

Silent Myocardial Ischemia during PET

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A resting perfusion defect detected during radioisotope myocardial perfusion imaging is generally thought to represent myocardial infarction. The administration of nitroglycerin during cardiac PET imaging results in improved resting defects, which suggests transiently abnormal resting perfusion with silent myocardial ischemia.

Key Words: myocardial perfusion imaging; positron emission tomography; myocardial ischemia

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CASE REPORT

Patient 1

A 66-yr-old man with a history of a recent uncomplicated inferior wall myocardial infarction was studied. One month after his infarct, he developed atypical chest pain and was referred for cardiac PET for further evaluation. Risk factors for coronary artery disease (CAD) included hypercholesterolemia and cigarette smoking. Medications included metoprolol, isosorbide dinitrate, digitalis and aspirin. His physical examination was unremarkable. Baseline electrocardiography (ECG) revealed normal sinus rhythm and 0.5 mm ST depression in the inferolateral leads.

The patient underwent myocardial perfusion imaging with ^{82}Rb . During acquisition of the resting scan, an additional 2.0-2.5 mm ST-segment depression was noted on ECG in the inferolateral leads, but no symptoms were reported.

Resting PET images obtained during these ECG changes revealed severe perfusion abnormalities in the lateral, inferolateral, inferoapical, inferior and posterior walls. The patient was treated with 0.4 mg sublingual nitroglycerin with resolution of the ST segment changes. Repeat PET perfusion images 30 min postnitroglycerin revealed marked improvement in the perfusion defects (Fig. 1).

The patient was admitted to the coronary care unit and was treated aggressively for unstable coronary syndrome. Serial enzyme determinations were negative for myocardial infarction. Cardiac catheterization revealed an 85% ostial left main stenosis, totally occluded proximal right coronary artery, and subtotally occluded left circumflex coronary artery. Left ventriculography revealed an akinetic inferior wall and basal septum with left ventricular ejection fraction of 36%. The patient subsequently underwent successful multivessel coronary bypass surgery.

Patient 2

This patient is a 58-yr-old man with a history of insulin-dependent diabetes mellitus, cerebellar vascular accident and coronary

artery disease confirmed by cardiac catheterization, which revealed three-vessel disease and normal left ventricular function. The patient was enrolled in a risk factor modification program consisting of a low-fat vegetarian diet and regular exercise. He was started on aspirin and diltiazem but was not taking them on a regular basis. No symptoms of angina or dyspnea were reported.

The patient was referred for cardiac PET perfusion imaging to establish a physiologic, noninvasive baseline for later assessment of treatment efficacy. Physical examination revealed a normal heart and lung exam and absent peripheral pulses. The baseline ECG showed 1.0 mm ST-segment depression in the inferolateral leads.

The patient underwent myocardial perfusion imaging with ^{82}Rb at rest and with dipyridamole. During the study, the ECG revealed minimal worsening of the baseline ST-segment changes in response to dipyridamole infusion. The patient reported no symptoms of angina. After administration of 0.4 mg sublingual nitroglycerin, the ST-segment changes completely resolved. A second resting image was obtained.

The first resting study revealed severe perfusion defects involving the lateral wall, which became slightly worse with dipyridamole. The third scan, obtained after nitroglycerin, showed significant improvement of the perfusion defect in the lateral wall compared to the baseline resting image as well as the dipyridamole image (Fig. 2).

The patient was treated with intensive intravenous anti-anginal therapy for 2 days and a repeat resting PET study was performed, which showed complete resolution of the previously observed perfusion defect (Fig. 3).

The patient was referred for cardiac catheterization and subsequent PTCA of the left circumflex coronary artery. A follow-up PET scan performed 1 wk later revealed a normal resting study with a moderate lateral wall perfusion defect during dipyridamole imaging. The patient was discharged from the hospital on anti-anginal medical therapy.

