Use of Pulmonary Segmental Reference Charts in Reporting Lung Scintigrams

TO THE EDITOR: We read with interest the report by Magnussen et al. (*1*). In using the PIOPED and other classification schemes to assist in the diagnosis of pulmonary embolism, we agree that a reference to a segmental anatomy resource is useful to enhance accuracy and reproducibility. In their article, Magnussen et al. developed a segmental reference chart for this purpose.

The charts they developed represent the individual segments in the various views as independent of each other and not overlapping. The charts apparently demonstrate where the segments meet on the surface of the lung. We note that when there is a perfusion defect, it may be anywhere within the segment, not just the part of the segment that is seen on the lung surface.

There is considerable overlap in the position of the segments when the projection anatomy rather than the surface anatomy is considered, and, in our opinion, the position of the volume of a segment (three-dimensional) cannot be estimated accurately from two-dimensional anatomy charts.

To address this problem, we developed a series of interactive drawings based on the projection anatomy of the individual segments of a standard lung model using CT. It has been published in the Radiological Society of North America's electronic journal (*2*) and may be viewed and used over the Internet. Using this system, the physician would select a defect, if present, on the scan to be analyzed. A presumptive determination of which segment (or part of a segment) it represents would then be made by looking at the drawings of projection images of all segments in the view in which the defect is best seen. By clicking the computer's mouse on that segment in the drawings, the position of that segment in all views normally obtained in a lung scan will appear. Then the pattern of the defect in the drawings would be compared with the pattern of the defect in the scan views. If the pattern of the defect in all views, as seen in the drawings, does not match the defect in the views on the scan being analyzed, then the physician would start again and select another segment until the best match is found. The best match would then be considered the segment in which the defect exists.

REFERENCES

1. Magnussen JS, Chicco P, Palmer AW, et al. Enhanced accuracy and reproducibility in reporting of lung scintigrams by a segmental reference chart. *J Nucl Med.* 1998;39:1095–1099.
2. Lee AY, Strommer J, Lee BY, Webber MM. Pulmonary segmental projection charts. *RSNA ej.* 1997;1. Available at: http://ej.rsna.org/EJ_0_96/TEJ.HTM. Accessed June 15, 1999.

Andrew Y. Lee
Milo M. Webber
Jim Strommer
University of California-Los Angeles
Los Angeles

Brian Y. Lee
University of California-Irvine
Irvine, California

Is There a Relationship Between ^{99m}Tc-Sestamibi Uptake and Oxyphil Cell Content in Hyperparathyroidism?

TO THE EDITOR: In the August 1998 issue of the *Journal* Carpentier et al. (*1*) tried to substantiate their earlier hypothesis of a relationship between ^{99m}Tc-sestamibi (MIBI) retention and parathyroid oxyphil cell count in parathyroid adenoma. Based on their retrospective analysis of 14 patients, they concluded that the oxyphil cell content is the only biological variable that is associated with late tracer retention, whereas the initial tracer uptake was correlated to the volume of the lesion and serum calcium levels. They further reported that the results of only one study conflicted with their results, but they did not regard it as a contradiction to their results because it was not based on a dual-phase imaging protocol.

We cannot agree with the authors, because we have already discussed this topic on the basis of preliminary results in a letter in 1995 (*2*) and in the publication of the final results of dual-phase imaging in 56 patients with primary hyperparathyroidism in 1997 (*3*). In contrast to the observation of Carpentier et al., we could not demonstrate a correlation between the oxyphil cell count and the regional sensitivity of dual-phase ^{99m}Tc-MIBI scintigraphy in a multivariate analysis. Furthermore, Ishibashi et al. (*4*) have shown that a prolonged retention of tetrofosmin was independent of the number of oxyphil cells in primary and secondary hyperparathyroidism. The most recent article by Ishibashi et al. (*5*), admittedly not accessible when Carpentier et al. submitted their manuscript, repeated this observation with MIBI.

Thus, based on the published literature, Carpentier et al. claim that the oxyphil cell content is the only biologic parameter variable that is associated with prolonged tracer retention has to be taken with some caution. The importance of the oxyphil cell content for dual-phase MIBI parathyroid scintigraphy may also be challenged on the basis of the clinical observation that the method is only of limited value in secondary and tertiary hyperparathyroidism, despite the increased concentration and secretory importance (*6*) of oxyphil cells in hyperparathyroidism due to chronic renal failure. One possible explanation of the conflicting results in the literature might be our observation of a correlation between serum calcium, parathyroid hormone levels and oxyphil cell content (*3*). This is in accordance with the findings of Carpentier et al. of a correlation between serum calcium levels and early tracer uptake, and, therefore, serum calcium levels may play the key role in modifying MIBI kinetics by influencing the membrane potential.

REFERENCES

1. Carpentier A, Jeannotte S, Verreault J, et al. Preoperative localization of parathyroid lesions in hyperparathyroidism: relationship between technetium-99m-MIBI uptake and oxyphil cell content. *J Nucl Med.* 1998;39:1441–1444.
2. Staudenherz A, Kletter K, Leitha Th. Rapid washout of technetium-99m-MIBI from a large parathyroid adenoma [letter]. *J Nucl Med.* 1995;36:1928.
3. Staudenherz A, Abela C, Niederle B, et al. Comparison and histopathological correlation of three parathyroid imaging methods in a population with a high prevalence of concomitant thyroid diseases. *Eur J Nucl Med.* 1997;24:143–149.

