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Left ventricular remodelling with increasing body fat: a 3D cardiac phenotyping study

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Background: Adipose mass is linked to LV mass, an important prognostic marker for cardiovascular mortality. However the pattern of remodelling, which itself has prognostic relevance, is unclear and there may be important gender differences which could explain the increased obesity-related mortality observed in men. Global 2D measures of LV geometry may mask physiologically important regional variations in LV remodelling in response to adiposity.

Purpose: We aimed to assess the relationship between fat mass and both global and regional left ventricular (LV) geometry in a cohort free of overt cardiovascular disease.

Methods: 1530 volunteers (55% female) without cardiovascular disease underwent 3-dimensional cardiac magnetic resonance imaging. Body composition was assessed via bioimpedance analysis. The associations between fat mass and regional measures of wall thickness, relative wall thickness and cavity volume were examined in 3D regression models. Models were adjusted for age, gender, race, systolic BP, height and lean mass. Interactions between gender and fat mass were included in the models and, where significant, were explored further in separate models for men and women.

Results: Fat mass was an independent predictor of LV wall thickness and overall was associated with a concentric pattern of remodelling ($p<0.001$). However, there were striking regional differences – concentric hypertrophy was strongest in septal regions and least evident in the lateral wall. This concentric remodelling response was present in both sexes but was stronger in men (p for interaction <0.05). In contrast, women demonstrated a LV dilatatory response to fat mass which was absent in men, due mainly to dilatation of the lateral LV wall ($p<0.001$).

Conclusions: Overall, fat mass is associated with concentric remodelling, an independent predictor of cardiovascular mortality. However, there are important regional differences in the LV response, which may mean that changes are masked in conventional, global 2D measurements. In addition, concentric remodelling is stronger in males. This may reflect gender differences in the haemodynamic response to increased adiposity and may explain the increased obesity-related mortality observed in men.