Correspondence

Response to Letter Regarding Article, "Direction of Preoperative Shunting Affects Ventricular Mechanics After Tetralogy of Fallot Repair"

We thank Dr DeGroff for his comments on our study of ventricular mechanics during repair of tetralogy of Fallot.[1] We acknowledge that the use of 2-dimensional echo sections to represent the 3-dimensional left ventricle (LV) is limiting. The degree of error introduced by this compromise is unknown in the absence of more comprehensive imaging. However, we believe that our conclusions are essentially correct.

As noted, Matsumori et al[2] defined limitations of a biplane Simpson rule for LV volume determination in the presence of right ventricular (RV) pressure and volume overload. A modified Simpson rule, including area planimetry of the LV short axis at 2 levels, was more accurate than a biplane model of the LV based on diameters and a prolate ellipsoid. Matsumori's data also indicated that errors of echo algorithms versus angiography were qualitatively larger for RV volume overload, where septal distortion is greatest, than for RV pressure overload. Furthermore, errors with the biplane algorithm were qualitatively different when end-diastole and end-systole were compared in volume overload but were quite similar when the same comparison was done for pressure overload.

Our use of pressure-area curves measured at the maximum LV cross section is a compromise, necessitated by the conditions of cardiac surgery. However, we are careful to obtain sections at a constant LV location and technique before and after repair. We also record and planimeter the full LV cross section, avoiding postulated planimetry errors described by Matsumori. In previous publications,[3] we have used the minor semiaxis ratio, d_1/d_2, to characterize ventricular distortion related to RV/LV loading. Interestingly, we have found that reversion of d_1/d_2 toward normal (1.0) is delayed for weeks after surgical repair of congenital heart defects, suggesting involvement of ventricular remodeling. Our data for d_1/d_2 in tetralogy of Fallot are consistent with this. Thus, d_1/d_2 averages 0.5 to 0.6 at end-diastole and end-systole both before and after repair in both groups, with 1 exception: at end-diastole in the left to right shunt group, d_1/d_2 averages 0.8 both before and after repair. Because the change effected in d_1/d_2 by systolic contraction is similar within each group before and after repair, it is unlikely that related calculations are affected by a systematic artifact. Our qualitative observations are consistent with this, as well. In summary, although our study does not have the elegant control of biplane angiography, there is little evidence to support the position that our findings are the result of systematic measurement errors or artifacts.

Other investigators have also demonstrated that LV cross-sectional area can accurately describe volumetric changes under abnormal loading conditions,[4] including stroke volume.[5] These studies, together with Matsumori's data, support the use of area measurement for assessment of LV preload and function when 3-dimensional LV volume measurements are not feasible.

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Disclosures

None.

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