Non-invasive techniques have become the workhorse of cardiologists for the diagnosis and risk stratification of patients with suspected coronary heart disease. To date, pharmacological stress echocardiography represents an alternative, exercise-independent stress modality and has become an established method for the diagnosis of coronary artery disease[1]. In a recent review article, Geleijnse and co-workers reported for a total of 2246 patients an overall sensitivity, specificity and accuracy of dobutamine stress echocardiography of 80%, 84% and 81%, respectively[1]. Although widely used, stress echocardiography has several limitations related mainly to the requirement for:

1. an adequate and optimal echocardiographic ‘window’: up to 15% of patients undergoing stress echocardiography suffer from the lack of a suitable acoustic window[2]. Endocardial border delineation may be sub-optimal and should be improved with second harmonic imaging and intravenous contrast agents[3–6].
2. an adequate assessment of reversible regional abnormalities that requires an expert sonographer[7].
3. an adequate reproducibility and interobserver agreement for ischaemia. However, in a study specifically addressing interinstitutional agreement in dobutamine stress echocardiography, Hoffman et al. reported an agreement in only 73% of patients[8].

One may expect that a quantitative approach may overcome the subjective interpretation of stress-induced wall motion abnormalities. The quantification approach may address the global function by measurement of left ventricular volumes and ejection fraction or the regional myocardial function by interrogating myocardial velocities[9–11] or regional endocardial motion by colour kinesis[12].

In the study presented in this issue, Joseph and co-workers have chosen the quantification of global left ventricular function to prospectively evaluate patients undergoing elective vascular surgery[13]. They have demonstrated that a decrease of less than 15% in left ventricular end-diastolic or end-systolic volume at peak stress was superior to wall motion segmental score index for detecting multi-vessel coronary artery disease (sensitivity and specificity of 92%), but not for one-vessel disease[13]. However, in the global population, the overall sensitivity of left ventricular volume analysis (56%) was lower than those reported by previous studies, ranging from 65% to 95%[1].

Quantifying stress echocardiography by measurement of left ventricular volumes and ejection fraction is attractive and rational, since ejection fraction calculation is a currently used method, and is well standardized and less subjective than segmental wall motion analysis. In normal subjects the left ventricular volumetric response to dobutamine inotropic stimulation is characterized by a modest decrease in diastolic volumes but marked reduction in systolic volumes that results in marked increases in fractional area changes of at least 30% up to 60%;[14]. However, left ventricular volumes and ejection fraction do not provide information on the segmental nature of myocardial dysfunction and are influenced by heart rate, preload and afterload[15,16]. Therefore, one cannot attempt to replace the segmental myocardial evaluation currently employed during dobutamine stress echocardiography with a global response as a unique criterion for positivity, especially in cases of one-vessel coronary artery disease. Therefore, what can we expect from left ventricular volume analysis during stress echocardiography? First, quantification of the global function may assist in the overall interpretation and remove the subjectivity among multiple readers. Second, an abnormal volume response may identify patients with an unfavourable outcome and provide a more accurate prognostic stratification[17]. Third, examination of left ventricular function during stress echocardiography may be worthwhile in the assessment of patients with valvular disease, as well
as for the detection of subclinical left ventricular dysfunction.[19]

Ideally, development of software assisting automatic edge detection should enable the quantitative assessment of both global and segmental function on-line to strengthen the current practice of visual analysis. However, while awaiting for the new era of on-line to strengthen the current practice of visual assessment of both global and segmental function, automatic edge detection should enable the quantitative improvement of both its accuracy and reproducibility.[19].

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References


