Magnetic resonance imaging with 3-dimensional analysis of left ventricular remodeling in isolated mitral regurgitation: implications beyond dimensions.

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Abstract BACKGROUND: Although surgery is indicated in patients with mitral regurgitation (MR) when left ventricular (LV) end-systolic (LVES) dimension is >40 mm, LV ejection fraction may decrease after mitral valve surgery. We hypothesize that significant LV remodeling before surgery is not reflected by standard echocardiographic parameters measured at the base of the heart.

METHODS AND RESULTS: Ninety-four patients (age, 54 ± 11 years; 38% female) with degenerative isolated MR underwent cine magnetic resonance imaging with tissue tagging and 3-dimensional analysis. In 51 control subjects (age, 44 ± 14 years; 53% female), the relation between LVES volume (LVESV) and LVES dimension was quadratic, whereas in 94 MR patients, this relation was cubic, indicating a greater increase in LVESV per LVES dimension among MR patients. Moreover, magnetic resonance imaging LVESV from summated serial short-axis slices was significantly greater than LVESV assessed with the Bullet formula in MR patients, attributed to a more spherical remodeling distal to the tips of the papillary muscles (P<0.001). Thirty-five patients underwent mitral valve repair per current guideline recommendations. LV ejection fraction decreased from 61 ± 7% to 54 ± 8% (P<0.0001)
and maximum shortening decreased significantly below normal at 1 year postoperatively (P<0.0001). Despite normalization of LV stroke volume and LV end-diastolic volume/mass ratio, there was a persistent significant increase in distal LVES 3-dimensional radius/wall thickness ratio and LVESV index after surgery.

**CONCLUSIONS:** Despite apparently preserved LVES dimension, MR patients demonstrate significant spherical mid to apical LVES remodeling that contributes to higher LVESV than predicted by standard geometry-based calculations. Decreased LV strain after surgery suggests that a volumetric analysis of LV remodeling and function may be preferred to evaluate disease progression in isolated MR.