sizing by 3D TEE. Both CT and TEE were analyzed by experienced cardiologists. We compared clinical findings in these two groups. A composite end-point of 30-day major complications was defined as including death, cerebrovascular accident (CVA), myocardial infarction, cardiac shock, major bleeding, major vascular complications, acute kidney injury (AKI), and acute respiratory failure. Post-procedural para-valvular leak (PVL) and 30-day PVL were recorded by TEE and TTE respectively.

RESULTS There was no significant difference in the baseline mean eGFR (ml/min/1.73m3) in these two groups (33.0±7.5 vs 28.6±10.8, p=0.20). Total number of patients with 30-day major complications in the low-dose contrast CT group were significantly lower than the 3D TEE based group (0% vs 18.5%, p<0.05), while there was no significant difference in post procedural PVL and 30-day PVL. In the ultra-low contrast group, there was no AKI and serum creatinine did not change after the CT scan (pre-scan creatinine 1.55±0.21 mg/dl, post-scan creatinine 1.45±0.40 mg/dl, p=0.21).

CONCLUSIONS TAVR in patients with CKD by planning with ultra-low contrast dose CT was associated with similar post procedural PVL and 30-day PVL but with lower incidence of 30-day major complications compared to the 3D TEE group. Our results offer preliminary data that ultra-low dose contrast CT appears feasible and safe to guide TAVR procedures in patients with CKD.

CATEGORIES IMAGING: Non-Invasive

KEYWORDS Contrast, CT sizing, TAVR

TCT-333

Accuracy of lumen boundary extracted from coronary CTA for calcified and noncalcified plaques assessed using OCT data

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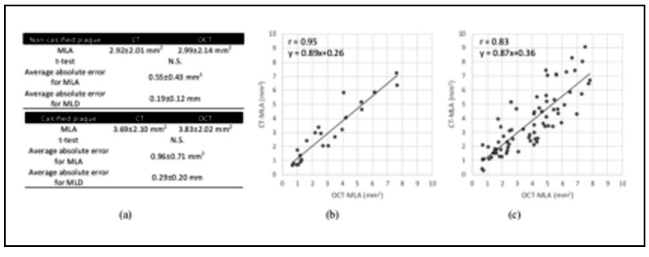
BACKGROUND Noninvasive methods to derive fractional flow reserve from coronary CT angiography data depend on the accuracy of the luminal boundary extracted from image data. The spatial resolution of coronary CTA data has been considered as a fundamental upper limit on the accuracy and precision of FFRCT, but this neglects the fact that CT image data can be segmented with sub-pixel resolution. We hypothesize that the quality of the image data and coronary calcification have a greater influence on lumen accuracy rather than the spatial resolution of CTA. We investigate the limits of the accuracy of lumen boundary identification from CT related to coronary calcification using OCT data as the reference standard.

METHODS Image processing methods were applied to segment the lumen boundaries of 96 lesions in 23 patients from coronary CTA and OCT data. Plaques were characterized as calcified or non-calcified based on appearance on CT. OCT data was co-registered to CT data using branch vessels found in both images as fiducial markers.

RESULTS Minimum lumen area was 3.47±2.09 mm^2 (CT) and 3.58±2.03 mm2 (OCT) for all plaques (p=N.S.), and the average absolute error for MLA was 0.86 ± 0.67 mm^2 and 0.26 ± 0.19 mm for MLD. For non-calcified plaques, the average absolute error for MLA was 0.48 ± 0.31 mm^2 and 0.18 ± 0.10 mm for MLD, the Pearson's correlation coefficient for MLA by CT to MLA by OCT was 0.96 and the bias was -0.04 mm2.



CONCLUSIONS The spatial resolution of coronary CT angiography does not limit the accuracy of the lumen boundary extracted using modern image segmentation methods. Given a spatial resolution of CT data of approximately 0.4 x 0.4 x 0.6 mm, the MLD can be resolved accurately as evidenced by the strong correlation with OCT data for non-calcified plaques. Limitations in anatomic resolution are due to image quality, especially related to the presence of calcium.

CATEGORIES IMAGING: Non-Invasive

KEYWORDS Computed tomography coronary angiography, OCT, Plaque

IMAGING: INTRAVASCULAR

Tuesday, October, 13, 2015, 4:00 PM-6:00 PM

Abstract nos: 334 - 370

TCT-334

Factors Affecting Quantitative Stent Assessment by Optical Frequency Domain Imaging: In Vivo Direct Comparison with Intravascular Ultrasound

