Correlation between fractional flow reserve and intravascular ultrasound in patients with isolated ambiguous left main stenosis

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Background: Fractional flow reserve (FFR) is a "golden standard" in determining hemodynamic significance of ambiguous lesions and provides guidance on appropriate- ness of revascularization. The cut-off values for intravascular ultrasound (IVUS) parameters corresponding to FFR of 0.75 or 0.80 are still under investigation. The aim of this study was to determine best IVUS criteria for predicting physiological significance of left main coronary artery (LMCA) stenosis with FFR as the standard.

Methods: FFR values during adenosine infusion (at the rate of 140 μg/kg/min - femoral venous) were calculated in 99 patients aged 58 ± 10 years with an angiographically ambiguous LMCA stenosis. Subsequently, all patients underwent IVUS with automatic pullback at a constant speed of 0.5 mm/sec, from the middle segment of left descending artery (LAD) to the aorto-ostial junction of LMCA. The following IVUS parameters were analyzed: minimum lumen area (MLA, mm²), minimum lumen diameter (MLD, mm), the minimum plaque burden (PB, %), and percent area stenosis (%AS, %).

Results: The averaged FFR was 0.77 ± 0.10 (range 0.51-0.99). FFR ≤ 0.75 was observed in 42 patients (42.4%). Linear regression analysis revealed a strong correlation between the values of FFR and MLA (AUC = 0.86, p <0.0001), PB (AUC = 0.64, p < 0.001), MLA (AUC = 0.72, p <0.0002) and the MLD (AUC = 0.75, p <0.0001). Cut-off points for the value of FFR ≤ 0.75 were: <5.9 mm² for MLA (sensitivity 0.69 and specificity 0.85), >9.7% for PB (sensitivity 0.77 and specificity 0.48), >36% for %AS (sensitivity 0.94 and specificity 0.44) and <2.9 mm for MLD (sensitivity 0.97 and specificity 0.50), respectively.

Conclusions: Strong correlation between FFR and LMCA lesion critical IVUS parameters was found in our patient group. MLA value of <5.9 mm² in IVUS seems to be a useful criterion for predicting FFR ≤ 0.75.

TCT-310

Plaque Neovascularization Correlates With Thermal Heterogeneity As Measured By Microwave Radiometry

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Background: Both neangiogenesis and inflammation contribute in atherosclerosis progression. Contrast-enhanced ultrasound (CEUS) provides visualization of plaque neovascularization. Microwave radiometry (MR) allows in vivo non-invasive measuring of temperature of tissues, reflecting inflammatory activation. We assessed the association of carotid plaque temperature, measured by MR, with plaque neovascularization assessed by CEUS.

Methods: Consecutive patients with coronary artery disease and carotid atherosclerosis underwent carotid ultrasound imaging, CEUS and MR. Plaque texture, plaque surface, and plaque echogenicity were analyzed. Contrast enhancement (CE) by CEUS was defined as the percentage of signal intensity difference, prior and post contrast infusion. Thermal heterogeneity (ΔT) was assigned as maximal temperature along the carotid artery minus minimum.

Results: Eighty-six carotid arteries of 48 patients were included. Fatty plaques had higher CE% compared to mixed and calcified (21.4±2.70 versus 17.1±5.23 versus 8.5±5.24%, p<0.001). Heterogeneous plaques had higher CE% compared to homogene- nous (21.4±2.7 versus 14.66.6±0.2% p<0.01). Plaques with irregular surface had higher CE% compared to plaques with regular (18.29±5.09 versus 13.64±6.06%, p<0.001). Fatty plaques had higher ΔT compared to mixed and calcified (13±0.27 versus 0.95±0.34 versus 0.83±0.26°C, p<0.001). Plaques with regular surface had higher ΔT compared to plaques with regu- lar (1.05±0.32 versus 0.75±0.32°C, p<0.001). Heterogeneous plaques had higher ΔT compared to homogenous (1.13±0.27 versus 0.83±0.37°C p<0.001). There was a good correlation between ΔT and CE (R=0.60, p<0.001).

Conclusions: Carotid plaque neovascularization on CEUS examination is associated with increased thermal heterogeneity and ultrasound characteristics of plaque vulnerability.

TCT-311

Rate of Plaque Negative to Plaque Positive Conversion in Patients by Serial 64-Slice Computed Tomography Coronary Angiography (CTCA)

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Background: This retrospective study sought to determine the conversion rate of patients by serial 64-slice computed tomography coronary angiography (CTCA). MSCT has emerged as a noninvasive technique for the accurate detection of coronary artery disease in both stable and unstable patients.

