

EDITORIAL COMMENT

Visualizing the Coronaries in Patients Presenting With Heart Failure of Unknown Etiology*

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While earlier in the past century hypertension and rheumatic heart disease were the most common causes of congestive heart failure in the U.S. (1,2), by the 1970s coronary artery disease (CAD) had taken the lead as the most common cause of chronic left ventricular (LV) dysfunction and congestive heart failure (1,2). More recently, the obesity pandemics and the increasing prevalence of diabetes mellitus in the industrialized world have underscored the current guidelines (3) that clinical cardiologists should investigate the presence and extent of CAD in most patients presenting with heart failure. This diagnostic separation can be difficult using clinical and noninvasive techniques and has therapeutic implications, as many patients with obstructive coronary disease and depressed LV function benefit from revascularization.

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Presently, to definitively rule out CAD, the performance of invasive coronary angiography with or without hemodynamic measurements from the left and right cardiac chambers is recommended. The paper by Andreini et al. (4) in this issue of the *Journal* examines the feasibility of a different strategy to assess the presence of CAD in patients with congestive heart failure. They compared coronary angiography by multidetector computed tomographic (CT) angiography (MDCTA) with conventional invasive angiography in 61 patients with severe global LV dysfunction and heart failure of unknown etiology. In addition, they evalu-

ated the performance of MDCTA against angiography in a group of 139 patients with normal LV function referred to MDCTA for nonheart failure reasons. They found that MDCTA correctly differentiated dilated cardiomyopathy patients with versus those without CAD. The importance of their findings to patients presenting with heart failure cannot be underestimated. In a matter of seconds (12 s to 18 s for 16-slice MDCTA and 6 s to 12 s for 64-slice MDCTA), cardiologists are now able to exclude CAD as the main etiology or as a contributing pathophysiologic factor in patients presenting with heart failure. Moreover, MDCT coronary angiography can identify, with a reasonable degree of accuracy, the presence and location of coronary stenoses versus nonobstructive soft or calcified atherosclerotic plaques (5). Importantly also, this technology is rapidly advancing towards enhanced temporal resolution using dual source CT technology (6), reduced radiation by prospective gating, and greater coverage by devices equipped with 256 detectors (7) that allow obtaining a full cardiac image within 3 s to 5 s in a nonhelical mode (8).

The diagnostic performance of 16-slice MDCTA in the study by Andreini et al. (4) is superior to recently published meta-analyses of single-center studies and a multicenter clinical trial utilizing this technology in comparison with invasive coronary angiography (9,10). The discrepancies are likely secondary to the typical biases of small single-center diagnostic studies relative to larger multicenter trials such as patient mix (in this case a small number of dilated cardiomyopathy patients with primary cardiomyopathies [$n = 44$] and an even smaller group of patients with advanced coronariopathies), concentrated expertise in data acquisition and data analysis among other factors that tend to increase the range of abnormalities and favor stronger correlations. In the larger control group, patient selection may have been less dichotomous in terms of underlying pathology with diagnostic performances that more closely resemble those reported for larger single-center trials (9,10). The possibility that coronary angiography performed by newer 32- or 64-slice MDCT scanners would be even more accurate is suggested by previous meta-analyses comparing <16- versus >16-slice MDCTA (9), but definitive answers are still unavailable.

While the potential advantages of evaluating CAD by MDCTA versus coronary angiography in terms of convenience, avoidance of invasive catheterization, and the ability to provide assessment of both stenotic as well as nonobstructive plaques are clear, several disadvantages, however, deserve discussion. First, the major limitation of CT is that quantities of iodinated contrast agent application similar to those needed for angiography are required. Accordingly this approach does not offer an advantage for those individuals at increased risk for dye-related side effects or toxicity. Secondly, if LV hemodynamic measurements are needed, invasive catheterization will not be precluded. Finally, if CAD requires invasive intervention, the diagnostic and

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therapeutic procedures can be combined saving the patient an additional CT test that also entails radiation and iodinated contrast administration. In this regard, if the CT shows significant CAD that requires short-term intervention, the additional radiation and contrast load may represent an additive safety concern. The latter cases are, however, the exception rather than the rule in the workup of patients with dilated cardiomyopathy of unknown etiology. Future studies addressing clinical presentation and other potential ancillary triage mechanisms could further refine the utilization of MDCTA in the workup of these patients.

It is also important to note that MDCTA offers substantially more data than coronary angiography. Computed tomographic imaging provides exquisite and high resolution assessment of cardiac structure and function, including precise tissue analysis. Thus, as we move towards the use of this imaging modality for coronary anatomy, the type and extent of clinical information may also expand significantly.

Finally, as we place the findings of this study in relation to other recent trials focusing on the utilization of MDCTA to exclude or assess the presence and severity of CAD in patients referred for aortic and mitral valve replacement (11), patients with left bundle branch block (12), and those who underwent cardiac transplantation (13), we might speculate that this modality may find a special niche in specific groups of patients who currently undergo invasive angiography but could in the future be better evaluated noninvasively. The combination of coronary angiography with quantitative assessment of global and regional myocardial function, transmural scar (14,15), and perfusion (16) in the future could further enhance the attractiveness of MDCTA in the care of patients with advanced heart disease and congestive heart failure. In the meantime, additional prospective studies testing the utility of MDCTA in patients with heart failure and cardiomyopathies of unknown etiology are needed before we can solidify a recommendation that this is the preferred modality of workup for these patients. The study by Andreini et al. (4) is an important first step in that direction.

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