1169-1180.
2. Goodgold HM, Samuels LD. Misleading findings on indium-111 leukocyte images. *Clin Nucl Med* 1986; 11:392-395.
3. Samuels LD, Goodgold HM, Hendershott L. Pediatric uses of In-111 WBC imaging [Abstract] *J Nucl Med* 1985; 26:P114.

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**REPLY:** We acknowledge that one possibility for focal inguinal activity during indium-111 (<sup>111</sup>In) platelet scintigraphy might be <sup>111</sup>In leukocyte uptake in inguinal lymph nodes. At first glance, the focal activity in the inguinal region in Fig. 7 of our paper appears to suggest nodal localization (1). However, in our opinion, this is extremely unlikely for the following reasons.

1. The degree of localization present at 4 hr is rather intensive. Indium-111 leukocytes accumulate more slowly in most inflammatory lesions. Datz et al. (2) identified only 33% of abdominal abscess at 1-4 hr compared to 24 hr. Furthermore, 70% of the studies showed more intense uptake at 24 hr. In addition, we would expect to see greater uptake in pelvic bone marrow if labeled WBCs were present as a contaminant.

2. Minimal leukocyte contamination in each of our labeled-cell preparations was verified by microscopic examination. Unlike Goodgold and Samuel's experience of "an abundant number of leukocytes", our experience has always demonstrated little contamination with leukocytes. The maximum contamination we have observed was 3%, the largest fraction of which were red cells. Although we have not determined the radioactivity distribution among the various cells present, only a few microcuries at the most would be associated with leukocytes. The degree of inguinal localization in the patient described above is not consistent with their hypothesis.

3. The patient did not have palpable lymphadenopathy and did not have signs or symptoms referable to the inguinal regions.

4. Tracer localization in normal lymph nodes related to subcutaneous extravasation has been reported. Wallis et al. (3) have observed localization of technetium-99m methylene diphosphonate in apparently normal lymph nodes proximal and ipsilateral to the injection site. This was not a considera-

tion in our patients, since they were all injected in an upper extremity. The example of <sup>111</sup>In leukocyte lymph node uptake published by Goodgold et al. (4) was confined to the left axilla and abdomen in a child with generalized lymphadenopathy. We wonder if the axillary focus might have been related to extravasation during injection in the left arm.

5. Finally, <sup>111</sup>In platelet localization has been reported at sites of inflammation/infection (5). Focal localization of <sup>111</sup>In platelets in inflamed inguinal lymph nodes would be an alternate clinical consideration, but would usually be a unilateral process.

## References

1. Seabold JE, Conrad GR, Kimball DA, et al. Pitfalls in establishing the diagnosis of deep venous thrombophlebitis by indium-111 platelet scintigraphy. *J Nucl Med* 1988; 29:1169-1180.
2. Datz FL, Jacobs J, Baker W, et al. Decreased sensitivity of early imaging with In-111 oxine-labeled leukocytes in detection of occult infection. *J Nucl Med* 1984; 25:303-306.
3. Wallis JW, Fisher S, Wahl RL. Tc-99m MDP uptake by normal lymph nodes on bone scans: clinical and laboratory evaluation. *J Nucl Med* 1986; 27:988-89.
4. Goodgold HM, Samuels LD. Misleading findings on Indium-111 leukocyte images. *Clin Nucl Med* 1986; 11:392-395.
5. Sugarman HJ, Tatum JL, Hirsh JI, et al. Gamma scintigraphic localization of platelets labelled with indium-111 in a focus of infection. *Arch Surg* 1983; 118:185-189.

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## Correction: Table Corrections

In the article by Spinks et al. "Performance Characteristics of a Whole Body Positron Tomograph," (*J Nucl Med* 1988; 29: 1833-1841), Table 1 appears incorrectly. Please note corrected Table 1 below including author alterations.

Measurements of Axial Resolution at Different Distances from the Center of the FOV

Distance from center of FOV (cm)	Axial resolution (FWHM) mm			
	Direct plane		Cross plane	
	Septa in	Septa out	Septa in	Septa out
0	15.4	16.6	14.2	19.6
6	15.2	16.9	14.6	20.6
12	15.8	17.3	16.5	21.8
18	16.8	18.1	19.9	23.7