DISCUSSION

Two cases of silent myocardial ischemia present during routine PET imaging that occurred without deliberate provocation were discussed. Previous studies of silent myocardial ischemia using PET involved some provocation to elicit ST-segment depression without chest pain. The stimuli used included cold pressor (1), mental stress (2), smoking (3) and even mastication of food (4).

Both patients had severe CAD, later proven by coronary angiography, and resting ECG abnormalities at the time of rest perfusion imaging. With treatment, we documented resolution of these changes. In both patients, there was significant improvement in perfusion defects at rest after sublingual nitroglycerin. For Patient 2, there was complete resolution of

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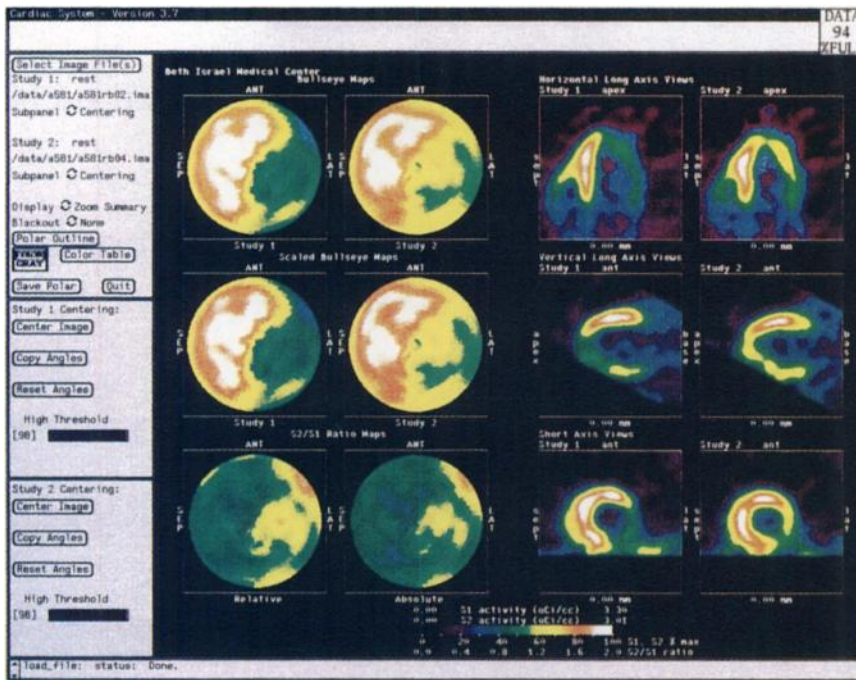


FIGURE 1. Resting cardiac PET images for Patient 1 before and after sublingual nitroglycerine.

the previously demonstrated resting perfusion defect after several days of intensive anti-anginal therapy.

This effect of nitroglycerin has been reported previously in SPECT thallium studies, using nitroglycerin at the time of redistribution imaging. Defects appeared less extensive and less severe compared to those seen when patients were not treated with nitroglycerin, making this a useful technique for assessing myocardial viability (5). Potential mechanisms for this observation include: (1) dilation of epicardial arteries or coronary collaterals with improve-

ment of myocardial perfusion and resolution of persistent ischemia and (2) change in loading conditions with improvement in wall motion which would affect isotope recovery in these regions (6).

Generally, resting defects on perfusion studies in asymptomatic patients are thought to represent myocardial infarction. These two case studies illustrate that this may not always be the situation. In Patient 2, resting scintigraphic defects appeared to represent true resting perfusion abnormalities with silent ischemia. It is important to consider

