Scientific oral presentations

OP1 CORONARY ARTERY DISEASE AND ATHEROSCLEROTIC PLAQUE SUBTYPES IN PATIENTS WITH SUSPECTED ANGINA AND A CORONARY CALCIUM SCORE OF ZERO

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Introduction This post-hoc analysis of the SCOT-HEART (Scottish COmputed Tomography of the HEART Trial) assessed the frequency and implications of coronary artery disease (CAD) in patients with a zero coronary artery calcium score (CACS).

Methods Agatston CACS was assessed on non-contrast and CAD on contrast CT coronary angiography. Adverse plaque characteristics (APC) were visually identified as positive remodelling or low attenuation plaque and quantitative plaque burden was measured.

Results Of 642 patients with zero CACS, CAD was present in 105 (16%). Compared to patients with normal coronary arteries, those with zero CACS and CAD were older (55±9 vs 53±10 years, p=0.016) and had higher cardiovascular risk scores (14±9 vs 12±8, p=0.013). On CTCA 92 (14%) had non-obstructive CAD, 13 (2%) obstructive CAD, 14 (2%) APC and 85 (13%) low attenuation plaque burden >4%. Compared to patients with normal coronary arteries, those with zero CACS and CAD were more likely to receive statins (67% vs 17%, p<0.001), antiplatelet therapy (74% vs 28%, p<0.001), angiography (18% vs 2%, p<0.001) and revascularisation (7% vs 0%, p<0.001). Quality-of-life and symptoms were similar in patients with normal coronary arteries and those with zero CACS and CAD (p>0.05). Over 5 years of follow-up, 1 event (1%, myocardial infarction) occurred in patients with zero CACS and CAD compared to 3 events (1%, 2 myocardial infarction and 1 coronary heart disease death) in patients with normal coronary arteries.

Conclusion CAD occurs in 16% of patients with zero CACS, with prognostically significant plaque subtypes occurring in some patients, although the overall event-rate is low.

OP2 18F-FLUORIDE PET/MR IN CARDIAC AMYLOID: A COMPARISON STUDY WITH AORTIC STENOSIS AND AGE AND SEX MATCHED CONTROLS

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Introduction Cardiac MR is widely used to diagnose cardiac amyloid but cannot differentiate AL and ATTR subtypes: an important distinction given their differing treatments and prognoses. We used PET/MR imaging to quantify myocardial uptake of 18F-fluoride in ATTR and AL amyloid patients as well as participants with aortic stenosis and age/sex matched controls (both negative controls).

Methods In this prospective multi-centre study, patients were recruited in Edinburgh and New York and underwent 18F-fluoride PET/MR imaging. Standardised volumes of interest were drawn in the septum and areas of late gadolinium enhancement to derive myocardial standardised uptake values (SUV) and tissue to background ratio (TBR_{MEAN}) after correction for blood pool activity in the right atrium.

Results 53 patients were scanned. 18 with cardiac amyloid (10 ATTR and 8 AL), 13 controls and 22 with aortic stenosis. No differences in myocardial TBR values were observed between participants scanned in Edinburgh and New York. Mean myocardial TBR_{MEAN} values in ATTR amyloid (1.13 ±0.16) were significantly higher than controls (0.84±0.11, p=0.0006), aortic stenosis (0.73±0.12, p<0.0001) and those with AL amyloid (0.96±0.08, p=0.01). TBR_{MEAN} values within areas of late gadolinium enhancement provided clear discrimination between patients with ATTR (1.36±0.23) and all other groups (e.g. AL [1.06±0.07, p=0.003]). Indeed, a TBR_{MEAN} threshold >1.14 in areas of LGE demonstrated 100% sensitivity (C.I. 72.25 – 100%) and 100% specificity (C.I. 67.56 – 100%) for ATTR compared to AL amyloid (AUC 1, p=0.0004).

Conclusion Quantitative 18F-fluoride PET/MR imaging can distinguish ATTR amyloid from other similar phenotypes and holds major promise in improving the diagnosis of this condition and helping to tailor appropriate treatments to those most likely to benefit.

OP3 IMPROVED CARDIAC RISK STRATIFICATION IN INDIVIDUALS WITH HIGH RISK PLAQUE FEATURES USING THE PERIVASCULAR FAT ATTENUATION INDEX ON CCTA

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Introduction High-risk plaque (HRP) features on coronary computed tomography angiography (CCTA) are indicators of increased cardiac risk. Coronary inflammation induces spatial changes in perivascular adipose tissue (PVAT) composition, which can be quantified with the perivascular Fat Attenuation Index (FAI). We hypothesized that perivascular FAI mapping can further stratify the cardiac risk associated with HRP on CCTA.

Methods Individuals from the CRISP-CT (Cardiovascular RISk Prediction using Computed Tomography) study were included (n=3,912, mean age 55.7±13.7 years, 41.1% females). Perivascular FAI mapping was performed around the proximal right coronary artery and was calculated based on the weighted average attenuation of PVAT using the CaRi-HEART algorithm, as previously described. HRP features were defined as the presence of either positive

remodelling, low-attenuation plaque, spotty calcification or napkin-ring sign. The association with future incidence of major adverse cardiac events (cardiac mortality or non-fatal myocardial infarction) was assessed using Cox regression models (adjusted for age, sex, epicardial fat volume and coronary artery disease [≥50% stenosis]).

