Use of Speckle-Strain in a Multiparametric Approach to Dyssynchrony Imaging*

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The group of Becker and colleagues have had a seminal role in understanding how transmural thickening can be used as a marker of the transmural distribution of scar and likelihood of recovery (9,10).

In this issue of iJACC, Becker et al. (11) investigate the role of myocardial viability on reverse remodeling after CRT in patients with systolic heart failure. In 65 heart failure patients studied before and 12 months after CRT implantation, the lead was placed in a viable segment in 47, among whom pacing was associated with more favorable reverse remodeling, improvement to ejection fraction, and improvement of exercise capacity than when the lead was placed in a nonviable segment. Although the results confirm the role of preserved myocardial viability at the site of CRT lead position, the authors advance the field by applying speckle tracking to assess not only mechanical dispersion, but also segmental systolic circumferential strain as a marker of myocardial viability. The unique role of strain analysis (rather than the alternative modalities) is its ability to provide data on dysynchrony and viability to inform the optimal pacing site during CRT implantation. The information provided may be especially important in patients with ischemic cardiomyopathy.

Several aspects of the paper are particularly noteworthy. First, it is important that these investigators used circumferential strain, rather than longitudinal strain, which has dominated the published reports on strain. The reason that this is an important development is that longitudinal strain is primarily a marker of subendocardial function, and although this appears to be the initial site of a variety of subclinical diseases (e.g., diabetes and hypertension), it is ill suited to viability assessment because subendocardial infarction causes reduction of this parameter, with little additional change as scar
thickened in patients with myocardial infarction that a segment with circumferential strain > –11.1% is likely to be a transmural scar (9), and indeed, analysis of the optimal cut-point in this group confirms that this threshold is –11.9%. In the current era of 3-dimensional strain, a more sophisticated approach to the assessment of strain—multiple dimensions may provide a more comprehensive means of understanding the extent and location of scar.

Second, the investigators have applied the same level of circumferential strain to responsiveness in patients with nonischemic cardiomyopathy. These findings infer a role for not just scar extent, but also residual contractility, suggesting that impaired function due to myocardial disease may have as adverse an effect as scar. Several studies have shown that the latest contracting LV segment can be used to guide the LV lead position (13,14). It is not clear from the current paper whether regional mechanical delay (that is, the latest contracting LV segment) or viability should be preferred for LV lead positioning.

So what is the future of imaging in the selection of patients for CRT? The current indications for CRT include patients with heart failure on appropriate medical therapy, with LV dysfunction, and a wide QRS (>0.12 s), without reference to mechanical synchrony (15,16). There has been widespread skepticism about the reliability of traditional echocardiographic evaluation of mechanical dyssynchrony since the PROSPECT (Predictors of Response to CRT) study (17). Nonetheless, the evaluation of CRT responsiveness remains a tantalizing goal. This challenging and controversial topic is clouded by difficulties in defining responsiveness (18), particularly in a patient group whose natural history is often to experience progressive symptoms. In such a context, failure to improve may not necessarily represent treatment failure, if the natural history in the absence of treatment might have been inexorable deterioration. Nonetheless, this work continues because although CRT offers clear prognostic benefit in patients with heart failure (19–21), for many of these elderly patients with comorbidities, symptom relief may be as (or even more) important than prognostic benefit.

Unfortunately, although this rationale appears reasonable, the evidence to support it is limited. Some studies have shown that the use of multiple synchrony markers improves the performance of tests of mechanical synchrony (22,23). But the dependence of the CRT response on many parameters suggests that the investigation of this approach will require a multidimensional score that incorporates, not only synchrony, but the degree of LV and right ventricular remodeling, scar extent and location, pacing lead location, mechanical dyssynchrony, and device optimization. The problem is that a variety of investigations may be required to derive all of the potentially relevant information, ranging from echocardiography with tissue Doppler or speckle imaging, computerized axial tomography, myocardial scintigraphy, and cardiac magnetic resonance. Many of these techniques can provide information on more than 1 of these variables. The paper by Becker et al. (11) is the start of such a multiparametric approach from a single test.

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References


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