Can speckle-tracking imaging improve the reliability of echocardiographic parameters for outcome evaluation in clinical trials?

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This editorial refers to ‘Early diastolic strain rate in relation to systolic and diastolic function and prognosis in acute myocardial infarction: a two-dimensional speckle-tracking study’, by M. Ersbøll et al., on page 648

Echocardiography has been used for the assessment of left ventricular (LV) structure and function over almost three decades, and it is the de facto clinical standard for two-dimensional (2D) quantification of LV dimensions, and systolic and diastolic function.

In agreement with this, echocardiography is also a commonly used imaging modality in the management of patients with acute myocardial infarction. Because of low costs, easy applicability, and wide availability, echocardiography is useful not only for establishing the diagnosis, site, and magnitude of a myocardial infarction, and its mechanical complications, but also for follow-up studies. In particular, it is valuable for assessment of prognosis and risk stratification. Consequently, the majority of clinical trials have applied dimensions or 2D-derived volumes including LV ejection fraction (EF) as primary or secondary endpoints. Several prognostic parameters can be derived from commonly used and from more sophisticated echocardiographic approaches, as listed in Table 1.

However, a major disadvantage of using 2D echocardiography measurement as an endpoint is that it relies to a great extent on vendor skills and therefore is characterized by a relatively high interobserver and test–re-test variability. Whereas interobserver variability could be decreased if post-acquisition analyses are performed at one site (e.g. core lab), test–re-test variability is hard to resolve efficiently, which leads to a need for larger study samples. The influence of test–re-test variability on the interpretation of study results becomes evident in an example of LVEF where a 95% level of agreement reported for LVEF (±7%) is only slightly higher than the treatment effect on LVEF observed in some studies. The novel echocardiographic modalities for assessment of LV function based on deformation imaging obtained by tissue Doppler imaging (TDI) and particularly when based on speckle-tracking imaging provide lower interobserver variability and better test–re-test reliability.

From the pathophysiological point of view, diastolic LV function, particularly LV relaxation, as an energy-dependent mechanism is impaired early after the onset of myocardial ischaemia, followed by contractility abnormalities. Even LV distensibility is affected in myocardial infarction by interstitial oedema and also due to fibrosis in the later phase. Therefore, diastolic dysfunction is shown to be a valuable predictor of adverse outcome in patients with acute infarction.

The speckle-tracking parameter, early 2D strain rate, has been validated in the diagnosis of diastolic dysfunction and LV filling pressure in several highly selected patient cohorts: with coronary artery disease, hypertrophic cardiomyopathy, hypertension, diabetes, or heart failure with preserved ejection fraction (HFPEF). Ersbøll et al. are the first group to have investigated the prognostic role of diastolic strain rate in addition to existing echocardiographic parameters in a large-scale study including all patients with acute myocardial infarction irrespective of LV dimensions or EF, who are therefore ‘real life patients’. However, the study should not be interpreted as a validation and comparison of diagnostic accuracies between several echocardiographic indices, as it lacks referent invasive standard measurements and a control population. The important value of this study is a strong independent association with adverse outcome in patients after myocardial infarction beyond already recognized clinical (e.g. age, Killip class, hypertension, diabetes, left bundle branch block) and echocardiographic (EF, left atrial dimension, strain, E/E’, mitral regurgitation) markers as proven by multivariate regression analysis.

The LV filling index obtained by the 2D strain rate (E/e’sr) significantly improved the prognosis compared with all other echocardiographic parameters. It is remarkable that the E/e’sr is found to be more strongly associated with adverse outcome than the systolic...
global longitudinal strain (GLS) known to have prognostic value in patients with myocardial ischaemia, which suggest that also among deformation-related functional parameters, an LV diastolic marker may be more sensitive than a systolic marker.

Impairment of conventional systolic echocardiographic parameters (e.g. LVEF) represents a relatively late stage in the development of myocardial dysfunction when significant myocardial damage has already occurred. Detection of the myocardial dysfunction in the early, subclinical stage may have significant diagnostic and therapeutic implications and seems to be one of the most promising indications for speckle-tracking echocardiography. Therefore, diastolic 2D strain rate and its derivative for estimation of LV filling (E/e’sr) appear to be not only a marker of early preclinical LV dysfunction in coronary artery disease but also a marker of adverse outcome (E/e’sr) appear to be not only a marker of early preclinical LV dysfunction.

Moreover, a major point concerns the lack of reproducibility of 2D strain rate values, although this problem is less manifest compared to the other parameters. Furthermore, a major point concerns the lack of reproducibility of 2D strain rate values, although this problem is less manifest compared to the other parameters. Furthermore, a major point concerns the lack of reproducibility of 2D strain rate values, although this problem is less manifest compared to the other parameters.
In conclusion, the findings of Ersbøll et al. have shown that 2D speckle-tracking echocardiography and particularly diastolic strain rate has a superior prognostic value beyond that of all conventional and novel echocardiographic markers in patients suffering from acute myocardial infarction. This indicates that further outcome studies should favourably include deformation-related parameters of LV function, strain, and strain rate which might provide better insights into pathophysiology and therapy strategies. The requirement is to be responsive to the limitations of new echocardiographic modalities.

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References