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Commentary: Elucidating the mechanisms underlying left ventricular function recovery in patients with ischemic heart failure undergoing surgical remodeling: Physiology versus Empiricism

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Myocardial infarction (MI) is a major etiologic factor for heart failure (HF). In addition to muscle loss, MI alters left ventricular (LV) size and shape (“remodeling”) through infarct expansion, scar formation, and hypertrophy of LV remote areas.^{1,2} LV dilatation also increases wall stress, which further decreases pump efficiency and blunts the benefits of revascularization.³

Surgical “reshaping” to revert postinfarction LV dilatation and remodeling has long been advocated.⁴ However, the ultimate benefits have been questioned, with surgeons wondering whether its aim is just achieving LV volume reduction, or restoring a more conical shape.⁵ Also, the

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CENTRAL MESSAGE

Why just reshaping! The importance of remote myocardium in enhancing LV function after ventricular surgical reconstruction is highlighted by 3D speckle tracking echocardiography.

STICH (Surgical Treatment for Ischemic Heart Failure) trial failed to demonstrate a clear benefit of adding LV surgical reconstruction to coronary artery bypass grafting in patients after an anterior MI⁶; still, that trial raised one important issue: would the benefits of surgical reduction of LV volume be offset by impaired diastolic distensibility/increased LV stiffness?

Choosing the optimal parameters to gauge improvement in LV function postoperatively is crucial when investigating the benefits of LV reshaping. Empirically, this has been pursued through measurements of LV ejection fraction (EF). That approach might prove fallacious, as EF is influenced by LV load conditions and other factors; more importantly, in this specific setting EF can be misleading. In fact, even if stroke volume remained unchanged after surgery (ie, no improvement of function), nonetheless expressing it relative to diastolic LV volume (which decreases postsurgery) would artifactually translate into greater EF; that would be just a “math improvement,” not a physiologically relevant benefit.

Speckle-tracking echocardiography (STE) can precisely measure myocardial strain deformation and quantify LV thickening, shortening, and rotation dynamics; furthermore,

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it is relatively angle-independent and only marginally affected by motion artifacts. Implementing STE to 3-dimensional (3D) echocardiography further refines analysis of global and segmental myocardial function.

In this issue of the *Journal*, Castelvechio and colleagues⁷ provide an important contribution to elucidate the mechanisms underlying LV functional improvement after surgical reconstruction. By 3D STE echocardiography, they studied 20 patients with anterior LV remodeling and ischemic HF, compared with matched controls.⁷ LV global longitudinal strain and mechanical dispersion, which were markedly impaired at baseline, significantly improved 6 months after surgical ventricular reconstruction, consistent with improved LV contractility and synchronicity.

Interestingly, the greatest improvement occurred in remote myocardium, lending support to the concept that postischemic remodeling also involves noninfarcted segments, possibly dyssynergic as a consequence of hibernation or increased wall stress.^{8,9} Indeed, hibernation per se may contribute to LV remodeling, which can revert upon revascularization,^{8,9} whereas remote myocardium alterations (eg, myocardial relaxation time by cardiac magnetic resonance) are associated with the development of HF post-MI.¹⁰ However, the role of hibernation in the findings of Castelvechio and colleagues remains speculative, as the presence of viable myocardium was not systematically sought.

Currently, 3D STE evaluation requires advanced equipment and skilled operators, which are not found at most sites. Yet, surgical ventricular reconstruction may have a role in selected patients with ischemic HF, particularly if

small end-systolic volume postoperatively can be anticipated. In this respect, identifying candidates with high likelihood of improving after surgery will require a tighter collaboration between surgeons and cardiologists and implementing multimodality imaging study of LV remodeling.

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