LETTERS TO THE EDITOR

Should we search for linear correlations between global strain parameters and ejection fraction?

We have read with great interest the article by Altman et al. recently published in the European Heart Journal—Cardiovascular Imaging. We wish to congratulate the authors on their study, which showed that three-dimensional (3D) speckle-tracking echocardiography allows accurate and accelerated analysis of deformation when compared with a two-dimensional (2D) technique. However, we would like to discuss a methodological aspect, which may be appropriate for future analysis.

One of the aims of this study was to compare correlations of deformation parameters with 2D- or 3D-derived left ventricular ejection fraction (LVEF) by means of linear regression analysis between global strain parameters and LVEF. We believe that comparing various techniques of measuring deformation parameters on the basis of their linear correlation strength with LVEF may not always lead to viable conclusions regarding the accuracy of these techniques.

Ejection fraction represents a relative change in left ventricular volumes, whereas deformation parameters represent relative changes in area, circumference, or length. To prove that these parameters are not bound to correlate in linear fashion, we used a mathematical model of hemi-ellipsoid to produce the scatter diagram of relationship between global longitudinal strain and ejection fraction (Figure 1). It clearly indicates that a given value of global longitudinal strain may be associated with various values of ejection fraction and a given change in global longitudinal strain may lead to various changes in ejection fraction. Therefore, a weak linear correlation between these parameters or its absence does not necessarily mean that the technique of strain measurement is less accurate. Our comment emphasizes the need to prospectively test different approaches for calculation of crucial prognostic indicators reflecting left ventricular function to build a correct hierarchy of their clinical appropriateness, rather than verifying their agreement which may not always be expected based on mathematical principles.

Reference

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We thank Lipiec et al. for their interest in our paper and also for bringing up the issue of the appropriateness of linear regression analysis in the evaluation of deformation imaging against left ventricular ejection fraction (LVEF). We agree that LVEF and myocardial systolic strain explore different aspects of the ventricular function within their own limits. LVEF is a well-established parameter of global systolic function, despite its strong dependence on loading conditions and its reliance on radial thickening. On the other hand, myocardial strain is a regional myocardial deformation parameter exploring function in its multidirectional aspects, which has recently been suggested in assessing global ventricular systolic function through the average of multiple regional values. More specifically, systolic strain has been emphasized by a few clinical studies demonstrating its superiority in diagnosing subtle systolic abnormalities and also in terms of prognosis, especially in patients with mildly impaired ejection fraction.

We do agree that 3D strain clinical usefulness and potential prognostic value need to be evaluated. However, initial validation studies are first required to firmly establish both its reproducibility and its accuracy before any prognostic information can be sought after. The choice of the reference method can be an issue and is often debatable. Experimental validation studies were based on direct invasive measurements using sonomicrometry, whereas in the clinical setting it is justified to use LVEF despite its well-known limitations. We are aware that the use of another imaging technique to assess LVEF such as CMR might be
more relevant, but this does not help in resolving the issue of patients with myocardial dysfunction but preserved ejection fraction. This is well illustrated in our data since we pointed out a group of heart failure patients with reduced longitudinal strain but normal LVEF.

The figure enclosed in the letter by Lipiec et al. confirms this assertion; however, we can question presented mathematical model showing a 0% strain value corresponding to an LVEF value of up to 55%. Nonetheless, the aim of our paper was to identify the patients with abnormal LVEF defined as values <55%. Therefore, with the new 3D acquisitions, simultaneous assessment of both LVEF and systolic strain might be a promising approach.

References


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