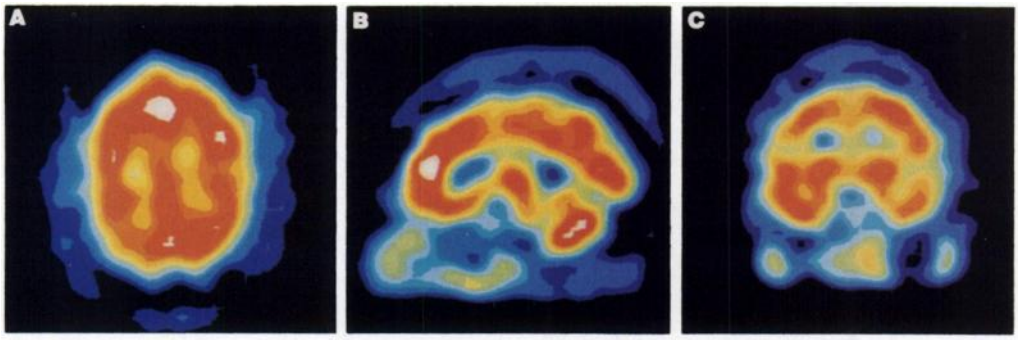

FIGURE 2. Technetium-99m-HMPAO SPECT transverse (A), saggital (B) and coronal (C) sections after (10/20/95) ECT treatment. All sections pass through the posterior frontal cortex.

patients with catatonic schizophrenia. Since rCBF changes with resolution of catatonic state were not assessed in these reports, at this juncture it is not possible to determine whether perfusion patterns reported for patients within catatonic schizophrenia by Satoh et al. were trait- or state-specific.

CONCLUSION

Resolution of hypoperfusion in the frontal and parietal cortices with resolution of acute catatonia in a patient with schizoaffective disorder indicates that these changes may be specific to the catatonic condition rather than to the diagnosis of catatonic schizophrenia. Thus, this finding supports the hypothesis that catatonia is a state phenomenon rather than a syndrome confined to catatonic schizophrenia. Further significance of this case lies in demonstrating the potential usefulness of SPECT as a clinical tool in psychiatry.

ACKNOWLEDGMENT

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Identification of Severe Right Ventricular Dysfunction by Technetium-99m-Sestamibi Gated SPECT Imaging

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An 84-yr-old man with previous anterior wall myocardial infarction presented with shortness of breath and palpitations. His symptoms were attributed to myocardial ischemia, and he was referred for a stress ^{99m}Tc-sestamibi SPECT imaging study with gating. The images showed minimal left ventricular ischemia, but a dilated and hypokinetic right ventricle suggested pulmonary pathology as the probable etiology of his presenting symptoms. A subsequent ventilation perfusion study was consistent with the diagnosis of multiple pulmonary emboli. Thus, ^{99m}Tc-sestamibi SPECT imaging with gating provides information about right ventricular perfusion and function, enhancing the clinical utility of stress myocardial perfusion imaging.

Key Words: gated SPECT; technetium-99m-sestamibi; right ventricle

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Stress radionuclide myocardial SPECT perfusion imaging is an important noninvasive modality for assessing patients with known or suspected coronary artery disease (*1–4*). The high

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count densities of the newer ^{99m}Tc-labeled perfusion tracers, such as ^{99m}Tc-sestamibi, result in improved spatial and contrast resolution of the myocardial walls compared to ^{201}Tl. This is especially helpful in visualizing the thin walled right ventricle (*5,6*). The additional counts provided by ^{99m}Tc-sestamibi also allow gating of perfusion images, permitting functional assessment of both the left and right ventricles. In the present case, gated-SPECT imaging of the right ventricle led to the correct diagnosis in a patient with exertional dyspnea that had been thought to be cardiac in origin.

CASE REPORT

An 84-yr-old man was admitted to the hospital with a 2-day history of palpitations and severe exertional dyspnea. The patient had suffered an anterior wall myocardial infarction 7 yr prior, resulting in reduced left ventricular function and an ejection fraction of 30%, but until the time of hospitalization was asymptomatic. On admission, the patient denied any chest pain or pressure and had no paroxysmal nocturnal dyspnea or orthopnea. The admission medications included isosorbide dinitrate, atenolol, captopril and furosemide.

On physical examination, the patient was found to be markedly dyspneic with minimal exertion. He was tachycardic, having a resting heart rate of 117/min. His blood pressure was 200/110 mmHg, and the respiratory rate was 24/min. There was jugular venous distention with prominent *v* waves. The lung exam was normal, without rales or rhonchi. The cardiac examination revealed a regular rate and rhythm, a displaced apical impulse and an S_3 gallop. No cardiac murmurs or rubs were appreciated. The abdominal exam was unremarkable, without organomegaly. There was 1^+ pitting edema.

