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Routine "Submillisievert" Coronary CTA with Prospective Gating and Iterative Reconstruction

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Background: Ultra-low radiation coronary CTA (submillisievert) has been so far only performed with high-pitch dual source CT.
Objective: To perform submillisievert coronary CTA with a regular 64-slice CT combining prospective ECG-gating (PECG) with iterative reconstruction (IR) that allows to reduce radiation dose without increasing image noise.
Methods: Forty-seven patients (age 53±12 , 70% men, BMI 24.7±2.0) with a regular heart rate< 60 bpm underwent coronary CTA using PECG, IR(100% IR ,0% FBP) a tube voltage of 100 kVp and a tube current that was adapted to patients BMI but reduced by 25% as compared to CTA performed without IR. For PECG, "padding" allowing reconstruction of images from 70 to 80% of the RR interval was used. Subjective image quality was graded 0 (non diagnostic) -3 (perfect) by 2 independent readers. Image noise, contrast to noise (CNR) and signal to noise (SNR) ratios were measured. The group was matched with a control group of 46 similar patients imaged with helical mode , 100 kVp without IR.
Results: Radiation and image noise were significantly lower in the study group: 0.84 ±0.13mSv vs 5.1±1.2 mSv (P<0.001), noise: 28.1±4.6 HU Vs 30.4±5.4 (p=0.01). SNR and CNR were similar: 24.9±5.4 vs 24.0 ±4.7 and 24.4± 5.4 vs 23.5 ± 4.7 in both groups. Mean Image quality was similar: 2.8±0.3 vs 2.9± 0.3 (p=ns). Inter-observer agreement was good (kappa = 0.74).
Conclusion: Routine "Submilliesievert" high quality coronary CTA is feasible in patients with a normal BMI and a regular slow heart rate combining PECG and IR with a 64-slice CT.

Value of QRS Width and LV Dyssynchrony of Myocardial Perfusion Imaging in Predicting Cardiac Events

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Purpose: Recently, phase analysis software has been developed to assess mechanical left ventricular (LV) dyssynchrony from myocardial perfusion imaging (MPI). Prolonged QRS duration is a known index of poor prognosis. Our aim is to examine the relation of LV dyssynchrony detected by phase analysis and QRS width related with heart failure (HF) hospitalization and cardiac mortality.
Methods: During 2010, in 405 consecutive patients who referred to Tc sestamibi GSPECT MPI, we selected 143 with LVEF iunlaut 50%. Phase analysis software was applied. In the phase analysis, LV dyssynchrony was measured by phase standard deviation (PSD). Patient's characteristics, risk factors of CAD, MPI, phase analysis results, LVEF and QRS width were analyzed. The patients were followed-up for cardiac events (HF hospitalizations and cardiac mortality) for 437±75days.
Results:

	Events N=20	Control N=123	p value
Age	71±12	66.3±12	0.10
Diabetes Mellitus	12 (60%)	43 (35%)	0.059
Infarct Size (1-5)	3.2±2	2.25±1.7	0.04
QRS width	129.8±40	105.52±31	0.01
LVEF	26.15±10	38.29±20	0.0001
PSD	57.18±24	39.59±20	0.002

Bivariate logistic regression analysis (QRS width and PSD) was used because of the low number of events, and showed that PSD p=0 .012 was significantly related with cardiac events.
Conclusion: In addition to LVEF as a predictor of events, PSD of phase analysis was identified to be an independent predictor for heart failure hospitalization and cardiac mortality.

Automatic Assessment of Calcium Score from Contrast-Enhanced 256-Row Coronary CT Angiography

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Background: The coronary artery calcium score (CS), an independent predictor of cardiovascular events, is performed as a stand-alone non-enhanced CT scan (CSCT) or as an additional non-enhanced procedure prior to a contrast enhanced coronary CT angiography (CCTA). The purpose of our study was to evaluate the accuracy of a fully automatic tool for computing CS from CCTA.

Methods: 136 consecutive symptomatic pts (age 59±11 yrs, 40% female) without known CAD who underwent both 256-row CSCT and CCTA were included. Original scan reconstruction (slice thickness) was maintained (2.5mm for CSCT and 0.67 mm for CCTA). CS was computed from CCTA by an automatic tool (COR Analyzer, Rcadia) and compared to CS results obtained by standard assessment of non-enhanced CSCT (HeartBeat CS, Philips). We also compared both methods for classification into 5 commonly used CS categories (0, 1-10, 11-100, 101-400, >400AU).

Results: All scans were of diagnostic quality. CS obtained by the COR Analyzer from CCTA classified 111/136 (82%) of pts into identical categories as CS by CSCT and 24 of remaining 25 into an adjacent category (Table). Overall, CS values from CCTA showed high correlation with CS values from CSCT (Spearman rank correlation = 0.95, $p<0.0001$).

Conclusions: 1. CS values automatically computed from 256-row CCTA were highly correlated with standard CS values obtained from non-enhanced CSCT. 2. Our results suggest that CS can be obtained directly from CCTA obviating the need for an additional scan.

