

Impaired aortic properties in patients with chronic heart failure as assessed by cardiovascular magnetic resonance

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Aortic properties change with age and in cardiac disease. In patients with chronic heart failure (CHF) it may contribute to patients' symptoms. In this study we used cardiovascular magnetic resonance (CMR) to assess the size and distensibility of the ascending and descending aorta in CHF patients with impaired and preserved left ventricular (LV) systolic function and compared it with younger and older normal subjects.

Methods

The study population included 209 patients with signs and symptoms of compensated CHF (NYHA functional class II or III). One hundred and forty patients (aged 69±10 years) who had LV systolic dysfunction (LV ejection fraction <45%) formed Group I, and 69 patients (aged 69±11 years) with preserved LV systolic function (LV ejection fraction ≥45%) formed Group II. The control population included 14 older volunteers aged 66±14 years (Group III) and 21 younger subjects aged 32±4 years (Group IV) with no known cardiac disease. The subjects underwent cine CMR on a 1.5T Signa CV/i GE Medical Systems scanner to characterise LV function and to assess cross-sectional areas and distensibility of the ascending aorta (AA) and the descending aorta (DA).

Results

There were no differences in age between groups I, II and III. Systolic blood pressure was significantly ($p < 0.05$) higher in group II (142±30 mm Hg) and Group III (144±29 mm Hg) as compared with Group IV (120±8 mm Hg). Systolic blood pressure in Group I was 129±22 mm Hg. Diastolic blood pressures were not significantly different between the groups (77±13, 81±17, 82±13 and 75±8 mm Hg respectively). The distensibility index (DI) of the AA and the DA was closely correlated with age ($r = -0.67$ and -0.68 respectively) in the entire study group. Maximal and minimal cross-sectional areas of the AA and the DA and corresponding DI indices in the 4 study groups are shown in the Table. Aortic size increased and aortic distensibility declined with age. CHF patients (Groups I and II) demonstrated aortic dilatation and increased stiffness compared to both younger and older groups of normal volunteers. Aortic distensibility was slightly less reduced in the group of patients with preserved LV systolic function than in the group of patients with impaired LV function but this did not reach statistical significance.

	AA area max (cm ²)	AA area min (cm ²)	DA area max (cm ²)	DA area min (cm ²)	DI (AA) (10 ⁻³ mm Hg ⁻¹)	DI (DA) (10 ⁻³ mm Hg ⁻¹)
Group I	8.61±2.07 ^{†‡}	8.07±1.99 ^{†‡}	5.16±1.16 [‡]	4.81±1.11 ^{†‡}	1.36±0.77 ^{†‡}	1.52±0.8 ^{†‡}
Group II	8.91±2.45 ^{†‡}	8.28±2.36 ^{†‡}	5.21±1.48 [‡]	4.80±1.40 ^{†‡}	1.52±1.07 ^{†‡}	1.66±1.17 ^{†‡}
Group III	7.10±2.07 ^{*#‡}	6.44±1.95 ^{*#‡}	4.43±1.12 [‡]	4.00±1.11 ^{*#‡}	2.15±1.01 [‡]	2.51±1.4 [‡]
Group IV	5.34±1.15 ^{*#†}	4.35±0.94 ^{*#†}	3.37±1.03 ^{*#†}	2.72±0.86 ^{*#†}	5.43±1.97 ^{*#†}	5.55±1.55 ^{*#†}

*- $p < 0.05$ vs group 1, #- $p < 0.05$ vs group 2, †- $p < 0.05$ vs group 3, ‡- $p < 0.05$ vs group 4

Conclusions

Patients with CHF show impaired elastic properties of the ascending and the descending aorta. Diminished aortic distensibility is present in patients with both impaired and preserved LV systolic function.