The admission electrocardiogram showed sinus tachycardia, 1° AV block, left-axis deviation and evidence of a Q wave anterior wall myocardial infarction. A room air arterial blood gas showed a pH of 7.42, a pCO_2 of 31 and a pO_2 of 71. The chest radiograph was normal, without evidence of congestive heart failure or other abnormalities.

The patient's initial working diagnosis was an unstable anginal equivalent. The cardiac enzymes were negative for myocardial infarction. An echocardiogram was technically limited, precluding accurate assessment of either left or right ventricular function.

Myocardial Perfusion Imaging

To further evaluate the patient, a combined dipyridamole and treadmill exercise ^{99m}Tc-sestamibi SPECT imaging study was done. The patient received 47.9 mg of intravenous dipyridamole, followed by 1:48 of exercise using a modified Bruce protocol. The patient had no chest discomfort but experienced marked dyspnea. There were no electrocardiographic changes of ischemia.

At peak exercise, 28.9 mCi of ^{99m}Tc-sestamibi were injected intravenously, followed 1 hr later by tomographic imaging using a gamma camera with a high-resolution collimator. All images were recorded using a 64 × 64 acquisition matrix across a 180° rotation (from 45° right anterior oblique to 45° left posterior oblique) using 64 projections of 20 sec each, with photon-energy limits set at a 20% window around the 140 keV ^{99m}Tc peak. Electrocardiographic gated-SPECT images were acquired simultaneously at 8 frames/cardiac cycle.

The patient also underwent rest imaging immediately before stress, receiving 7 mCi of ^{99m}Tc-sestamibi, followed approximately 1 hr later by SPECT imaging similar to stress except that images were acquired with 64 projections of 25 sec each. The postrest images were not gated.

Transverse image slices 6-mm thick were reconstructed via filtered backprojection using a Butterworth filter. For the rest images, a cutoff frequency of 0.5 Hz order 10 was used, while for the stress images a cutoff frequency of 0.66 Hz, order 7 was used.

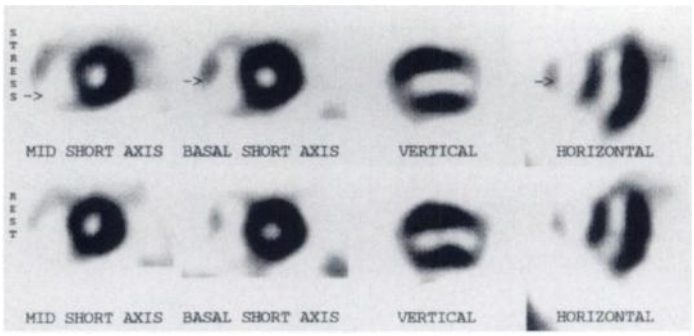

FIGURE 1. Representative slices of SPECT images displayed in the standard ACC/AHA/SNM format (*7*). There is a partially reversible defect of the anterior, septal and apical walls of the left ventricle. As seen in the mid short-axis, basal short-axis and horizontal views, the right ventricle (arrows) is abnormally enlarged.

Image Results

The SPECT images are displayed in Figure 1. There is a partially reversible perfusion defect in the anterior, septal and apical walls, corresponding to the territory of the patient's previous myocardial infarction. The right ventricle appears to be markedly dilated. The gated SPECT images, seen in Figure 2, show hypokinesis of the anterior, septal and apical walls of the left ventricle. In addition, the right ventricle appears markedly hypokinetic, and during systole there is distortion of the intraventricular septum towards the left ventricle, consistent with right ventricular pressure overload. These findings suggested a primary pulmonary problem, rather than myocardial ischemia, as the etiology of the patient's presenting symptoms. A pulmonary ventilation perfusion scan was performed (Fig. 3) and found to be consistent with a diagnosis of multiple pulmonary emboli.

DISCUSSION

The ability of ^{99m}Tc-labeled myocardial perfusion agents to enhance visualization of myocardial walls and allow simulta-

