Myocardial perfusion imaging in non-ischemic cardiomyopathy

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CASE PRESENTATION

A 63-year-old African-American man was referred for exercise SPECT myocardial perfusion imaging (MPI) for the evaluation of non-exertional chest pain of 2-3 months duration that had worsened recently (occurring almost daily). He carries the diagnosis of dilated, non-ischemic cardiomyopathy (NICM) with left ventricular (LV) dysfunction by gated SPECT-MPI and 2-dimensional echocardiography (images not shown). His medication list is shown in Table 1.

He exercised for 8:15 minutes using a standard Bruce protocol (Table 2) and stopped due to fatigue. The baseline electrocardiogram (ECG) demonstrated sinus bradycardia, 1st degree AV block, and left ventricular hypertrophy with QRS widening and repolarization abnormalities (Figure 1).

The MPI SPECT images using Tc-99m sestamibi were abnormal showing a large area of ischemia (Figure 2). Gated images showed LV dilatation and diffuse hypokinesis with LV ejection fraction (EF) of 27% (Videos 1 and 2). When compared to his MPI from 10 years earlier, the ischemia is new, but the LV EF was unchanged.

Coronary angiogram revealed only minimal atherosclerotic changes, but no lesion was $> 50\%$ diameter stenosis (Figure 3).

DISCUSSION

Determining whether heart failure is secondary to coronary artery disease (CAD) or due to one of the many causes of NICM is critical in the evaluation of patients with significant LV dysfunction. SPECT-MPI has proven useful in differentiating ischemic versus NICM in both chronic and new onset heart failure with a high sensitivity (87-96%) and negative predictive value (96%).[1,2]

The SPECT-MPI pattern in ischemic cardiomyopathy is characterized by large perfusion defects due to scar, ischemia, and/or hibernation. On the other hand, most (2/3) of patients with dilated NICM have an almost normal perfusion pattern, but a dilated LV cavity with severe wall motion/thickening abnormalities. However, some patients (like our patient) with no obstructive CAD by coronary angiography may have perfusion abnormalities (either reversible, fixed, or both). In many situations, the pattern is diffuse and does not correspond to a given vascular territory, but in a few (like our patient) it does. Often the size of the perfusion abnormality is small compared to the degree of LV

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dysfunction.[3] It is important to exclude attenuation artifacts as a cause of such defects because attenuation is magnified in the presence of LV dilatation and wall motion abnormalities due to partial volume effect. In our patient, the defect was reversible which makes it unlikely due to attenuation.

Table 1. Baseline medication list

Aspirin 81 mg daily
Furosemide 40 mg daily
Carvedilol 25 mg twice daily
Irbesartan 300 mg daily
Digoxin 0.25 mg daily
Atorvastatin 20 mg daily
Potassium Chloride 10 mEq daily
Spironolactone 50 mg daily

Several studies document abnormalities in myocardial blood flow and metabolism (using positron emission tomography) in patients with dilated cardiomyopathy due to microvascular dysfunction and microinfarcts, and thus it is unwise to refer to the imaging results as false positives when compared to coronary angiography, especially when accompanied by typical symptoms of angina.[4–6] It may be that microvascular abnormalities play a role in progression of the disease and symptoms (chest pain in our patient). Further, it is plausible that patients with NICM may develop CAD as they age, and therefore the development of new perfusion defects on serial imaging should not be disregarded. In this scenario, coronary angiography is not being performed to differentiate between ischemic vs. NICM, but rather to determine whether revascularization is an option to relieve symptoms. In the presented case, the symptoms were attributed to microvascular disease and medical therapy was intensified.

Table 2. Exercise stress test data

Exercise time (mins)	08:15
Baseline HR (bpm)	52
Peak HR (bpm)	109
Percent of age-predicted maximum HR (%)	69
Baseline BP (mmHg)	143/65
Peak BP (mmHg)	153/76
Exercise capacity (METS)	9.9
Result	Non-diagnostic due to failure to achieve 85% of age-predicted maximal heart rate and baseline ST/T changes