4. Ishibashi M, Nishida H, Strauss HW, et al. Localization of parathyroid glands using technetium-99m-tetrafosmin imaging. *J Nucl Med.* 1997;38:706–711.
5. Ishibashi M, Nishida H, Okuda S, Suekane S, Hayabuchi N. Localization of parthyroid glands in hemodialysis patients using Tc-99m sestamibi imaging. *Nephron.* 1998;78:48–53.
6. Tanaka Y, Funahashi H, Imai T, Seo H, Tominaga Y, Takagi H. Oxyphil cell function in secondary parathyroid hyperplasia. *Nephron.* 1996;73:580–586.

Anton Staudenherz
Thomas Leitha
University Clinic of Nuclear Medicine
Wien, Austria

REPLY: We thank Drs. Staudenhertz and Leitha for their comments and note their concern over our finding of a positive relationship between oxyphil cell content of parathyroid lesions and the positive uptake during the late phase of dual-phase ^{99m}Tc-sestamibi (MIBI) (*1*). We initiated our retrospective study after observing positive uptake during the first phase of the scan but not during the late phase in a patient with parathyroid adenoma in whom no oxyphil cells could be found (*2*). Admittedly, our study had some limitations, such as its retrospective design and the small number of patients included. However, we carefully performed the interpretation in a blind fashion for both the scintigraphic and the pathologic findings and assessed the late phase of ^{99m}Tc-MIBI independently from the early phase. This had not been done by other investigators (*3,4*).

The discrepancy noted by Staudenhertz and Leitha between the results of their study (*3*) and ours (*1*) is not entirely clear. In their study, no independent relationship was found between the positivity of the scan and the parathyroid oxyphil cell content using multivariate analysis that included laboratory parameters, age, sex and volume of the parathyroid adenoma. However, they did not differentiate in their analysis between positivity during the early phase versus the late phase. Although their study included more patients than ours, it is likely that it had insufficient power to allow the detection of an independent relationship with oxyphil cell content using a multivariate analysis model. In our study, the calcium levels were almost identical between patients with and without positive late-phase uptake, which is in contrast to the higher calcium levels of those patients who had a positive scan during the early phase. It is therefore unlikely that calcium levels play a role in the late retention of ^{99m}Tc-MIBI in parathyroid lesions. There is a wider concern to us as to the biologic plausibility of prolonged cellular retention of MIBI in parathyroid lesions. Currently, the presence of mitochondria-rich oxyphil cells appears to be the most plausible hypothesis, although more research must be done on this topic.

REFERENCES

1. Carpentier A, Jeannotte S, Verreault J, et al. Preoperative localization of parathyroid lesions in hyperparathyroidism: relationship between technetium-99m-MIBI uptake and oxyphil cell content. *J Nucl Med.* 1998;39:1441–1444.
2. Bénard F, Lefebvre B, Beuvon F, Langlois MF, Bisson G. Rapid washout of technetium-99m MIBI from a large parathyroid adenoma. *J Nucl Med.* 1995;36: 41–243.
3. Staudenhertz A, Abela C, Niederle B, et al. Comparison and histopathological correlation of three parathyroid imaging methods in a population with a high prevalence of concomitant thyroid diseases. *Eur J Nucl Med.* 1997;24: 143–149.
4. Ishibashi M, Nishida H, Okuda S, Suekane S, Hayabuchi N. Localization of parathyroid glands in hemodialysis patients using Tc-99m sestamibi imaging. *Nephron.* 1998;78:48–53.

André Carpentier
Simon Jeannotte
Jean Verreault
Bernard Lefebvre
Guy Bisson
Charles-Jacques Mongeau
Pierre Maheux
Centre Universitaire de Santé de l'Estrie
Sherbrooke, Québec, Canada

Regarding Sentinel Lymph Node Localization in Early Breast Cancer

TO THE EDITOR: In their recent article, Gulec et al. (*1*) state that the ideal radiocolloid for sentinel lymph node biopsy (SLNB) should migrate in a reasonable time frame (0.5–1 h) in sufficient quantities to be detected by a gamma detecting probe. They also state that radiocolloid retention in sentinel lymph nodes and delay of pass-through to nonSNs should be sufficiently long to permit SLNB to be performed over a wide range of time intervals (0.5–8 h) after injection of the colloid. While we understand the desire to embrace such a definition, we have to disagree with it. Logically, the ideal radiocolloid for SLNB is one that most accurately maps physiological lymphatic drainage from the primary tumor site to draining sentinel nodes (SNs). The ideal radiocolloid will thus be one with a particle size that allows it ready entry into the lymphatic system under physiological conditions.

These "ideal" radiocolloids would have particle sizes in the 5–75 nm range. Particles > 75 nm will have only limited entry into lymphatics under physiological conditions and migrate more slowly through the lymphatic vessels. Most particles in filtered ^{99m}Tc-sulfur colloid are >75 nm in diameter; when using this tracer, there are fewer particles in the lymphatic vessels. These vessels usually are not visualized during dynamic imaging, whereas they are routinely seen using radiocolloids such as antimony sulfide or nanocolloid of albumin, both of which have the majority of their particles in the desirable size range. Visualization of the lymphatic vessels is important, because the channels can be seen draining directly into SNs. More accurate identification of SNs is thus obtained, and, therefore, small-particle radiocolloids are preferred for any lymphatic mapping procedure, including SLNB.

With smaller-particle-size colloids, more tracer might be expected to pass through SNs and lodge in second-tier nodes; however, this is not determined solely by particle size and certainly does not occur in all patients. Using ^{99m}Tc-antimony sulfide colloid, the appearance of tracer in second-tier lymph nodes correlates with the speed of movement of the tracer through the lymphatics (*2*). The higher the flow rate, the greater the likelihood that activity will be seen in second-tier nodes. Nevertheless, in many patients, antimony sulfide colloid passes to the SN and remains in this node, with no movement whatsoever to second-tier nodes over several hours.

Some second-tier activity will occur in certain circumstances with any radiocolloid, including microfiltered ^{99m}Tc-sulfur colloid,