ABSTRACTS

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Obesity Results in Progressive Atrial Electrical and Structural Remodeling: Implications for Atrial Fibrillation

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Background: Obesity has been associated with the development of atrial fibrillation (AF); however the mechanisms by which it results in a pro-arrhythmic substrate remain unknown.

Methods: Thirty sheep were studied at baseline, four months and eight months, following an ad libitum calorie dense diet. Ten were sampled at each time point for cardiac MRI, invasive haemodynamic evaluation (left atrial and arterial pressure) and detailed electrophysiologic study. An additional six maintenance-fed control sheep were sampled at four and eight months to control for time/age-related effects. A custom made 128-electrode plaque applied to the right and left atria was used to quantify; bi-atrial effective refractory periods (ERP); conduction velocity (CV); conduction heterogeneity index (CHI) at four pacing cycle lengths (PCL) from four sites; and AF inducibility. Quantitative myocardial histology was performed for myocardial fibrosis, inflammation and lipidosis.

Results: Weight increased from 58 ± 7 kg to 77 ± 5 kg to 105 ± 13 kg ($P < 0.001$). With increasing weight there was: progressive decrement in atrial CV ($P = 0.01$), increasing atrial volumes ($P = 0.01$), atrial fibrosis ($P = 0.007$) and lipidosis ($P = 0.049$). There was regional variation in conduction heterogeneity ($P = 0.04$) with increasing weight. Electrophysiologic disturbances persisted after adjusting for haemodynamic variables. No changes were observed in the control cohort (ERP; $P = 0.5$, CV; $P = 0.8$, CHI; $P = 0.9$). With increasing adiposity, AF event number ($P = 0.001$) and duration ($P < 0.001$) significantly increased. No significant change was observed in ERP with increasing adiposity ($P = 0.198$).

Conclusion: Obesity induces early and progressive atrial structural and electrophysiological remodelling. These electrophysiological abnormalities were independent of adverse haemodynamic changes and occurred with a step-wise increase in AF burden.

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Evidence for an Acute Diffuse Fibrotic Response Throughout the Left Ventricle Following Acute Myocardial Infarction

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Introduction: A fundamental process in the development of ischaemic cardiomyopathy is left ventricular (LV) remodeling, characterised by structural and functional abnormalities throughout the entire myocardium. However, contributing factors and time-course of this process are not well understood.

Methods: We assessed the temporal evolution of LV remodeling in patients 1–24, 52–243, and 180–7300 days post-acute myocardial infarction (MI) forming the acute ($n = 25$), subacute ($n = 21$), and chronic MI ($n = 15$) groups, respectively. Contrast-enhanced cardiac magnetic resonance imaging evaluated LV morphology and function, with post-contrast T1 mapping to semi-quantitatively assess myocardial fibrosis. Controls ($n = 20$) without prior MI were also scanned.

Results: Age, gender, diabetic and hypertensive status were similar across all groups ($p > 0.05$). Compared with controls, LV ejection fraction (LVEF) was reduced, and indexed LV mass and LV end-diastolic volume were increased in all MI groups. Abnormalities of myocardium remote to the area of infarction were present immediately after acute infarction, with reduced systolic thickening compared to controls ($60 \pm 5\%$ vs. $106 \pm 8\%$, $p = 0.009$), and diffuse fibrosis suggested by lower T1 times compared to controls (437 ± 25 ms vs. 549 ± 27 ms, $p = 0.02$). These changes persisted at all stages post MI. T1 times correlated with acute and subacute LVEF ($r = 0.43$, $p = 0.05$; $r = 0.50$, $p = 0.03$, respectively) and systolic thickening in acute infarct ($r = 0.46$, $p = 0.04$) and subacute peri-infarct regions ($r = 0.56$, $p = 0.02$).

Conclusion: Acute MI triggers immediate remodeling changes in the remote myocardium, characterised by diffuse fibrosis and systolic dysfunction that persist into chronic stages. This is the first demonstration in humans of an acute diffuse fibrotic response in the entire myocardium post-acute MI.

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