Cardiac rhythm management

BARIATRIC SURGERY REVERSES VENTRICULAR REPOLARISATION HETEROGENEITY – MECHANISTIC INSIGHTS INTO FAT-RELATED ARRHYTHMIC RISK

1Kiran Patel, 2Nikesh Bajaj, 3Ben Statton, 2Nihara Herath, 2Xinyang Li, 2Ross Davidson, 2Stelutsa Sawidou, 1Joseph Coghlin, 1Job Stoks, 2Sanjay Purkayastha, 2Jonathan Cousins, 1James Ware, 2Declan O’Regan, 2Pier Lambiase, 2Matthijs Cluitmans, 2Nicholas Peters, 3Fu Song Ng, 1Imperial College London, 4th floor ICTEM building, Du Cane Road, London, HMF W12 0NN, United Kingdom; 1Imperial College London; 2Maastricht University; 4Imperial College Healthcare NHS Trust; 3Royal Brompton Hospital; 6University College London

Background Obesity confers higher risks of atrial arrhythmias and sudden cardiac death. Despite this, the proarrhythmic substrate in obesity and its reversibility with weight loss has not been studied in-depth. To address this, the proarrhythmic substrate in obese patients, and its reversibility with bariatric surgery, was characterised using electrocardiographic imaging (ECGi).

Methods ECGi was performed in 16 obese patients pre-bariatric surgery (PreSurg; mean age 43±12 years, 13 female) and 16 age- and sex-matched non-obese (lean) individuals (42±11 years). 12/16 obese patients also underwent ECGi after surgery (PostSurg). Over 2000 atrial and ventricular epicardial electrograms were computed using high density body surface mapping (256-lead ECG) and heart-torso geometries from cardiac magnetic resonance imaging, by solving the inverse problem of electrocardiography. Local atrial and ventricular epicardial activation times (AT) were calculated as the steepest downslope of their respective activation complexes, and local ventricular repolarisation times (RT) as the steepest upslope of the T-wave. Atrial activation gradients (ATG) and ventricular repolarisation gradients (RTG) were calculated as the maximum difference within 10 mm radius divided by the corresponding distance.

Results BMI was greater in PreSurg vs lean (46.7±5.5 vs 22.8±2.6 kg/m^2, p<0.0001) and decreased with surgery (PostOb 36.8±6.5 kg/m^2, p<0.0001). Epicardial adipose tissue (EAT) was greater in PreSurg vs lean (83±56 vs 28±13 ml, p<0.0001) and decreased post-surgery (PostSurg 69±45 ml, p=0.0010). Total atrial AT was prolonged in PreSurg vs lean (62±15 vs 46±12 ms, p=0.0028), which persisted post-surgery (PostSurg 67±15 ms, p=0.86). Atrial ATG were also greater in PreSurg vs lean (26±15 vs 15±7 ms/mm, p<0.0024) and decreased with weight loss (PostSurg 19±8, p=0.0009), and were similar between PostSurg and lean (p=0.20). EAT correlated with atrial ATG (r=0.36, p=0.044) and ventricular RTG (r=0.54, p=0.0014). Ventricular AT was similar between lean (31±6 ms), PreSurg (34±5 ms) and PostSurg (35±9 ms); all p>0.05.

Conclusion Bariatric surgery in obese patients reduces ventricular repolarisation heterogeneity that may be partly explained by regression of epicardial fat. Atrial activation remains prolonged in obesity post-bariatric surgery. These results provide mechanistic insights into obesity-related arrhythmic risks and its reversibility with bariatric surgery.

Conflict of Interest Nil
DETERMINANTS OF POST-OPERATIVE ATRIAL FIBRILLATION IN 1613 PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING IN THE STATIN THERAPY IN CARDIAC SURGERY (STICS) TRIAL

1Rohan Wijesurendra, 2Rebecca Sardell, 2Michael Hill, 2Raja Jayaram, 2Natalie Staplin, 2Rory Collins, 2Zhengming Chen, 2Jonathan Emberson, 2Richard Haynes, 2Barbara Casadei. 1University of Oxford, OCMR (Level 0), John Radcliffe Hospital, Headley Way, Oxford, OXF OX2 7ED, United Kingdom; 2University of Oxford

Introduction

Post-operative atrial fibrillation (POAF) occurs in 20–40% of patients in the first week after cardiac surgery, and is associated with longer hospital stay, higher stroke risk, and worse overall prognosis. The surgery-related inflammatory response has been strongly implicated in POAF pathogenesis; however, lower CRP levels resulting from perioperative rosuvastatin therapy in the Statin Therapy In Cardiac Surgery (STICS) randomized trial were not associated with a reduced incidence of POAF. Furthermore, POAF independently predicts subsequent clinical AF and as such may reflect the presence of a subclinical cardiomyopathic substrate. We tested this hypothesis by investigating determinants of POAF in 1613 patients who underwent isolated coronary artery bypass grafting in China in the STICS trial.

Methods

Clinical data included age, sex, body mass index, medical history, medications, and type of surgery (on-pump vs off-pump). Blood taken prior to surgery was assayed for troponin I, N-terminal pro-brain natriuretic peptide (NT-proBNP), creatinine, low-density lipoprotein (LDL) cholesterol, and serum CD40 ligand. The biomarkers growth differentiation factor 15, interleukin-6, procalcitonin, and placental growth factor were measured at baseline and at 6 hours after surgery. Echocardiography evaluated left ventricular ejection fraction (LVEF) and left atrial (LA) size. POAF was detected by continuous Holter electrocardiographic monitoring for 5 days after surgery.

Results

POAF occurred in 314 of 1613 patients (19%). As expected, age was the single strongest predictor of POAF (C-statistic 0.66 [95% CI 0.62–0.70]). After adjustment for age, NT-proBNP, LA size, Troponin, LVEF, sex, calcium-channel blocker use, and prior myocardial infarction were all significantly associated with POAF when assessed individually (all P<0.05). In multivariate analysis, a basic model incorporating only age, NT-proBNP, and LA size had a C-statistic of 0.69 (95% CI 0.66–0.73). This performance was not significantly different to that of models including all available variables, irrespective of whether baseline or post-surgery biomarker results were used (all C-statistics 0.71 [95% CI 0.68–0.75]; Table 1). The basic model numerically outperformed more complex risk prediction scores including CHARGE-AF (0.66, 95% CI 0.63–0.70; Figure 1), POAF score (0.64, 95% CI 0.61–0.68), CHA2DS2-VASc (0.60, 95% CI 0.57–0.63), and AF risk index (0.57, 95% CI 0.54–0.60).

Conclusions

A basic model requiring only age, NT-proBNP, and LA size has good predictive value for POAF in this population, comparing well to more complex risk prediction scores. More broadly, these results suggest that systemic inflammation and perioperative myocardial injury may be less relevant to the pathogenesis of POAF than the effects of aging and cardiac structural and functional changes.

Conflict of Interest

None

Abstracts

Abstract 82 Figure 1 Epicardial adipose tissue regresses post-bariatric surgery in obese patients

Abstract 82 Figure 2 Ventricular repolarisation time gradients (RTG) reverse post-bariatric surgery

Abstract 83 Figure 1 Receiver operating characteristic (ROC) curves for models predicting risk of post-operative atrial fibrillation (AF) using a) a basic model containing age, baseline NT-proBNP and baseline left atrial size, b) the basic model including growth differentiation factor 15, interleukin-6, procalcitonin, and placental growth factor at 6hr, and c) CHARGE-AF score (excluding blood pressure)