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Rapid Fire Abstract Session: Cardiac Imaging

O39–O44

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O39

Effect of coronary diameter on transluminal attenuation gradient derived from coronary CT angiography to predict ischemia in SPECT myocardial perfusion imaging

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Background: Parameters such as transluminal attenuation gradient (TAG) have been proposed to assess the functional relevance of a stenosis in coronary computed tomography angiography (CCTA). However, few studies have shown conflicting results indicating that other factors as scanner type or coronary diameter may influence TAG.

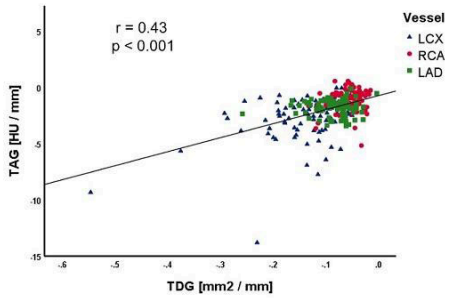
Purpose: To assess the value of TAG using a latest generation 256-slice computer tomography (CT) scanner to predict ischemia in single-photon emission computed tomography (SPECT) myocardial perfusion imaging (MPI) and to assess the correlation between TAG and transluminal diameter gradient (TDG).

Methods: Patients who underwent hybrid CCTA and SPECT-MPI for suspected coronary artery disease were included in the analysis. TAG and TDG was calculated by measuring the mean vessel attenuation and vessel section area, respectively, in all major coronary vessels at 5-mm intervals from the ostium to a distal segment with a minimal cross-sectional area of 2 mm^2.

Results: A total of 255 coronary arteries of 87 patients were included in this study. TAG and TDG did not discriminate between coronary arteries with or without ischemia as assessed by SPECT-MPI ($p = 0.61$ and $p = 0.67$, respectively). Neither the addition of TAG nor TDG to visual CT analysis alone did increase diagnostic accuracy. There was a significant correlation between TAG and TDG ($r = 0.43$; $p < 0.001$; Figure).

Conclusions: CCTA-derived TAG and TDG do not offer any value in predicting ischemia as assessed with SPECT-MPI, despite application of a latest generation 256-slice CT scanner. TAG and TDG correlate moderately.

Figure: O39-1. TAG and TDG correlate significantly.



O40

Regional differences in myocardial flow reserve add prognostic value in patients with suspected coronary artery disease

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Background: Although the prognostic value of global myocardial flow reserve (MFR) is well documented, data on the impact of regional differences in MFR on outcome is scarce. In the present study we aimed to assess the value of regionally reduced MFR in the risk stratification of patients with suspected coronary artery disease (CAD).

Methods: We retrospectively included 146 consecutive patients who were referred for exclusion of CAD by 13N-ammonia myocardial perfusion positron emission tomography (PET). Global and regional MFR were calculated based on a 17-segment model and patients were classified into three groups. Group 1: Patients with preserved global and regional MFR. Group 2: Patients with preserved global but regionally reduced MFR (i.e. ≥ 3 adjacent segments with MFR <2.12 ml/min/g). Group 3: Patients with globally reduced MFR (i.e. <2 ml/min/g). Follow-up was obtained regarding a composite endpoint including all-cause death, nonfatal myocardial infarction, and late revascularization (i.e. ≥ 60 days after the PET scan). We performed Kaplan-Meier and Cox regression analysis.

Results: Median follow-up was 47 months (IQR: 33 - 110). A total of 24 events (15 deaths, 2 nonfatal myocardial infarctions, 7 late revascularizations) occurred. Annual event rate was 1.4% in group 1, 4.8% in group 2, and 3.1% in group 3. Kaplan-Meier analysis showed a significant difference between the groups (log Rank p = 0.046). Group 1 differed significantly from group 2 (log Rank p = 0.013) and group 3 (log Rank p = 0.013). However, there was no difference between groups 2 and 3. In multivariate cox regression, a regionally reduced MFR was found to be an independent predictor for future cardiac events (p = 0.011).