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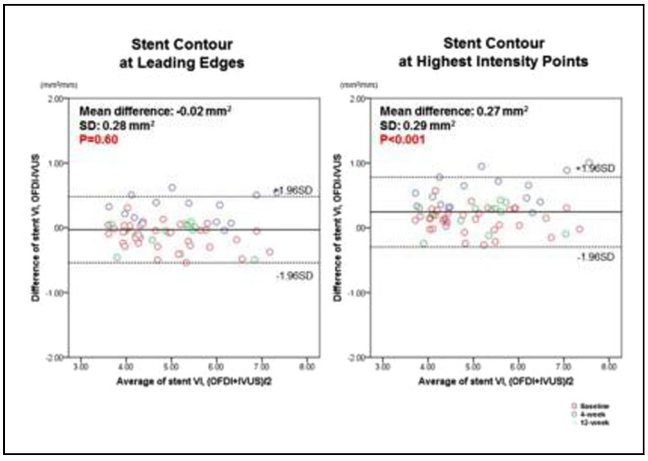
BACKGROUND Current catheter-based coronary imaging systems are calibrated to measure a distance from the probe to a lumen border through blood or a flushing medium with known signal propagation speed. Thus, presence of instent neointima may affect stent measurements, since the speed of signal can vary in soft tissue. Blooming artifacts from strongly-reflective metal struts can also result in a certain variability, particularly in light-based approaches. This study aimed to elucidate potential factors affecting stent measurements in comparison of conventional IVUS and optical frequency domain imaging (OFDI).

METHODS IVUS and OFDI were compared in 64 matched segment images obtained in vivo from 20 swine coronary stent models: 34 images were obtained at baseline, 17 images at 4 weeks, and 13 images at 12 weeks (corresponding to 6- and 18-month follow-up in humans, respectively). IVUS measurements were performed at the leading edge of boundaries, as ultrasound blooming mainly occurs distally. In OFDI where blooming can occur both proximally and distally at strut surface, stent contours were traced at leading edges and at highest intensity points of strut images.

RESULTS When stent was traced at leading edges of OFDI strut images, stent volume (mm^3/mm) by OFDI was 2.6% smaller at baseline (p<0.001), 5.1% larger at 4 weeks (p<0.001), and equivalent at 12 weeks, compared with those obtained by IVUS. In contrast, when traced at highest intensity points by OFDI, stent volume was larger in OFDI than in IVUS at all time points but to varying degrees: 2.4% at baseline (p<0.001), 10.9% at 4 weeks (p<0.001), and 3.6% at 12 weeks (p=0.01). Similar findings were also observed for minimum stent area measurements. In the assessment of instent neointima at follow-up, neointimal volume by OFDI was larger at both 4 weeks and 12 weeks than IVUS, regardless of the strut tracing methods, possibly due to indistinct neointimal border on IVUS images leading to underestimation of neointima particularly in stents with a relatively thin neointimal layer.



CONCLUSIONS In vivo measurements by OFDI and IVUS can show variable discrepancies depending on the parameters and time points after stent deployment. Methods for strut contour tracing can also lead to a small but systematic difference in OFDI measurement results; therefore, consistency in methodology is advised for comparative studies.

CATEGORIES IMAGING: Intravascular

KEYWORDS IVUS, OCT, OFDI

TCT-335

Diagnostic concordance of intravascular ultrasound imaging compared to fractional flow reserve for the severity assessment of coronary lesions: A bivariate meta-analysis

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BACKGROUND Intravascular ultrasound (IVUS) has been introduced as a useful diagnostic tool in coronary interventions by providing additional anatomic and morphological details of coronary lesions. However, limited studies have examined the diagnostic accuracy of IVUS compared to fractional flow reserve (FFR) for the detection of significant coronary stenoses. We aimed to evaluate the diagnostic accuracy of IVUS using FFR as the reference standard in a bivariate meta-analysis.

METHODS Through a broad computerized literature search of PubMed, Cochrane Libraries, and EMBASE, we identified original studies that evaluated the diagnostic accuracy of IVUS compared to FFR. Eligible studies provided raw lesion-level data that enabled the calculation of diagnostic accuracy metrics. Our analyses were focused on the IVUS-derived measurements of minimal lumen diameter (MLD), minimum lumen area (MLA), and percent area stenosis (%AS). We constructed 2x2 tables according to the concordance of IVUS versus FFR by using a threshold of 0.80 for identification of hemodynamically significant stenoses. A sensitivity analysis by excluding studies of left-main coronary lesions was also performed. Three prespecified cutoffs for MLD, MLA, and %AS were adopted for definition of significant coronary stenoses: MLD of 1.50, 1.75, 2.0 mm; MLA of 2.0, 3.0, 4.0 mm2; and %AS of 50%, 70%, 90%. A recently developed bivariate random effects meta-analysis model was used to derive summary metrics of diagnostic accuracy.

RESULTS A total of 14 studies concerning 2,740 patients (2921 coronary lesions) were deemed eligible; whereas two studies had exclusively included patients with left main coronary artery stenoses. Bivariate meta-analysis demonstrated a moderate diagnostic concordance of IVUS compared with FFR. For the lower cutoffs of MLD (1.50 mm) and MLA (2.0 mm2), IVUS yielded high specificity (0.87 (95% CI, 0.69-0.95) and 0.94 (95% CI, 0.88-0.97) respectively) and very low sensitivity (0.41 (95% CI, 0.18-0.68) and 0.18 (95% CI, 0.09-0.32) respectively). Overall sensitivity and specificity was 0.65 (95% CI, 0.28-0.90) and 0.75 (95% CI, 0.33-0.95) for MLD of 1.75 mm; and 0.69 (95% CI, 0.55-0.80) and 0.74 (95% CI, 0.58-0.85) for MLA of 3 mm2. The sensitivity and specificity for the commonly used threshold of 2.0 mm for MLD was 0.90 (95% CI, 0.64-0.98) and 0.55 (95% CI, 0.17-0.88) respectively, with an area under the hierarchical summary receiver-operator curve (HSROC) of 0.85 (95% CI, 0.81-0.88). The results were consistent also for %AS. In the sensitivity analysis, diagnostic accuracy of IVUS was slightly improved but remained moderate.

