Acute impairment of regional myocardial glucose uptake in the apical ballooning (takotsubo) syndrome

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Background. Apical ballooning syndrome (ABS) is a poorly understood clinical entity characterized by acute, transient systolic dysfunction of the left ventricular (LV) apex in the absence of epicardial coronary artery disease and commonly associated with acute emotional stress. We report abnormal regional myocardial perfusion and glucose uptake in 4 consecutive ABS patients studied using positron emission tomography with \(^{13}\)N-ammonia and \(^{18}\)F-fluorodeoxyglucose within 72 hours of presentation with ABS.

Methods. All patients were postmenopausal females, 3 of whom had a major recent life stress event. Coronary angiography revealed no or minimal obstructive epicardial coronary artery disease. All patients exhibited reduced glucose uptake in the mid-LV and apical myocardial segments, which was out of proportion to perfusion abnormalities in half of the cases.

Conclusion. In all 4 patients, affected regions subsequently recovered regional LV systolic function within 6 weeks. (J Nucl Cardiol 2006;13:244-50.)

The apical ballooning syndrome (ABS), also known as takotsubo cardiomyopathy and broken-heart syndrome, is a form of acute, reversible cardiomyopathy characterized by transient systolic dysfunction of the mid and apical left ventricular (LV) segments with associated electrocardiographic abnormalities, in the absence of obstructive epicardial coronary artery disease.\(^1\)-\(^8\) The majority of reported ABS patients have been postmenopausal women who commonly presented proximate to an acute emotional or physical stressor.

The underlying mechanism responsible for the syndrome is unknown. Current scientific theories include multivessel epicardial spasm,\(^9\) acute microvascular spasm/endothelial dysfunction,\(^3,5\) acute plaque rupture in the left anterior descending coronary artery,\(^10\) and neurogenic sympathetically mediated myocardial stunning.\(^8\) A recently published study demonstrated acute impairment of myocardial fatty acid metabolism in the LV apex and midventricle in ABS, suggesting myocardial “stunning” in these regions.\(^11\)

We report novel positron emission tomography (PET) myocardial perfusion and glucose metabolic findings in 4 consecutive patients presenting to our institution with ABS. All patients gave written permission to use their medical records including diagnostic images for research and publication purposes.

The PET scans were performed on a GE Advance PET camera (GE Medical Systems, Waukesha, Wis). All studies were conducted after a 12-hour fast. Two-minute and fifteen-minute transmission scans were obtained for optimal positioning and for subsequent attenuation correction, respectively. Myocardial perfusion was assessed with nitrogen 13 ammonia (19-23 mCi) via intravenous injection and a 20-minute static emission scan.\(^12\) At 70\(^\text{mH}11006\) 15 minutes into hyperinsulinemic-euglycemic clamping, fluorine 18 fluorodeoxyglucose (FDG) (15-20 mCi) was injected intravenously, followed 30 to 45 minutes later by a 20-minute static emission scan, for assessment of myocardial glucose uptake.\(^13\) Emission images were then corrected for attenuation, scatter, random coincidences, dead time, and radioactive decay and reconstructed via filtered backprojection with a ramp filter (cutoff, 4 mm) into a 22-cm field of view. The reconstructed images were displayed in short-axis and horizontal and vertical long-axis views on a personal computer workstation by use of in-house software. The PET images were interpreted by consensus by 2 experienced observers using a 16-slice model of the left ventricle and a semiquantitative 5-point scale (in
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