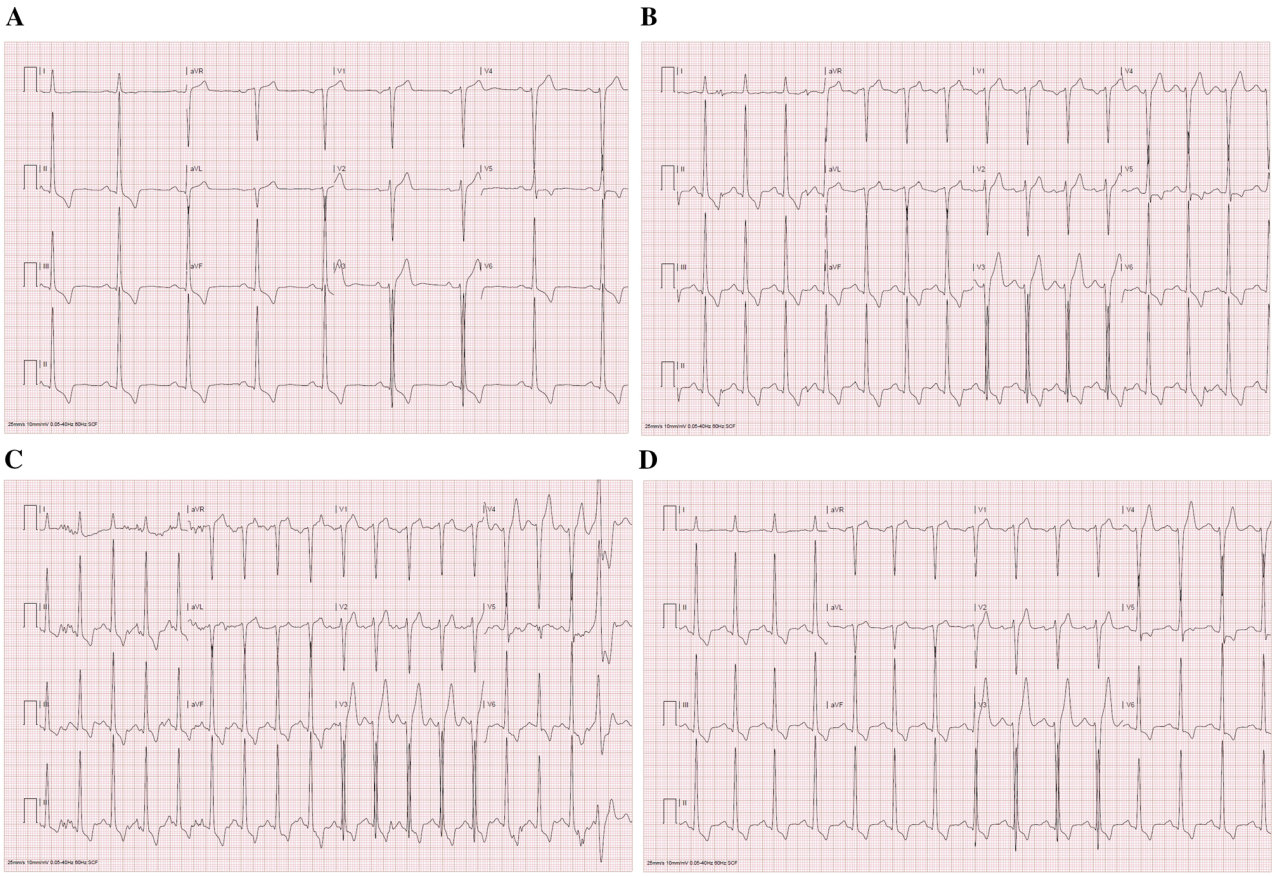

Figure 1. The ECG at rest (**A**), early exercise (**B**), peak exercise (**C**), and recovery (**D**). Baseline ECG reveals sinus bradycardia, 1st degree AV block, and left ventricular hypertrophy with QRS widening and repolarization abnormality. There was no significant change in baseline ST-T wave abnormalities with exercise.

