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Indexed coronary volume - a potential novel low-dose CCTA derived predictor for cardiovascular events


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Introduction: Little is known about the long-term predictive performance of CCTA-derived coronary volumes and mid-diastolic left ventricular (LV) mass. In the present study we assessed the long-term prognostic value of coronary volumes and mid-diastolic LV mass as novel potential imaging predictors derived from low-dose prospectively ECG-triggered CCTA.

Methods: Consecutive patients with suspected or known coronary artery disease, referred for low-dose CCTA, were included. Patients with previous revascularization were excluded. The following parameters were evaluated: calcium score, segment involvement score (SIS: 1 point for each coronary segment with presence of plaque), coronary volume, mid-diastolic LV mass and coronary volume indexed to LV mass. Major adverse cardiovascular events (MACE) were defined as all-cause death, non-fatal myocardial infarction and revascularization (PCI or CABG). The association between CCTA measures and the occurrence of events was quantified using Cox regression hazard and Kaplan-Meier analysis.

Results: A total of 147 consecutive patients were included in the study. Of them, 93 (63.3%) were male and 79 (53.7%) had one or more traditional cardiovascular risk factors. There was a weak but statistically significant inverse correlation between indexed coronary volume and both calcium score (R=-0.3, p=0.01) and SIS (R=-0.24, p=0.005). After a median follow-up of 5.8 years 30 MACE occurred in 25 patients, including 3 deaths, 26 revascularizations and 1 non-fatal myocardial infarction. In univariate Cox regression hazard analysis calcium score (HR=12.69, 95% CI 2.99-53.83, p<0.001), SIS (HR=1.66, 95% CI 1.43-1.94, p<0.001), LV mass (HR=1.02, 95% CI 1.01-1.03, p=0.007) and indexed coronary volume (HR=0.89, 95% CI 0.82-0.96, p=0.004) were associated with outcome. In multivariate analysis, indexed coronary volume, remained an independent predictor for MACE when adjusted for traditional risk factors and SIS (HR=0.93, 95% CI 0.87-1.00, p=0.05), while LV mass did not reach statistical significance (p=0.46). By ROC curve analysis, a value of 21.85 mm3/gr was defined as optimal cutoff for indexed coronary volume. In Kaplan-Meier plots, patients with low indexed coronary volume (<21.85 mm3/gr) showed higher event rates (log rank p<0.001) compared to high indexed coronary volume (≥21.85 mm3/gr).

Conclusions: Indexed coronary volume, derived from low-dose CCTA, independently predicts cardiovascular events.

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Diagnostic accuracy of coronary artery calcium score for immediate prediction of myocardial ischaemia

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Introduction: Coronary artery calcium score (CACS) is an excellent predictor of long-term adverse cardiac events. However, little is known about its diagnostic value and thresholds for immediate prediction of myocardial ischaemia. Therefore, we assessed the diagnostic accuracy of CACS to predict myocardial ischaemia in a large cohort of patients with single-photon emission computed tomography (SPECT).

Methods: All consecutive patients undergoing SPECT myocardial perfusion imaging between August 2015 and November 2018 at our centre were enrolled. Patients with known coronary artery disease, coronary anomaly, cardiomyopathy, cardiac transplantation, or missing imaging data were excluded. Ischaemia was defined as a summed difference score (SDS) ≥4 in SPECT, and severe ischaemia as SDS ≥8. CACS was measured from low-dose computed tomography scans using the Agatston method. Area under the curve (AUC) was compared for prediction models based on CACS or on cardiovascular risk factors (CVRF) with symptoms. Receiver operating characteristic (ROC) analysis was used to calculate sensitivity, specificity, positive and negative predictive values of CACS for ischaemia at pre-specified cut-offs.

Results: Of 3916 patients, 1752 were excluded. Thus, 2164 patients with both CACS and SPECT were included.
CTA to diagnose CAD among patients undergoing TAVI

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Transcatheter aortic valve implantation of coronary artery disease among patients undergoing computed tomography angiography (CTA). Some studies evaluated the performance of CTA to diagnose CAD patients undergoing TAVI and showed interesting results. Nevertheless, data remain scarce and this diagnostic method is not validated in this population. In this context, we thought to evaluate the diagnostic performance of CTA to diagnose CAD among patients selected for TAVI.

Methods: A total of 199 patients that had a TAVI in the Lausanne University Hospital between the 1st of June 2013 and the 31st of December 2017 were retrospectively included. Exclusion criteria were coronary artery bypass graft prior to CTA and unavailable CTA images. Finally, 127 patients were included. Two independent radiologists - blinded for ICA report - were asked to read the CTA of these patients and to indicate the presence of ≥50% and ≥70% stenosis in the 4 main coronary vessels. Their evaluation was then compared with ICA reports and analyses were performed at vessel and patient levels.