Conclusion: Globally and regionally reduced MFR impact prognosis in patients without known CAD. However, in the present study, only regional MFR was found to be an independent predictor of adverse cardiovascular outcome.

O41

Speckle tracking derived twist for differentiation of left ventricular non-compaction and hypertrabeculation

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Introduction: Strain analysis is a tool to study left ventricular (LV) mechanics, and has an emerging role in the diagnosis of cardiomyopathies. Left ventricular non-compaction (LVNC) is a rare cardiomyopathy characterised by a two-layered LV myocardium with prominent trabeculae separated by deep recesses perfused from the LV cavity. Left ventricular hypertrabeculation (LVHT) may be difficult to differentiate from LVNC. We investigate the differences in speckle tracking derived LV strain analysis and twist features between LVNC and LVHT in comparison to controls.

Methods: We compared 30 patients with LVNC, 30 individuals with LVHT, and 30 controls. LVNC diagnosis was established by the criteria of Jenni et al. LVHT was defined as presence of three or more trabeculae in the LV apex visualised in both parasternal short axis and apical views. Controls had a normal echocardiography, and no evidence of cardiovascular disease. Strain analysis was performed using TomTec Image-Arena (v.4.6).

Results: Global circumferential strain (GCS) was significantly different between LVNC (13.3[12.3-13.9]) and controls (23.6[22.4-24.6]), and between LVHT (18.3[16.8 - 18.6]) versus controls (p = 0.001). Similarly, global radial strain was significantly different between LVNC (13.3[12.3-13.9]) and controls (25.4[23.5-28.1]), and between LVHT (22.1[20.8-22.9]) and controls (p = 0.001). Basal segments rotation was significantly different between LVNC (-4.6[-6.3 to -3.5]) and controls (-6.3[-7.5 to -4.5], p = 0.013), but not between LVHT (-5.1[-5.8 to -4.7]) and controls (p = 0.05). Apical segments rotation was significantly different between LVNC (-6.1[-7.1 to -4.9]) and controls (7.2[2.3 to 10.1]; p = 0.001), also between LVHT (4.9[2.8 to 6.1]) and controls (p = 0.001). Basal-apical rotation ratio was significantly different between LVNC (-0.7[-2.0 to -0.5]) and controls (0.7[0.5-0.9]; p = 0.001), but not between LVHT (-1.0[-1.5 to -0.9]) and controls (p = 0.34). LV twist was significantly different between LVNC (-2.2[-2.9 to -0.3]) and controls (12.5[8.6 to 16.1]; p = 0.001) also, between LVHT (9.7[8.3 to 11.5]) and controls (p = 0.02). GCS, apical rotation, basal-apical rotation ratio, and LV twist were all significantly different between LVNC and LVHT (p = 0.001 all).

Conclusion: LV GCS and GRS as well as segmental rotation and twist were able to differentiate between LV mechanics in patients with LVNC and LVHT. This observation offers novel perspectives for the echocardiographic diagnosis of LVNC.

O42

Fully automated measurements of scar size on computed tomography relate to arrhythmia risk in post-infarction patients implanted with ICDs for primary prevention

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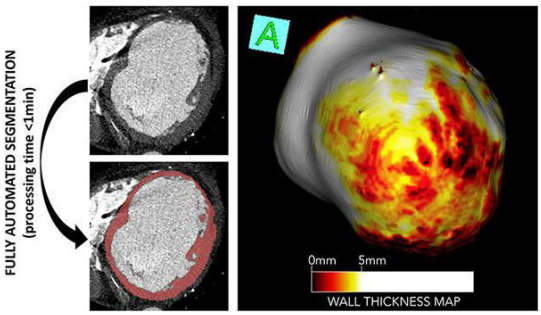
Introduction: Current criteria for ICD implantation for primary prevention of sudden cardiac death are suboptimal. An association between wall thinning (WT) measurements from CT and arrhythmogenic substrate of ventricular arrhythmia (VA) has been reported after myocardial infarction (MI).

