EDITORIAL COMMENT

Improving the Evaluation of Left Ventricular Systolic Function With Intravenous Perfluorocarbon Ultrasound Contrast: Will Suboptimal Echocardiograms Become an Endangered Species?*

Thomas R. Porter, MD, FACC
Omaha, Nebraska

Over the past five years, intravenous ultrasound contrast imaging has gone from a technique that had a few limited right-sided applications (e.g., detecting a patent foramen ovale) to one that has the potential to become an all-encompassing imaging technique for both the determination of global and regional left ventricular (LV) systolic function and the rapid assessment of myocardial perfusion. If this potential becomes a reality, functional perfusion imaging will be possible in clinical situations where other imaging techniques (radionuclide imaging, computed tomography, right and left heart catheterization) simply cannot go—to the bedside. In this issue of the Journal, Reilly et al. (1) take one step toward the achievement of this goal by demonstrating the value of harmonic imaging with intravenous Optison during bedside transthoracic echocardiography in the intensive care unit (ICU) (1). Seventy patients, examined from April to June 1998, were randomly evaluated to determine whether harmonic imaging with an intravenous ultrasound contrast agent improved the reader’s confidence in assessing wall motion and the global LV ejection fraction. They found that contrast imaging permitted the interpretation of 76% of the segments that could not be seen with standard imaging. More importantly, the authors found that they could interpret LV ejection fractions in 11 of the 16 patients in whom ejection fractions were uninterpretable with standard imaging and in 4 of the 9 patients whose ejection fractions were uninterpretable with harmonic imaging alone. Contrast echocardiography significantly changed the estimation of ejection fractions determined with standard imaging in 31 of the 70 patients. These data demonstrate the marked potential of intravenous contrast agents in intensive care settings, even when compared with standard harmonic imaging alone.

The importance of intravenous perfluorocarbon containing microbubbles. The findings of Reilly et al. (1) demonstrate that intravenous perfluorocarbon containing microbubbles can significantly improve the quality of the echocardiogram in the ICU. Previous studies using room air containing microbubbles (Levovist and Albunex [2,3]) have failed to demonstrate that these contrast agents added significantly to the endocardial border enhancement of harmonic imaging alone. Unlike these studies, Reilly et al. (1) demonstrate the value of both harmonic imaging and perfluorocarbon containing microbubbles. Although harmonic imaging improved the quality of wall motion as compared with standard imaging, more than 20 patients in the ICU had a significant change in their ejection fraction estimation after the injection of intravenous Optison as compared with harmonic imaging alone. Although Reilly et al. (1) did not compare Optison with room air containing microbubbles, the value of perfluorocarbon containing microbubbles over room air containing microbubbles in delineating endocardial borders has been described in a recent phase III multicenter trial using the perfluorocarbon emulsion EchoGen (4).

Study limitations. Although the report by Reilly et al. (1) is very important, it did not address some clinically relevant questions regarding the accuracy and utility of contrast echocardiography. First, we do not know if the increased “surety” after intravenous Optison correlated with increased accuracy. Because no comparative procedures were done on any of the patients (e.g., radionuclide imaging, left ventriculography), we cannot be sure that the ejection fractions with contrast imaging were entirely correct. For example, both diagnostic ultrasound pressures and LV systolic pressures destroy contrast microbubbles. Therefore, it is possible that the end-systolic images with contrast echocardiography falsely appeared smaller than they actually were owing to destroyed contrast agent. Hundley et al. (5) have shown, however, that there is a strong correlation between end-diastolic and end-systolic volumes obtained after contrast opacification with intravenous EchoGen and those obtained with magnetic resonance imaging. In this study, use of an intravenous contrast agent improved the number of ejection fractions that were correctly classified by echocardiography from 71% to 94%. Furthermore, the improved accuracy of contrast echocardiography was seen for ejection fractions that ranged from <35% to >50% (2).

Secondly, the authors (1) do not relate to us in what direction contrast imaging changed the ejection fraction—for the better or for the worse. For example, are the 44% of cases in which a significant change in ejection fractions occurred after use of contrast agent mainly the result of

See page 485

*Editorials published in the Journal of the American College of Cardiology reflect the views of the authors and do not necessarily represent the views of JACC or the American College of Cardiology.

From the University of Nebraska Medical Center, Omaha, Nebraska.
underestimations of ejection fractions during standard imaging (because of poor definition of end-systolic borders) or is there a large percentage of cases for which we are overestimating ejection fractions with standard imaging and missing important wall motion abnormalities (because of poor apical endocardial definition)? The clinical implications of this report are contingent on not only knowing whether we can improve endocardial borders with intravenous contrast agents, but also identifying what kind of change the addition of contrast agent makes in the diagnostic and therapeutic management of these patients. These data still have not been presented by any investigators in the field, to my knowledge.

Conclusions. The findings of Reilly et al. (1) indicate that intravenous perfluorocarbon containing microbubbles may have a significant impact on patient management in the ICU. Instead of having nearly 25% of the studies in which ejection fractions cannot be determined, harmonic ultrasound imaging with Optison may enable us to determine ejection fractions in over 95% of cases. Furthermore, intravenous Optison may prevent the misinterpretation of ejection fractions in over 40% of studies. These findings indicate that suboptimal transthoracic studies with echocardiography may become a rare entity in the twenty-first century.

Reprint requests and correspondence: Dr. Thomas R. Porter, Section of Cardiology, 981165 Nebraska Medical Center, Omaha, Nebraska 68198-1165. E-mail: trporter@unmc.edu.

REFERENCES