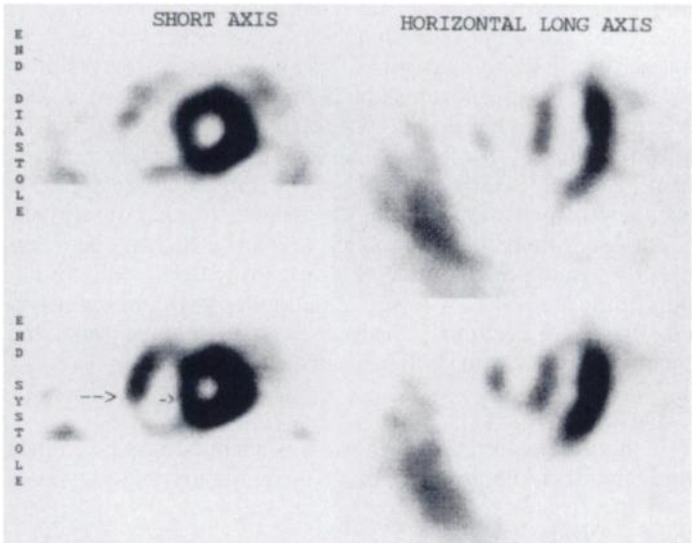

FIGURE 2. Gated-SPECT display of mid short-axis and horizontal long-axis slices. There is impaired thickening of the septal and apical walls of the left ventricle, seen best in the horizontal long-axis views. The right ventricle is markedly enlarged, with severe hypokinesis, noted most prominently in the short-axis views where an abnormally enlarged, end-systolic, right ventricular cavity can be seen (large arrow). At end-systole, the interventricular septum is abnormally flattened towards the left ventricle (small arrow), consistent with right ventricular pressure overload and pulmonary hypertension.

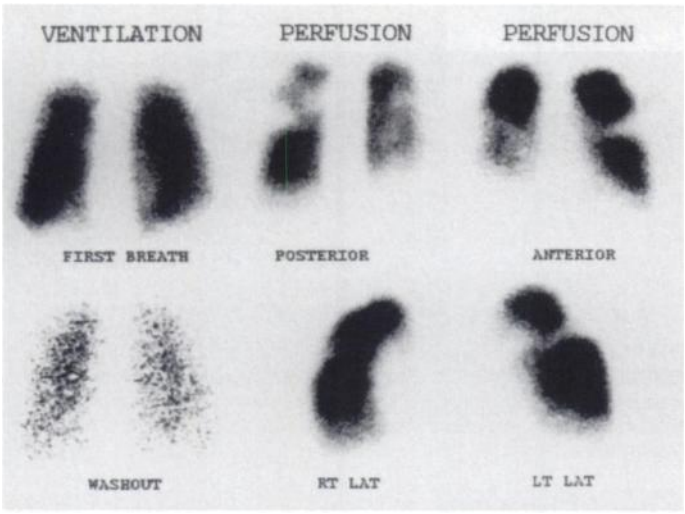

FIGURE 3. Ventilation perfusion scan shows mismatched defects of the posterior segment of the right upper lobe, and the anterior and posterior segments of the left upper lobe, consistent with bilateral pulmonary emboli.

neous assessment of ventricular function, whether by first-pass or gating techniques, promises to improve the clinical utility of stress radionuclide myocardial perfusion imaging (*8–10*). With ^{201}Tl, visualization of the right ventricle is often poor and inconsistent. In two studies by Brown et al. (*11,12*), the right ventricle was not visualized in 18% and 11%, respectively, of patients imaged with ^{201}Tl. Wackers et al. (*13*) described difficulties using ^{201}Tl to visualize the right ventricle, particularly with rest imaging. Using ^{99m}Tc-sestamibi, however, DePuey et al. (*14*) showed that there was superior visualization of the right ventricle compared with ^{201}Tl and that sestamibi SPECT can provide an accurate means of assessing right ventricular perfusion. Travin et al. (*6*) observed that ^{99m}Tc-sestamibi allowed consistent visualization of the right ventricle for both stress and rest perfusion images and could reliably assess ischemia and/or infarction there.

The ability to simultaneously assess ventricular function when performing stress perfusion imaging with ^{99m}Tc-sestamibi adds important diagnostic and prognostic information. The assessment of ventricular function using either first-pass or gated SPECT techniques with ^{99m}Tc-sestamibi has been shown to correlate well with other modalities, such as contrast ventriculography, echocardiography or equilibrium gated blood-pool imaging (*9,10,15,16*). Assessment of ventricular function using gated SPECT has been shown to enhance the diagnostic accuracy of perfusion imaging by helping to identify artifacts (*17*). Assessment of ventricular function with first-pass has been shown to provide important prognostic data, and information from gated-SPECT imaging, particularly with newer methods that more accurately measure ventricular dimensions and function, promises to do likewise (*8,18*).

CONCLUSION

In this case report, the diagnosis was unclear from the clinical presentation. Although there were symptoms suggestive of myocardial ischemia and possible congestive heart failure in the patient with known coronary artery disease, other findings such as the absence of chest pains, clear lungs, a normal chest-radiograph and an unremarkable arterial blood gas, were puzzling. Echocardiography was technically limited and not helpful. Although the ^{99m}Tc-sestamibi SPECT myocardial perfusion images revealed ischemia of the left ventricle, the ischemia was in the territory of a previously known large infarction and was thus felt unlikely to explain the patient's presentation of new onset, severe dyspnea, particularly in light of absence of any chest pain. In this patient, there was a strikingly enlarged and dysfunctional right ventricle, with paradoxical septal motion consistent with right ventricular pressure overload and pulmonary hypertension. These findings led to the correct diagnosis of pulmonary emboli.

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