Method: We developed a fully automated CT-based substrate assessment and studied its relationship with the occurrence of VA in a retrospective cohort of post-MI patients. 110 patients who received an ICD for primary prevention in two different European centres underwent cardiac CT at a median of 87.5 months after ICD implantation. A fully automated segmentation of the left ventricular (LV) wall was developed using deep learning on a prior database of 462 studies segmented by experts. In the study cohort, this method was used to automatically quantify scar area, defined as WT <5mm and further divided into severe (<3mm) and moderate (3-5mm) WT. Remote monitoring records and in-office ICD follow-up (FU) reports were reviewed to identify arrhythmic patients.

Results: Out of 110 patients (98 male, 69±9 years), 39 (35%) had experienced at least one VA episode since implantation (FU 89±24 months, minimum 47 months). None of the baseline characteristics related to arrhythmia during FU (including LVEF, NYHA class, age, gender, BMI, cardiovascular risk factors, renal function), except for a slightly higher rate of thyroid disease (P = 0.03). The automated CT segmentation method was validated on 51 CT studies segmented by experts that were not used to train the neural network, showing excellent accuracy (Dice score 0.95). In the study cohort, automated WT measurement was feasible in all patients, the processing time for each patient being below 1 min. Total scar area was 7.0±3.6 cm^2, including 4.0±2.1 and 2.8±2.0 cm^2 for moderate and severe

Figure: O42-1.



WT areas, respectively. When compared to patients without arrhythmia, arrhythmic patients showed higher LV volume (P = 0.009) and higher total scar area on CT (P = 0.02). Areas with moderate WT closely related to arrhythmia (4.7±2.5 vs. 3.4±1.7 cm^2 in patients with vs. without arrhythmia, P = 0.005), while areas of severe WT did not (P = 0.35).

Conclusion: In post-MI patients implanted with ICDs for primary prevention, areas with moderate LV WT are associated with higher risk of VA. These scar characteristics can be assessed by a full-automated CT scan analysis.

O43

Added value of fusion imaging during transcatheter aortic valve replacement

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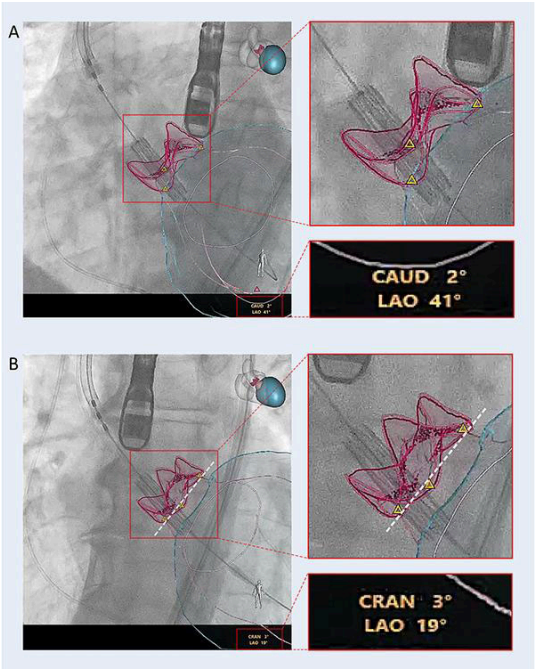
Introduction: Echocardiography-fluoroscopy fusion software EchoNavigator (EN) automatically segments the whole heart and allows fusion of a dynamic heart model with fluoroscopy during structural heart interventions. The study assessed accuracy and safety of EN during transcatheter aortic root replacement (TAVR) and compared procedural outcomes to TAVR without EN.

Methods: TAVR interventions before (EN-; *n = 69, mean age 83.1 ± 6.0 years*) and after (EN+; *n = 69, mean age 79.3 ± 8.8 years*) the introduction of EN software were compared. In the EN+ group, pre-TAVR aortic root analysis based on computed tomography angiography (CTA) was compared to automated annular dimensions provided by EN.