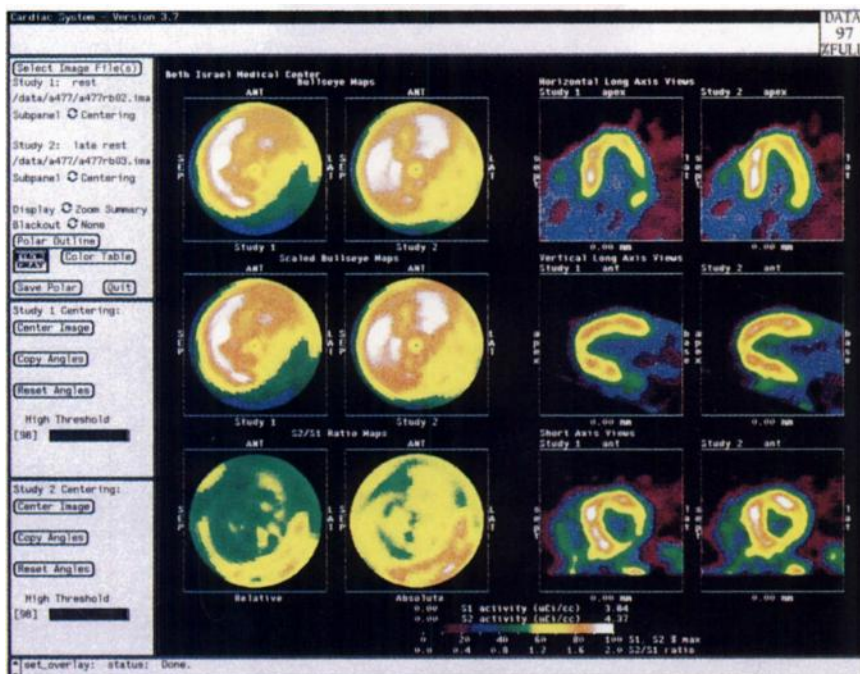


FIGURE 2. Resting cardiac PET images for Patient 2 before and after sublingual nitroglycerine.

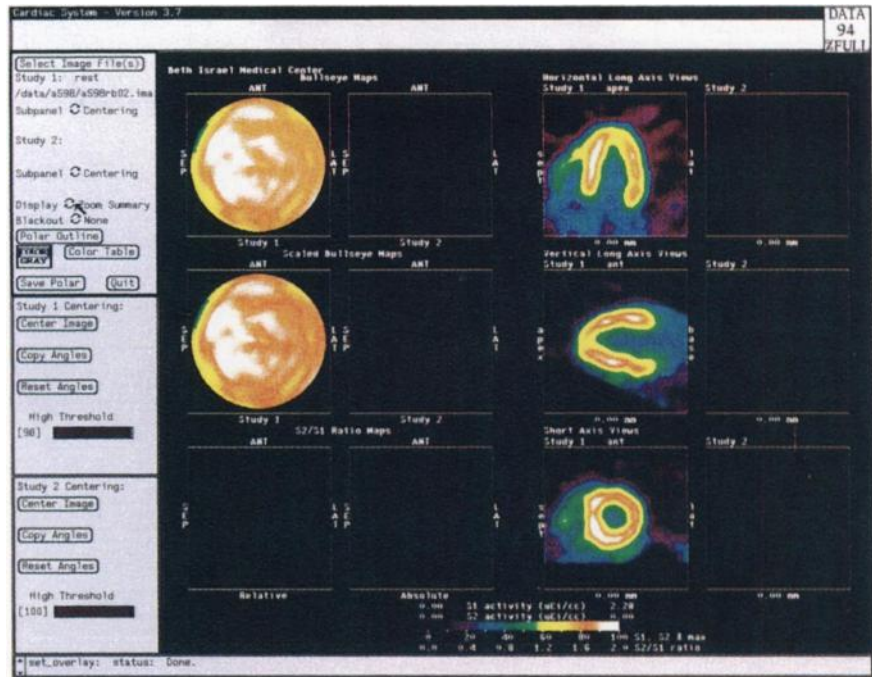


FIGURE 3. Resting cardiac PET images for Patient 2 after 3 days of intensive anti-anginal therapy.

these different possibilities during interpretation of resting static PET images. Further studies are necessary to clarify whether nitroglycerin should be routinely administered prior to myocardial perfusion imaging using PET.

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