Results The prevalence of HRP and high FAI (≥-70.1 Hounsfield Units, as previously validated) was 23.6% (n=923) and 24.3% (n=952), respectively. Over a median follow-up of 5.6 years (25th-75th percentile: 4.0–7.0 years) 91 MACE were recorded. Patients with both HRP features and high FAI (FAI +/HRP+) had a 6.3-fold higher adjusted risk of MACE compared to those with neither of these risk features (HRP-/FAI-). Furthermore, patients without HRP features but with high FAI (HRP-/FAI+) had a 4.9-fold higher adjusted risk of MACE compared to the reference (HRP-/FAI-) group.

Conclusion FAI is a stronger predictor of cardiac mortality than high-risk plaques, and there is additive predictive value between plaque morphology and coronary inflammatory burden. There is need for tools to provide comprehensive risk assessment based on CCTA, by extracting, weighting and interpreting all available information from these scans.

OP4 PERIVASCULAR FAT ATTENUATION INDEX MAPPING AROUND THE RIGHT AND LEFT CORONARY ARTERY INDEPENDENTLY PREDICT CARDIAC MORTALITY

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Introduction Coronary inflammation induces spatial changes in perivascular adipose tissue (PVAT) composition, which can now be detected as spatial changes in PVAT attenuation quantified by the perivascular Fat Attenuation Index (FAI) on coronary computed tomography angiography (CCTA). We assessed the ability of perivascular FAI mapping around the right and left coronary territories to independently stratify future cardiac risk.

Methods This was a post-hoc analysis of the CRISP-CT (Cardiovascular RISk Prediction using Computed Tomography) study that included 3912 patients with an average age of 55.7 years (standard deviation [SD]: 13.7 years). Perivascular FAI mapping was performed around the proximal right (RCA) and left anterior descending (LAD) coronary arteries. FAI was calculated based on the weighted average attenuation of PVAT using the CaRi-HEART algorithm, as previously described. The independent association with future incidence of cardiac death was assessed in adjusted Cox regression models.

Results Over a median follow-up period of 5.6 years, 74 cardiac deaths were recorded. The cross-sectional association between perivascular FAI around the RCA and LAD at baseline was found to be moderate (R2=0.36, P<0.001). Interestingly, both higher peri-RCA and peri-LAD FAI values were independently associated with a higher risk of cardiac mortality, following multivariable adjustment for age, sex, hypertension, hyperlipidemia, diabetes mellitus, smoking, epicardial adipose tissue volume and coronary artery disease (≥50% stenosis) (adjusted Hazard Ratio [95% confidence interval] of 1.70 [1.23–2.35], P=0.001 & 1.55 [1.12–2.14], P=0.008 per 1 SD increments, respectively)

Conclusion Perivascular FAI around the coronary arteries is characterised by anatomical/regional variability, and its values are affected by the coronary segment interrogated. Non-invasive characterization of coronary inflammation using CCTA-derived FAI should include a comprehensive assessment of both coronary arteries in order to better characterize the inflammatory residual risk of each patient.

OP5 PERICORONARY ADIPOSE TISSUE DENSITY IS GREATER IN TAKAYASU ARTERITIS THAN ATHEROSCLEROSIS AND IS ASSOCIATED WITH CORONARY ARTERIAL INFLAMMATION MEASURED BY 68GA-DOTATATE PET

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Introduction Pericoronary adipose tissue (PCAT) density is associated with vascular inflammation, but its nature is not fully understood. We compared PCAT density with clinical and molecular imaging markers of inflammation.

Methods PCAT density was quantified in patients with Takayasu arteritis (TAK), coronary artery disease (CAD), and age and gender-matched healthy controls from cardiac CT images using semi-automated software (Autoplaque). In TAK patients, PCAT density was also compared to the Indian Takayasu Clinical Activity Score (ITAS). In CAD patients, PCAT density was compared to maximum tissue-to-blood ratio (TBR_{max}) from motion-corrected ^{68}Ga-DOTATATE PET, using image registration software (FusionQuant), and aortic ^{18}F-fluorodeoxyglucose (FDG) PET. Imaging was acquired during clinical care or prior research. ^{68}Ga-DOTATATE is an experimental marker of vascular inflammation that binds macrophage somatostatin receptor-2.

Results 60 patients were included (TAK, n=20; CAD, n=20; healthy, n=20). Mean PCAT density varied significantly among the three groups (TAK: -74.00 ±SD 11.92 Hounsfield unit [HU]; CAD: -80.39 ±SD 10.9 HU; healthy controls: -83.85 ±SD 10.07 HU; p<0.0001). C-reactive protein was greater in TAK than CAD patients (TAK: 25.2 ±SD 16.1 mg/L; CAD: 2.5 ±SD 1.73 mg/L, p=0.04). PCAT density was significantly associated with ITAS (r=0.61, p=0.004) in TAK patients, and coronary ^{68}Ga-DOTATATE TBR_{max} (rho=0.31, p<0.001) in CAD patients. No significant patient-level confounders were identified. PCAT density was not statistically associated with aortic ^{18}F-FDG in CAD patients, or subcutaneous (pre-sternal) adipose tissue density in either disease group.

Conclusion PCAT density could be a useful, non-PET marker of coronary arterial inflammation and disease activity in both TAK and CAD patients.