Results: Peri-interventional implant success rate, duration of stay and echocardiographic outcome parameters at discharge did not differ between groups. The procedural time was shorter in the EN+ group (*41.1 min vs. 49.2 min, p = 0.024*), and there was a non-significant reduction of contrast agent in the EN+ group (*34.3 ml vs. 39.0 ml, p = 0.231*). Fluoroscopic time did not differ between groups (*11.4 min in EN+ vs. 10.9 min in EN- group, p = 0.548*).

For EN+ patients, automated heart segmentation performed by EN was judged as good in 90% of cases. Angulation of the c-arm was chosen based on the annular plane suggested by EN generated cusp nadirs instead of CTA suggestions. EN aortic root measurements were larger compared to CTA (*annular area [498 vs 440mm^2, p <0.000], perimeter [79.0 vs 75.5mm, p <0.000], mean diameter [25.1 vs 23.9mm, p <0.000]*). Despite these differences, the identical prosthetic valve size would have been chosen for 61% of patients, while 30% of patients would have received larger and 9% of patients smaller valve prostheses than suggested by CTA. Repeat test variability for EN derived aortic root measurements was small (same data set: *identical measurements and Pearson correlation coefficient of 1.0 for all tests*; two data sets of same patient: *Pearson correlation coefficients between 0.96 and 0.99*).

Figure: O43-1. Automatically generated cusp nadirs allowing for optimized annular alignment. A) CTA ; B) EN.



Conclusion: The use of EN during TAVR was safe and significantly reduced procedure time without increasing fluoroscopy time compared to TAVR without EN. EN derived heart segmentation was accurate and automated aortic cusp nadirs proved superior to CTA for optimal c-arm angulation. EN derived, user-independent automated annular dimensions were highly reproducible, but generally larger than CTA measurements.

O44

Mitral cardioband and left circumflex artery interference quantification

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Aims: One of the main issues during Cardioband implantation is the risk of circumflex artery (Cx) impingement, due to close course of the vessel in the region between the anterolateral trigone and the P1 posterior segment of the mitral annulus. The aim of the study is to compare the baseline and post-implantation course of the Cx in this particular region, analyzing its distance from the ring in systole and diastole, by CT scan analyses.

Methods: A total of 11 patients with severe functional MR (mean age 73 ± 9.2 years, 65% men) who underwent CT prior and post transcatheter direct mitral annuloplasty with Cardioband were evaluated. A minimun distance of 4 mm (from left ventricular endocardium to the anchor) with an angle of anchor's penetration of 45° was set in these patients during CT analyses. The minimum distance from the projected anchor to Cx was measured, in end-systole and end-diastole, analysing every 30° several points occurring from the anterolateral commissure to the end of the P1 region, in a counterclockwise fashion.

Results: In 10 out of 11 patients a right coronary dominance was present. The narrowest course of the Cx from the projected anchor was found during diastole, at the initial and middle portion of P1 segment, with a minimal distance of 3.95 mm (IQR 2.9-5.6). Median Cx displacement in P1 between systole and diastole was 1.85 mm (IQR 1.1-2.3). At the level of the anterolateral trigone minimal distance of Cx from the projected anchor was 5.9 mm (IQR 4.7-8.1), with Cx displacement of 0.7 mm (IQR 0.4-1.3).

In Cardioband´s pre- and post-implant CT analyses comparison, the mean distance of Cx from the projected anchors increases of 3.3 ± 0.5 mm in systole and of 2.5 ± 0.2 mm in diastole. These measurements were reproducible in all patients, regardless of left coronary dominance.

Conclusions: This dynamic CT study compares the distance and displacement of the Cx during the cardiac cycle, pre- and post Cardioband implantation. The narrowest areas of Cx, in correspondence of P1 increases its distance from the anchors after Cardioband cinching, improving procedural safety profile.