The Cardiac Activity Simulator (CAS) - A Non-Invasive Tool for Management of Heart Failure Patients

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Aim: Understanding the hemodynamic measures in heart failure patients found to be crucial in the management and optimizing the treatment in advanced disease.

Objective: The Cardiac Activity Simulator (CAS) is a novel non-invasive diagnostic tool, allowing complete hemodynamic assessment (pressure and flow in all cardiac chambers) from structural information and pressure measured in a single chamber. The CAS uses a computer simulation based on basic principles of cardiovascular physiology and flow equations.

Methods: Echocardiographic data was obtained from patients who underwent right and left heart catheterization. Thirty one patients from two medical centers were evaluated and 5 were excluded due to incomplete data. For the current analysis simulated LV pressure (based on RV pressure and echocardiographic data) was compared to actual LV pressure curve (catheterization data). Accuracy of the simulation was based on the standard error of the difference between the actual and the simulated pressures.

Results: Typical LV pressure curve morphology (systolic and diastolic components) was obtained from simulation in all patients
 Accuracy of 89% was obtained by comparison to actual LV data. Similarly when LV pressure was used as input data for the CAS the accuracy of the simulated RV pressure was 81%.

Conclusions: CAS is a promising technique that can accurately characterize the complete hemodynamic condition from single chamber measured data. The CAS can be helpful during cardiac catheterization (obtaining complete hemodynamic assessment from single chamber data). Alternatively this system can be extremely useful to analyze pressure data from implanted cardiac pressure sensor.