Differential reduction in regional myocardial deformation occurs in cardiac amyloidosis as determined by left ventricular wall thickness

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Introduction
Amyloidosis is a systemic disease characterised by extracellular deposition of insoluble fibrillar protein in organs and tissues. Cardiac amyloidosis results in increased wall thickness, diastolic dysfunction (DD) and ultimately cardiac failure.

Left ventricular mechanical function is a complex interaction of myocardial fibres arranged in helical, longitudinal and radial orientations. Strain (S) and strain rate (Sr) measure myocardial mechanics and can identify regional heterogeneity in left ventricular contractile and relaxation function.

Velocity vector imaging (VVI) is a quantitative echocardiographic method of myocardial S and Sr assessment, based on two-dimensional gray scale imaging. It involves tracking ultrasonic speckles permitting angle-independent measurement of tissue's velocity and deformation.

Aim
Our aim was to measure left ventricular S and Sr using VVI, for the assessment of global and regional functions in patients with cardiac amyloidosis.

We hypothesised that VVI derived strain imaging would further define differential myocardial fibre dysfunction consequent to increased left ventricular wall thickness.

Method
46 patients with cardiac amyloidosis were compared to age matched normals.

Subgroup analysis within the amyloid group was performed based on LV wall thickness (Group 1: <12 mm, Group 2: 12-14 mm, Group 3: ≥15 mm).

LV parameters including LVEF, transmitral flow, E', E/E' were measured and extent of DD graded. Longitudinal, circumferential and radial myocardial strain (S) and strain rate (Sr) were determined from apical and short axis views using VVI.

Results
Increased LV wall thickness and reduced LV diastolic function was observed in the amyloid group.

Mean LVEF of the amyloid group was 53.3 ± 8.9%.

Global longitudinal strain (-14.0 ± 4.1% vs -16.7 ± 3.8%; p<0.001) and radial strain (27.4 ± 13.4% vs 38.8 ± 15.7%; p<0.001) were significantly lower in the amyloid group compared with controls. Circumferential strain (-21.8 ± 5.2% vs -24.9 ± 9.6%; p=0.062) approached significance. (Graph 1)

Similarly, significant reductions were noted in systolic and diastolic Sr in the amyloid group (data not shown).

Conclusion
Reduction in longitudinal, radial and circumferential strain and strain rates occur in amyloidosis despite apparent preservation of systolic function by conventional measures.

With increasing left ventricular wall thickness, there is differential reduction in longitudinal deformation compared to circumferential and radial functions.

Declaration of interest
The authors declare no conflicts of interest.