Effects of Passive Cardiac Containment On Left Ventricular Geometry And Wall Stress in Patients With Idiopathic Dilated Cardiomyopathy


Objectives
The study was designed to verify changes in left ventricular (LV) size, shape and wall stress after implantation of the Acorn cardiac support device (CSD).

Background
The CSD is a polyester meshgraft, that is wrapped around the ventricles for passive external support in advanced congestive heart failure.

Methods
The CSD was implanted in 10 male patients, who underwent electron-beam CT both preoperatively and 32 ± 6 weeks postoperatively. LV volumes (EDV, ESV) were calculated and LV major and minor axes were measured. LV geometry was studied by the major-to-minor axis ratio and a sphericity index. End-systolic meridional and circumferential wall stress were calculated.

Results
LV-EDV decreased from 310.4 ± 87.8 to 232.2 ± 98.0 ml, LV-ESV from 239.7 ± 78.9 to 159.7 ± 93.3 ml and LV ejection fraction increased from 23.4 ± 6.2 to 34.4 ± 13.0 % (p<0.05 each). LV minor axis decreased more than major axis resulting in an increase of the major-to-minor axis ratio from 1.28 ± 0.20 to 1.36 ± 0.18 at end-diastole and from 1.35 ± 0.18 to 1.51 ± 0.29 at end-systole (p<0.05 each). The sphericity index decreased from 0.77 ± 0.22 to 0.67 ± 0.18 at end-diastole and from 0.70 ± 0.19 to 0.53 ± 0.16 at end-systole (p<0.05 each), indicating a more ellipsoidal LV shape postoperatively. Alterations in LV geometry results in a reduction of meridional wall stress from 246.6 ± 67.6 to 171.9 ± 77.5 kdyne/cm² and circumferential wall stress from 505.5 ± 134.1 to 366.4 ± 153.2 kdyne/cm² (p<0.05 each).

Conclusion
After CSD implantation a reduction of LV size, a more ellipsoidal LV shape and a decrease of LV wall stress are observed which confirms the efficacy of passive cardiac containment.