Results: Between 2004 and 2011, 241 consecutive patients were identified that underwent screening and clinically indicated serial 64-slice computed tomography coronary angiography (CTCA). MSCT has emerged as a noninvasive technique for the accurate detection of coronary artery disease in both stable and unstable patients.

Methods: Between 2004 and 2011, 241 consecutive patients were identified that underwent serial 64-slice CTCA studies over a mean period of 34.6 months. History of coronary atherosclerosis was evaluated through the full length of each patient’s coronary tree using percent diameter stenosis (%DS), as well as through serial chart review and telephone interview to determine patient demographics, coronary artery disease risk factors, and cumulative cardiac event (coronary revascularization, non-fatal MI or stroke, death) rates during the follow-up period.

Results: There were 68.5% male and 31.5% female patients, ranging from 33 to 92 years (mean: 66.5 years) and an average Framingham Risk Score of 11.1%. Of this cohort, 32 patients were observed to have no calcified or non-calcified plaque. There were 11 patients (34%) that converted to abnormal CTCAs with 10 of those patients (90%) having only calcified plaques and one of those patients (10%) with non-calcified plaques. The rate of conversion of 0.10% from normal was observed to be 11.9% per year. This is the first study of this scale to suggest a follow-up in CTCA is indeed to be suitable to identify the vast majority of patients who convert to plaque positive. Identification of calcified plaque as the first plaque to appear on CTA challenges the prevailing theory that the presence of calcium is indicative of an older and perhaps more plaque resistant coronary plaque.

TCT-312

Coronary Plaque Regression by 64-Slice Computed Tomography Coronary Angiography (CTCA): Pipe Dream or Real Possibility

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Background: This retrospective study sought to demonstrate coronary plaque regression in patients that underwent screening and clinically indicated serial 64-slice computed tomography coronary angiography (CTCA). MSCT has emerged as a noninvasive technique for the accurate detection of coronary artery disease in both stable and unstable patients.

Results: Between 2004 and 2011, 241 consecutive patients were identified that underwent serial 64-slice CTCA studies over a mean period of 34.6 months. History of coronary atherosclerosis was evaluated through the full length of each patient’s coronary tree using percent diameter stenosis (%DS), as well as through serial chart review and telephone interview to determine patient demographics, coronary artery disease risk factors, and cumulative cardiac event (coronary revascularization, non-fatal MI or stroke, death) rates during the follow-up period.

Results: There were 68.5% male and 31.5% female patients, ranging from 33 to 92 years (mean: 66.5 years) and an average Framingham Risk Score of 11.1%. Of this cohort, 32 patients were observed to have no calcified or non-calcified plaque. There were 11 patients (34%) that converted to abnormal CTCAs with 10 of those patients (90%) having only calcified plaques and one of those patients (10%) with non-calcified plaques. The rate of conversion of 0.10% from normal was observed to be 11.9% per year. This is the first study of this scale to suggest a follow-up in CTCA is indeed to be suitable to identify the vast majority of patients who convert to plaque positive. Identification of calcified plaque as the first plaque to appear on CTA challenges the prevailing theory that the presence of calcium is indicative of an older and perhaps more plaque resistant coronary plaque.

TCT-313

Incidence and Morphologic Characteristics of Plaques that Evolve into Culprit Lesions: A Coronary CT Angiography Natural History Study

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Background: The defining morphologic characteristics of plaques that progress to culprit lesions have not been delineated. This study was undertaken to determine if plaques that evolve late to become culprit lesions have distinct morphologic features by coronary CT angiography (CTCA) compared to plaques which remain quiescent.

Methods: Using our CTA database, we studied patients undergoing CTA for any reason who were ultimately determined not to have a culprit lesion. From this population, we identified patients who subsequently presented with acute coronary syndrome (ACS) >45 days later, and were found to have a new culprit lesion by invasive angiography. Among these patients, the index CTA was analyzed in a blinded fashion for plaque morphology. The morphologic characteristics of plaques observed to evolve into culprit plaques were compared to those which remained clinically silent.

Results: Among 4,459 patients undergoing CTA, a total of 9,718 plaques were present. There were 24 patients who subsequently developed ACS >45 days (mean 409±324 days after the index CTA). Among these plaques, the index CTA revealed a soft plaque in 10 patients (41.7%), high-risk plaque in 10 patients (41.7%), and atherosclerotic plaque in 4 patients (16.7%) with a mean calcium score of 2.0±0.8 (range 1.25-3.0). The rate of plaques evolving into culprit lesions was 0.26%. Analysis of the index CTA revealed that plaques that evolved into culprit plaques were frequently positively-remodeled (68%) and were composed of low-attenuation plaque (21 ± 21 mm²).