CONCLUSIONS By using FFR as the reference method, IVUS demonstrated a moderate diagnostic accuracy to detect hemodynamically significant coronary artery stenoses for different thresholds of the examined metrics. The role of IVUS in clinical practice should be complimentary to the other available diagnostic tools.

CATEGORIES IMAGING: Intravascular

TCT-336

Predictors of plaque progression in hypertensive angina patients with achieved low density lipoprotein cholesterol less than 70 mg/dL after rosuvastatin treatment

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BACKGROUND We evaluated the predictors of plaque progression in statin-treated hypertensive angina patients whose achieved low density lipoprotein cholesterol (LDL-C) level was less than 70 mg/dL at follow-up using virtual histology-intravascular ultrasound (VH-IVUS).

METHODS The effects of 10 mg of rosuvastatin therapy on coronary plaque progression were evaluated using VH-IVUS. 78 patients who achieved an on-treatment LDL-C <70 mg/dL were divided into plaque progressors (n=30) and plaque regressors (n=40) at the baseline minimum lumen area (MLA) site at 9-month follow-up.

RESULTS There were higher prevalence of chronic kidney disease (CKD) [creatinine clearance (CrCl)< 60 mL/min) and current smoking in progressors compared with regressors (90.0% vs. 31.3%, p<0.001, 40.0% vs. 12.5%, p=0.005, respectively). Baseline CrCl was significantly lower and baseline apolipoprotein(apo) B/A1 was significantly higher in progressors compared with regressors (21±13 mL/min vs. 70±20 mL/min, p<0.001, 0.77±0.23 vs. 0.65±0.16, p=0.011, respectively). At MLA site, external elastic membrane cross-sectional area increased in progressors, in contrast decreased in regressors (+0.48±0.73 mm^2 vs. -0.63±0.67 mm^2, p<0.001) and absolute and relative fibrotic areas increased in progressors, in contrast decreased in regressors from baseline to follow-up (+0.84±0.77mm^2 vs. -0.44±0.75 mm^2, p<0.001 and +7.2±10.5% vs. -3.4±15.3%, p=0.001, respectively). CKD [Odds ratio (OR) 2.13, 95% CI 1.77-2.53, p=0.013], smoking (OR 1.76, 95% CI 1.23-2.22, p=0.038), and apoB/A1 (OR 1.25, 95% CI 1.12-1.40, p=0.023) were the independent predictors of plaque progression at follow-up.

CONCLUSIONS In hypertensive angina patients who achieved very low LDL-C after rosuvastatin treatment, clinical factors including CKD, smoking, and apoB/A1 rather than baseline plaque components detected by VH-IVUS are associated with plaque progression at follow-up.

CATEGORIES IMAGING: Intravascular

KEYWORDS Angina pectoris, Hypertension, Plaque

TCT-337

Intravascular Assessment of Arterial Diseases using Compensated Optical Coherence Tomography: Proof-of-Concept with Comparison with Histology

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BACKGROUND While Optical Coherence Tomography (OCT) has emerged as the state-of-the-art modality for intravascular imaging, its use for assessment of atherosclerotic plaque is hampered by shadow artefacts and limited penetration depth due to rapid attenuation of OCT signals within tissues. In this study, we evaluated the improvement in image contrast with compensated OCT over conventional OCT.

METHODS 22 OCT pullbacks were acquired from pathological coronary artery specimens (subject 1: male, 53 years old, LAD; subject 2: male, 46 years old, LCX) using a C7 intracoronary OCT system (St Jude Medical, St Paul, MN). OCT-Histology matched sections were obtained from histopathology analysis. OCT pullbacks were exported in raw format and post-processed in Matlab (Mathworks, US) with an algorithm that was previously developed to compensate for OCT signal attenuation in tissues. The intra- and interlayer contrasts were analyzed before and after compensation and compared with histological images. Comparison was based on 3 parameters, namely 1) intralayer contrast (between shadowed and non-shadowed areas) to evaluate shadow removal, 2) intralayer contrast (between different intraplaque structures) and 3) interlayer contrast (between adjacent vessel wall layers) to evaluate the clarity of boundaries. Statistical analyses were performed using one way ANOVA with Tukey multiple post-comparison test (GraphPad Prism software package), with $p < 0.05$ representing significance.

RESULTS The study showed that compensation: i) Enhanced the detectability of intraplaque morphology and deep tissue boundaries as evidenced by the increase in contrast between different structures within the plaque components (from 0.05 to 0.23; $p < 0.0001$) and that