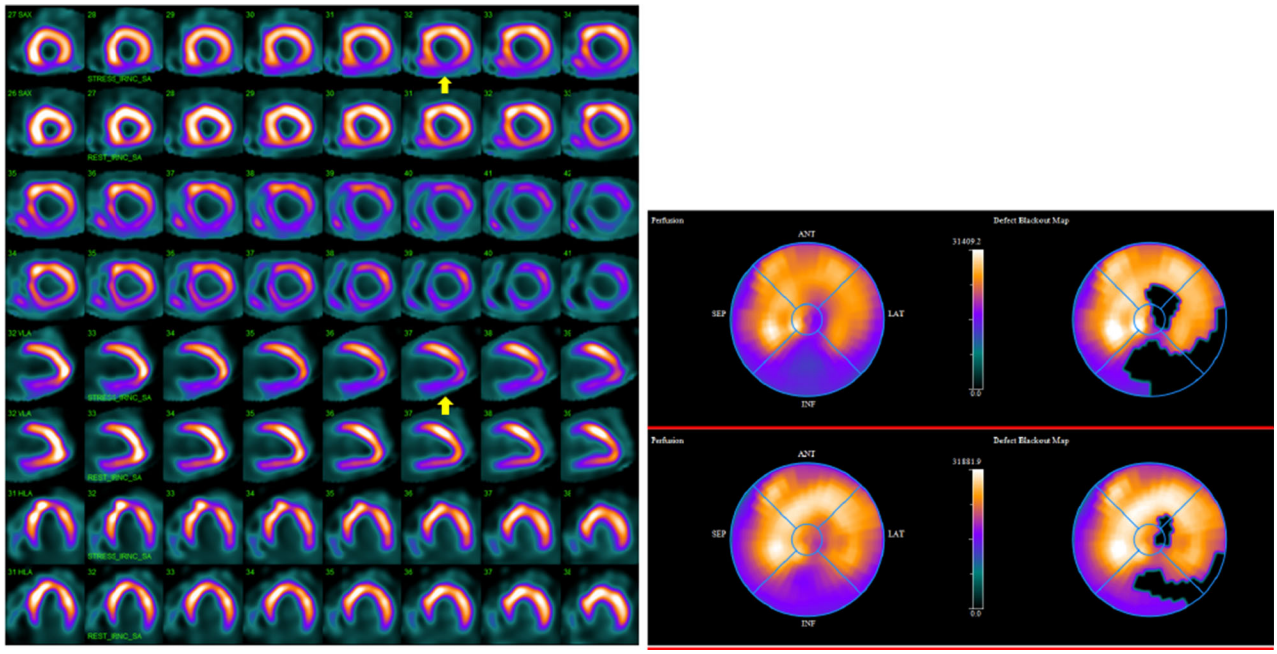

Figure 2. Left panel: Stress/rest SPECT myocardial perfusion images (Tc-99m Sestamibi). There is a large area of mild partially reversible perfusion abnormality in the distribution of the left circumflex and right coronary arteries involving 25% of left ventricular myocardium (yellow arrow). There is no transient ischemic dilation, but there is severe fixed left ventricular dilation. Right panel: Raw and normalized polar maps at stress (upper raw) and rest (lower raw). The blackened areas represent perfusion defects.

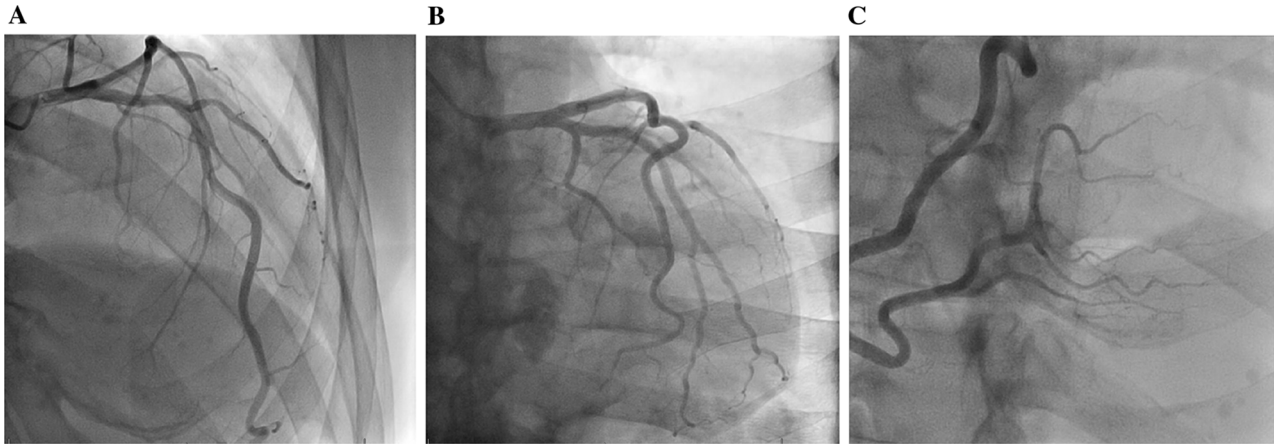

Figure 3. **A** Left anterior descending artery in PA cranial projection. **B** Left circumflex artery in LAO caudal projection. **C** Right coronary artery in LAO cranial projection. *PA*, posteroanterior; *LAO*, left anterior-oblique.

Disclosures

All authors declare that they have no conflict of interest.

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