

# Prognostic significance of ischemia location on stress myocardial perfusion SPECT: Tracing the fingerprints of the widow maker

Abdou Elhendy, MD, PhD<sup>a</sup>

<sup>a</sup> Department of Cardiology, Marshfield Clinic, Marshfield, WI

Received Mar 9, 2015; accepted Mar 9, 2015

doi:10.1007/s12350-015-0121-8

---

## See related article, pp. 274–284

---

One of the great advantages of myocardial perfusion SPECT imaging is its ability to localize and quantify ischemia with good correlation with invasive angiographic findings.<sup>1</sup> Although the extent of perfusion abnormalities has been consistently associated with death and cardiac events,<sup>2–4</sup> little is known about whether ischemia in a certain coronary arterial territory is particularly more predictive of adverse events.

In this issue of the journal, Nudi et al demonstrated that ischemia in the distribution of the left anterior coronary artery (LAD) was independently predictive of mortality and hard cardiac events. This risk was incremental to clinical data, stress test parameters, and the number of ischemic segments.<sup>5</sup> The study was conducted in patients with moderate to severe ischemia. The study supports previous findings in patients undergoing exercise stress echocardiography.<sup>6</sup> The previous study was conducted in unselected patients and included those with normal test as well as mild ischemia. Both resting and inducible wall motion abnormalities were correlated with prognosis.

The association of LAD-related ischemia with more adverse outcome may not be surprising considering the known larger myocardial territory served by LAD compared to the right and left circumflex coronary

arteries. However, the most interesting finding is that this association persisted after adjustment for the total number of ischemic segments,<sup>5,6</sup> suggesting that other clinical, angiographic, and imaging characteristics come into play. The bases for such an independent association with prognosis may not be entirely understood. Many hypotheses could be suggested to explain this association.

### THE POTENTIALS FOR UNDERESTIMATION OF ISCHEMIA

Although stress echocardiography and SPECT provide a good estimate of the area at risk, ischemia is seldom elicited in the entire distribution of the significantly stenotic coronary artery. However, the entire territory remains at risk of dysfunction and necrosis with acute occlusion, regardless of the number of ischemic segments on an earlier stress test.

The underestimation of ischemic territory could be due the fact that areas with moderate and severe ischemia may be readily seen with SPECT and stress echocardiography, whereas adjacent segments with trivial ischemia may appear relatively normal. Other factors resulting in attenuation of extent of ischemia include collateral circulation, vascular overlap, cardiac medication, and suboptimal stress level.<sup>7,8</sup>

### SUSPECT THE LEFT MAIN

Abnormalities in LAD distribution could potentially be due to left main stenosis. Scarce data are available regarding stress imaging abnormalities in patients with left main stenosis, particularly those without other vessel involvement. It is conceivable that abnormalities may not develop in the left circumflex distribution due to shortcomings described. Therefore, the odds of having fatal myocardial infarction with isolated and even mild LAD abnormalities may be higher as these could be a

Reprint requests: Abdou Elhendy, MD, PhD, Department of Cardiology, Marshfield Clinic, Marshfield, WI; [elhendy.abdou@marshfieldclinic.org](mailto:elhendy.abdou@marshfieldclinic.org)

J Nucl Cardiol 2016;23:285–6.

1071-3581/\$34.00

Copyright © 2015 American Society of Nuclear Cardiology.

sequel of left main stenosis. In these patients, observation of left ventricular dilation with stress may be particularly useful.

### **ARE LAD-RELATED ABNORMALITIES MORE TRULY POSITIVE?**

One other explanation is that SPECT is more specific in LAD compared to other territories. Diaphragmatic and bowel attenuation artifacts may hamper interpretation of perfusion in the inferior wall resulting in more false positive results for right coronary artery disease. This will tend to render LAD-related abnormalities more prognostically significant as these are more likely to represent true ischemia. Nevertheless, in the era of hybrid imaging and attenuation correction, it remains questionable whether specificity is lower in the inferior wall.<sup>1</sup>

### **IMPROVED RISK STRATIFICATION WITH SPECT IMAGING**

Regardless of the mechanism by which LAD-related ischemia independently predicts outcome, the current paper expands the body of literature that demonstrated the ability of SPECT imaging to predict prognosis based on extent of ischemia. Furthermore, it emphasizes the importance of location of ischemia to LAD territory. As current guidelines consider LAD stenosis a factor in determining need for revascularization, the current study expands the role of myocardial perfusion imaging in selecting high-risk patients for revascularization. Further studies are needed to determine whether the results can be extrapolated to patients with mild ischemia and whether prognosis can be altered by revascularization in relation to the distribution of perfusion abnormalities. Another area to explore is whether LAD-related ischemia is a better predictor of

the site of future myocardial infarction compared to ischemia in other territories.

### **References**

1. Hendel RC, Berman DS, Di Carli MF, Heidenreich PA, Henkin RE, Pellikka PA, et al. ACCF/ASNC/ACR/AHA/ASE/SCCT/SCMR/SNM 2009 Appropriate Use Criteria for Cardiac Radionuclide Imaging: A Report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, the American Society of Nuclear Cardiology, the American College of Radiology, the American Heart Association, the American Society of Echocardiography, the Society of Cardiovascular Computed Tomography, the Society for Cardiovascular Magnetic Resonance, and the Society of Nuclear Medicine. *J Am Cardiol* 2009;53:2201-29.
2. Hachamovitch R, Berman DS, Shaw LJ, Kiat H, Cohen I, Cabico JA, et al. Incremental prognostic value of myocardial perfusion single photon emission computed tomography for the prediction of cardiac death: Differential stratification for risk of cardiac death and myocardial infarction. *Circulation* 1998;97:535-43. Erratum in: *Circulation* 1998;98:190.
3. Shaw LJ, Iskandrian AE. Prognostic value of gated myocardial perfusion SPECT. *J Nucl Cardiol* 2004;11:171-85.
4. Schinkel AF, Elhendy A, van Domburg RT, Bax JJ, Vourvouri EC, Bountiokos M, et al. Incremental value of exercise technetium-99m tetrofosmin myocardial perfusion single-photon emission computed tomography for the prediction of cardiac events. *Am J Cardiol* 2003;91:408-11.
5. Nudi F, Schillaci O, Neri G, Pinto A, Procaccini E, Vetere M, et al. Prognostic impact of location and extent of vessel-related ischemia at myocardial perfusion scintigraphy in patients with or at risk for coronary artery disease. *J Nucl Cardiol* 2015. doi:10.1007/s12350-015-0077-8.
6. Elhendy A, Mahoney DW, Khandheria BK, Paterick TE, Burger KN, Pellikka PA. Prognostic significance of the location of wall motion abnormalities during exercise echocardiography. *J Am Coll Cardiol* 2002;40:1623-9.
7. Elhendy A, Geleijnse ML, Roelandt JR, van Domburg RT, TenCate FJ, Cornel JH, et al. Dobutamine-induced hypoperfusion without transient wall motion abnormalities: Less severe ischemia or less severe stress? *J Am Coll Cardiol* 1996;27:323-9.
8. Elhendy A, van Domburg RT, Sozzi FB, Poldermans D, Bax JJ, Roelandt JR. Impact of hypertension on the accuracy of exercise stress myocardial perfusion imaging for the diagnosis of coronary artery disease. *Heart* 2001;85:655-61.