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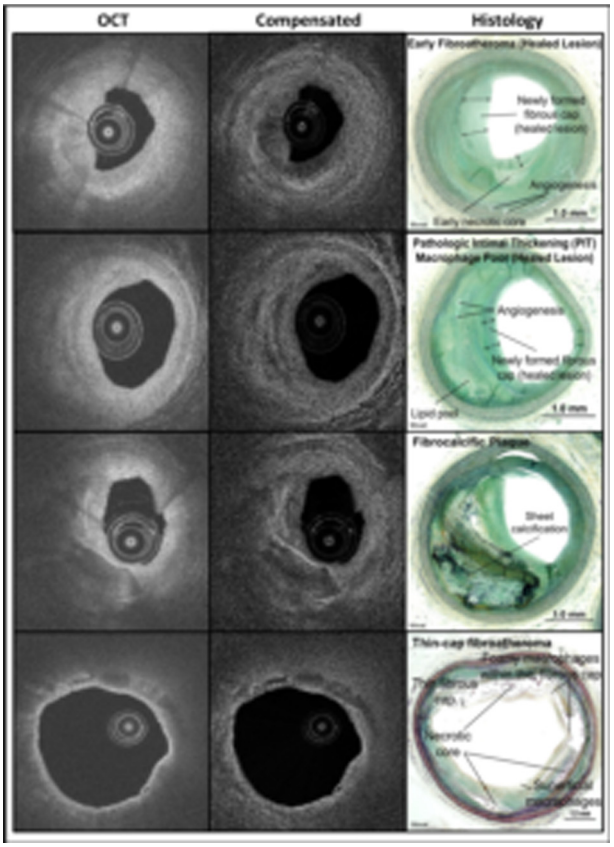
BACKGROUND While Optical Coherence Tomography (OCT) has emerged as the state-of-the-art modality for intravascular imaging, its use for assessment of atherosclerotic plaque is hampered by shadow artefacts and limited penetration depth due to rapid attenuation of OCT signals within tissues. In this study,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

of between adjacent layers of the vessel wall (from 0.09 to 0.20; $p < 0.0001$). ii) Enhanced the visibility of deep structures which is important for accurate OCT-based identification of plaque composition and disease burden. iii) Reduced shadow artefacts (decrease in intralayer contrast between shadowed and neighboring areas.



CONCLUSIONS Compensation was effective in improving plaque interpretation from coronary OCT by enhancing the contrast in the vessel wall and removing shadow artefacts. Such compensation of OCT images may increase the accuracy of plaque assessment with OCT during Percutaneous Coronary Interventions (PCI).

CATEGORIES IMAGING: Intravascular

KEYWORDS Histological analysis, OCT, Plaque morphology

TCT-338

Head-to-Head Comparison of Two Commercially Available Automated Detection Algorithms for Lumen Contour in Optical Coherence Tomography Analysis

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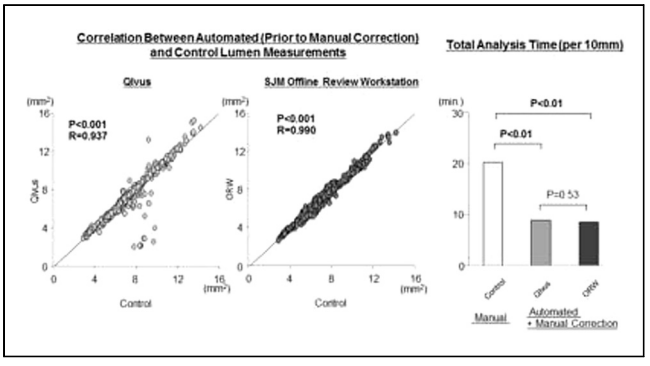
BACKGROUND In optical coherence tomography (OCT), accurate quantitative and qualitative analysis is crucial not only in offline research but in online clinical applications to formulate PCI strategy and procedural guidance. However, manual lumen contour tracing for every frame over the entire analysis segment is a tedious and time-consuming process. Automated computer-assisted approaches may facilitate rapid assessment of coronary lumen contour and avoid potential sources of interobserver variability. This study aimed to assess the accuracy and usefulness of 2 commercially available automated lumen contour detection algorithms for OCT analysis: QIvus (Medis Medical Imaging Systems) and SJM Offline Review Workstation (ORW) (St. Jude Medical).

METHODS Automated detection algorithms were tested in 713 frames obtained from 11 patients with Fourier-domain OCT imaging at post-stent implantation (length: 25.7±11.0 mm, frame interval: 0.4 mm). Using QIvus and ORW, automated lumen contour detection and additional manual correction (if needed) were performed in each frame. The automated analysis results were compared with control data provided by an expert analyst using a conventional off-line manual analysis system (echoPlaque4, Indec Systems).

RESULTS In paired-frame analysis, automated lumen measurements derived from QIvus and ORW showed good agreements with control lumen area data ($R=0.937$, $p<0.001$ and $R=0.991$, $p<0.001$, respectively), except for several frames with significant underestimation resulted from residual blood or wire artifact within the lumen. In per-segment analysis, both QIvus-, and ORW-derived mean lumen areas were comparable with control (7.43±2.53 and 7.36±2.52 vs 7.46±2.46 mm2, $p=0.72$ and 0.29, respectively); minimum lumen areas determined by automated analyses were reasonably accurate (<6% error) in 72.7% by QIvus and 81.8% by ORW ($p=0.34$). Total analysis times (including automated analysis plus, if needed, manual correction) were significantly shorter with automated systems compared to control manual analysis ($p<0.01$ for both), while they were equivalent between the 2 automated systems.

CONCLUSIONS Despite the remaining need for some manual corrections, both of the 2 automated lumen contour detection algorithms developed for OCT can facilitate rapid assessment of the coronary artery.



CATEGORIES IMAGING: Intravascular

KEYWORDS Comparison, OCT

TCT-339

Different Pattern of Neoatherosclerosis for DES versus BMS in Very Late Stent Thrombosis

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BACKGROUND There are few clinical studies on the pathophysiological mechanisms of very late stent thrombosis (VLST, >1 year from stent implantation).

METHODS We conducted a registry of stent thrombosis at 4 North American centers with OCT imaging programs (SAFE registry). Images were acquired in 51 patients (35 DES and 16 BMS) presenting with definite VLST. Neoatherosclerosis was defined as the lipid neointima (including thin-cap fibroatheroma -TCFA, defined as the fibroatheroma with fibrous cap < 65 μm) or calcified neointima.

RESULTS The median duration from implantation to VLST presentation was 54.7 months in the DES and 70.0 months in the BMS group. The frequency of cases with uncovered and malapposed struts were 76.5% (39/51) and 72.5% (37/51), respectively. The percentage of frames with malapposed struts was significantly higher in DES than in BMS (16.67% [4.35, 25.93] and 0.82% [0.00, 6.35]). Lipid neointima,