Results: A total of 342 vessels were analyzable. Based on ICA, significant CAD (at least 1 ≥50% stenosis) was present in 49 (38.6%) patients. Severe CAD (≥70% stenosis) was found in 29 (22.8%) patients. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of CTA to diagnose significant CAD were 81.1%, 87.9%, 44.8%, 97.5% and 87.1% at vessel level using the cut-off of 50% and 42.8%, 97.8%, 56.3%, 96.3% and 94.4% for severe CAD, using the cut-off of 70%. At patient level, sensitivity, specificity, positive and negative predictive values were respectively 84.6%, 64.6%, 56.4% and 88.6% for significant CAD.

Conclusion: Pre-TAVI CTA shows good performance to rule out significant and severe CAD and could be used as a gatekeeper for ICA. Positive findings on CTA should be confirmed with ICA given the low positive predictive value.

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Adaptation of left atrial function in acute and chronic ST-segment elevation myocardial infarction


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Background: The left atrium (LA) is exposed to left ventricular (LV) pressure and volume changes. LA functional adaptation in acute ST-segment elevation myocardial infarction (STEMI) and during healing is not known.

Materials and methods: We examine LA changes in 31 patients with a first episode of STEMI. Patients underwent a cardiac magnetic resonance examination (CMR). 21 patients had a CMR within 15 days from STEMI (acute-STEMI), while 17 patients were studied after ≥40 days from the acute event (chronic-STEMI). 8 patients had 2 CMR examinations in both, the acute-STEMI and chronic-STEMI...
In the acute STEMI situation, the LA can adapt its active emptying performance in the presence of compromised passive emptying. This might reflect a compensatory mechanism to maintain adequate LV filling in the chronic state after infarction.

**P25**

**Strain parameters using CMR feature tracking are associated with fibrosis and not with edema in patients with suspected myocarditis**

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**Introduction:** Myocarditis is a leading cause of dilated cardiomyopathy. Cardiovascular magnetic resonance imaging (CMR) is the primary imaging tool in the clinical setting of suspected myocarditis, with the ability to non-invasively characterize the myocardial tissue. Late gadolinium enhancement (LGE) is a marker of focal fibrosis, T1 mapping and extracellular volume (ECV) fraction strengths are detection of diffuse fibrosis, while T2-weighted imaging is a marker for edema. Feature tracking CMR (FT-CMR) is a quantitative method that uses cine CMR to measure different strain parameters. FT-CMR has recently been shown to have diagnostic and prognostic value; however, it has not yet been investigated in myocarditis. We aimed to analyze the association of FT-CMR with tissue characterization in suspected myocarditis.

**Method:** Patients with clinically suspected myocarditis and no coronary artery disease who underwent a contrast enhanced CMR exam were enrolled. The presence of focal fibrosis was assessed in LGE and diffuse fibrosis in native T1 and ECV images. Myocardial edema was depicted by the T2 ratio of the signal intensity of the myocardium compared to skeletal muscle. An independent reader measured myocardial deformation using circumferential peak strain (PS), systolic strain rate (sSR), diastolic strain rate (dSR), time to peak strain (TTP) and displacement (DPL). Global FT parameters were then compared to tissue characterization results (figure P25-1).

**Results:** 129 patients (46±15 years) were included, with a mean LGE size of 3.7±7.0%, mean native T1 of 1006±75ms (at 1.5T), T2 ratio of 1.8±0.7 and ECV of 30.9±5.4%. Mean PS was 13.8±5.3%, sSR -0.8±0.34/s, dSR 0.8±0.43/s, TTP 311.80±67.12ms and DPL 0.95±2.25mm. PS and sSR showed a significant correlation with LGE, T1 and ECV, while dSR only showed a correlation with LGE and a trend with native T1 and ECV (figure 2, p<0.001). TTP, DPL were not associated with tissue characterization. No association was found between T2 ratio and FT-CMR.

**Conclusions:** In patients with suspected myocarditis, circumferential left ventricular strain obtained by FT-CMR is associated with the presence of fibrosis, both focal and diffuse. However, myocardial edema was not associated with global left ventricular strain parameters. Investigation of a larger population, regional strain parameters and association of FT-CMR with outcome is needed to assess its potential role for contrast-free markers in patients with suspected myocarditis.
**Abstracts**

**Figure: P25-1.**

Circumferential Strain  
LGE (Fibrosis)  
T2 Ratio (Edema)

Top row: In this patient, peak circumferential strain is abnormal primarily in the inferior wall (yellow), matching the largest region of fibrosis indicated by LGE (orange), while edema was primarily located in the anterior wall (blue). Bottom row: Patient with a normal peak circumferential strain (blue) no LGE enhancement or elevated T2 ratio.

**Figure: P25-2.**

Significant linear relationships between feature tracking parameters and tissue characterization are shown with solid trend (p<0.05), dashed lines represent non-significant trends (0.05<p<0.1).