CS	CSCT CS 0	CSCT CS 1-10	CSCT CS 11-100	CSCT CS 101-400	CSCT CS>400
CCTA CS 0	24	4	0	0	0
CCTA CS 1-10	5	6	3	0	0
CCTA CS 11-100	1	1	29	2	0
CCTA CS 101-400	0	0	5	26	2
CCTA CS>400	0	0	0	2	26

Influence of Attenuation Correction on Left Ventricular Dilation in Myocardial Perfusion Imaging

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Background: The present study aims to assess the effect of attenuation correction (AC) on transient ischemic dilatation of the left ventricle (LV) (TID) threshold values.
Methods and Results: Ninety six patients assessed for known or suspected coronary artery disease (CAD) (mean age 58+11 yrs, women 15%) underwent dual isotope Tl201 rest-Tc-99m Sestamibi stress myocardial perfusion imaging (MPI) with CT-attenuation corrected (AC) SPECT. Thirty eight patients completed exercise and 58 had a pharmacologic dipyridamole stress test. Severe and extensive CAD was defined as the presence of > 90% stenosis either in the left ascending coronary artery (LAD) or in two or three coronary vessels demonstrated non-invasively using CT coronary angiography. The TID ratio was calculated for AC- and non-AC MPI studies as the ratio of the end-diastolic LV volume at stress divided by end-diastolic LV volume at rest. ROC analysis was used to define the threshold that separated best between patients with and without severe and extensive CAD. Angiographically nonsignificant, mild-moderate, severe/extensive CAD was found in 41 (43%), 25 (26%) and 30 (31%) patients, respectively. In the exercise group a non-AC TID threshold of 1.23 had a sensitivity of 61% and specificity of 62% for indicating severe CAD (P=0.3). The AC-TID threshold was 1.39 with a sensitivity and specificity of 30% and 86% respectively for significant CAD (P=0.5). In the dipyridamole group a non-AC TID threshold of 1.46 had a sensitivity and specificity of 49% and 65% respectively, (P=0.8). The AC-TID threshold of 1.19 had a sensitivity and specificity of 28% and 91%, respectively for diagnosis of significant CAD (P=0.9).
Conclusion: The TID index, a parameter for severity of CAD appears to be affected by AC processing with a decrease in sensitivity and an increase in specificity.

High-Frequency QRS Analysis Improves Specificity of Exercise ECG in Women Referred for Angiography

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Introduction: Exercise ECG testing in women with suspected coronary artery disease (CAD) is limited by low diagnostic accuracy. Consequently, women referred for coronary angiography often have normal coronary arteries or non-obstructive lesions. Analysis of the high-frequency components of the QRS complexes (HFQRS) has been reported to provide a sensitive, gender-independent indication of myocardial ischemia. This study compared the diagnostic performance of HFQRS with conventional exercise ECG in detecting stress-induced ischemia in women referred for angiography.
Methods: The study included 113 female patients (age 64±9 years) referred for non-urgent angiography. Patients performed a symptom-limited treadmill exercise test prior to angiography. High-resolution ECG was acquired during the test and used for both HFQRS and conventional ST-segment analyses. HFQRS diagnosis was determined by computerized analysis, measuring the stress-induced reduction in HFQRS intensity in each ECG lead. The diagnostic performance of HFQRS, ST-segment analysis and clinical interpretation of the exercise test were compared using angiography as gold standard.
Results: HFQRS was more specific than both ST segment analysis and clinical interpretation (80% vs. 54% and 55% respectively, $P<0.005$) with similar sensitivities (70% vs. 70% and 73%). The number of ECG leads with ischemic HFQRS response correlated with the severity of CAD. HFQRS was highly specific (93%) in patients who achieved their age-predicted target heart rate, and retained its diagnostic accuracy in subgroups of patients with resting ECG abnormalities or inconclusive exercise ECG.
Conclusion: HFQRS analysis, as an adjunct technology to exercise stress testing, may improve the diagnostic value of the ECG, and reduce the number of unnecessary imaging and invasive procedures

Role of Automatic Strain Analysis of Echos for Chest-Pain Triage in the Emergency Departmentresults

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Background: Chest pain (CP) is a very prevalent complaint among people presenting to emergency departments (ED) and rapid exclusion of an ischemic etiology is critical.
Objective: To assess the value of automated segmental and global longitudinal strain analysis of echocardiograms for detecting ischemic CP over clinical judgment based on routine ED examinations and visual identification of wall motion (WM) abnormalities.
Methods: Patients presenting to the ED for CP who did not have a history of ischemic heart disease (IHD) or evidence of acute ischemia were evaluated by attending physicians. Decisions if to hospitalize patients were based on medical history, physical examination, ECG, chest X-ray, routine blood tests and cardiac markers. Echocardiographic clips were recorded and visual segmental WM analysis was performed independently by an experienced echocardiographer and by a cardiac sonographer. Global and segmental longitudinal strain values were determined by an automatic application.
Results: Of 84 patients, 37 were hospitalized based on clinical judgment alone. Of these, 15 underwent coronary angiography: 13 had abnormal coronary perfusion and at 6-month follow-up an additional patient had IHD. Assessments by ED physician, echocardiographer, sonographer and automated 2D longitudinal and segmental strain analysis yielded sensitivities of 91%, 63%, 73%, 64% and 46%, respectively, and specificities of 63%, 90%, 75%, 53% and 79%, respectively.
Conclusion: ED physicians' assessments of CP in the ED resulted in a high sensitivity but a low specificity for IHD. Echocardiograms, interpreted by an echocardiographer or by an automated application for segmental strain analysis had a better specificity and may improve correct triage of CP in EDs.