Effects of Passive Cardiac Containment on Left Ventricular Structure and Function: Verification by Volume and Flow Measurements


Background
The cardiac support device (CSD, Acorn) is a compliant, textile-mesh graft placed around the ventricles to prevent further dilatation and to improve function in congestive heart failure. The aim of this study was to verify post-operative changes in left ventricular volumes, ejection fraction, blood flow, and myocardial mass.

Methods
Fourteen patients underwent contrast-enhanced, electrocardiography-triggered electron-beam computerized tomography before and 6 to 9 months after CSD implantation. We measured volume and flow using the slice-summation method and the indicator-dilution technique.

Results
We found significant changes for the following parameters: end-diastolic volume decreased from 382.9 ± 140.2 ml to 311.3 ± 138.7 ml, end-systolic volume from 310.4 ± 132.4 ml to 237.4 ± 133.8 ml, end-diastolic diameter from 75.3 ± 7.8 mm to 70.7 ± 11.6 mm, end-systolic diameter from 65.8 ± 7.8 mm to 60.0 ± 14.0 mm, and myocardial mass from 298.6 ± 79.6 g to 263.1 ± 76.8 g. Ejection fraction increased from 20.3% ± 6.4% to 27.8% ± 13.1%. We found no significant differences for stroke volume (from 72.5 ± 24.6 ml to 73.8 ± 23.6 ml), heart rate (from 80.5 ± 11.0 beats per minute to 76.5 ± 6.8 beats per minute), and total cardiac output (from 5.8 ± 1.9 liter/min to 5.6 ± 1.8 liter/min). Mitral regurgitation fraction decreased from 30.5% ± 15.5% to 15.6% ± 12.8%, increasing antegrade cardiac output from 3.8 ± 0.9 liter/min to 4.7 ± 1.5 liter/min. For most parameters, pre- and post-operative values in these patients differed significantly from those in an age- and gender-matched control group. In each patient, we observed a small hyperdense stripe along the pericardium after surgery, but we observed no local complications.

Conclusions
Three-dimensional structural and functional data obtained by computerized tomography volume and flow measurements confirm the safety and efficacy of CSD implantation.

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