IMAGING

IVUS

CRT-300.01

Predictors of Dimension of Non-diseased Left Main Coronary Arteries Assessed by Intravascular Ultrasound

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BACKGROUND Estimation of the length, diameter and percent diameter stenosis of left main coronary artery lesions (LMCA) remains challenging. Limited data is available on the exact diameters and length of non-diseased left main coronary arteries. Our aim was to provide insights in the dimensions of left main coronary arteries and to find a possible correlation with gender and patient habitus.

METHODS This study was performed in a consecutive cohort of patients that underwent Intravascular Ultrasound (IVUS) guided PCI of the left coronary system between January 2010 to December 2016. Out of a total of 1197 pullbacks, 254 pullbacks were available from patients who did not undergo left main treatment and of whom complete footage of the LMCA was available. All pullbacks were motorized with a pullback speed of 0,5 mm/sec.

RESULTS Mean age was 63±11 years, and 78% of the patients were male. Average weight was 83.8±15.9 kg while average length of the patients included was 175.0±9.2 cm; BMI was 27.3±4.5. Mean LMCA length as measured with IVUS was 7.37±4.2mm, and mean lumen area was 15.63±4.76 mm2 corresponding to a mean lumen diameter of 4.41±0.67mm. An IVUS derived mean lumen diameter of >4 mm was present in 71.7%, >4.5 mm in 43% and >5mm in 19% of patients. Weight of the patient was the sole significant predictor for length of the left main (ß=0.14, CI(0.017:0.085), p=0.003). Significant predictors of the mean lumen area are length of the left main artery and height of the patient. IVUS derived mean lumen areas were larger among men compared to women, although excluded in a multivariate regression (16.15±4.8, 14.11±4.01 p=0.004 univariate analysis) and they were negatively correlated with the length of the left main (ß=-0.25, CI(-0.41:-0.14), p<0.001) and positively with the height of the patient (ß=0.20, CI(0.04:0.17), p=0.002).

CONCLUSION Mean lumen area of non-diseased left main coronary arteries significantly correlates to the height of the patient and negatively correlates to the length of the left main. IVUS derived mean luminal diameter is 4 mm or greater in the majority of patients.

CRT-300.02

Longitudinal Distribution of Lipid-rich Plaque Components in Culprit Lesions: A Near-infrared Spectroscopy Study

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BACKGROUND The near-infrared spectroscopy (NIRS) catheter system identifies lipid core-containing coronary plaques (LCP) of interest in the coronary arteries. We sought to evaluate axial distance in location between the maximum LCP site and the site that had the most luminal-narrowing as assessed by NIRS system.

METHODS We performed NIRS imaging in 72 native coronary lesions in 63 patients: 14 acute coronary syndrome (ACS) and 58 non-ACS culprit lesions. Intravascular ultrasound (IVUS) derived lesion was defined as the site of minimal lumen area (MLA) within the culprit segment. Otherwise, an NIRS-derived lesion was defined as the site of maximum LCP site (the center of 4mm maximum lipid core burden index [$_{max}$LCBI4mm) within the culprit segment. The distance between the IVUS-derived lesion and the NIRS-derived lesion was evaluated for each culprit segment.

RESULTS Overall, the mean distance between the MLA site and the maximum LCP site was 2.3 ± 4.4 mm. Of the total of 72 lesions, 48 were in the left anterior descending (LAD), 11 were in the left circumflex (LCx) and 13 were in the right coronary artery (RCA). There was no significant difference in axial measurement data in the IVUS- and NIRS-derived lesion when comparing LAD to non-LAD (LCx and RCA). Furthermore, $_{max}$LCBI4mm was also similar among the lesion location (479.1 ± 218.5 vs. 436.7 ± 239.9, p = 0.46). Interestingly, the maximum LCP site was located more proximally to the MLA site and more widely distributed in the LAD lesion than that in the non-LAD lesion (3.01 ± 4.93mm vs. 0.82 ± 2.61mm, p = 0.02).

CONCLUSIONS NIRS may be helpful to identify vulnerable regions more precisely as well as assess strategies for their modification.

CRT-300.03

Explanation of Post Procedural Fractional Flow Reserve Below 0.85: A Comprehensive Ultrasound Analysis of the FFR SEARCH Registry

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BACKGROUND Fractional Flow Reserve (FFR) after Percutaneous Coronary Intervention (PCI) is a predictor of adverse cardiovascular events during follow-up. However, the rationale for low post procedural FFR values remains often elusive based on angiographic findings alone.

METHODS FFR search is a prospective registry in which post procedural FFR were assessed in 1000 consecutive all-comer patients after successful PCI. FFR measurements were performed with a novel over-the-wire monorail microcatheter inserted over the previously used coronary guidewire distally of the most distal stent edge. FFR measurements were performed in resting conditions and under maximum hyperemia with intravenous adenosine. In patients with a post-procedural FFR ≤0.85 intravascular high definition ultrasound analysis were performed at a pullback speed of 2.5 mm/sec at 60 MHz to identify potential reasons for a low post-procedural FFR in 100 consecutive cases. Images were analyzed every 0.5 mm.

RESULTS 22% of the patients in FFR SEARCH had at least one lesion with an FFR value ≤ 0.85 post procedural. IVUS analyses were performed in 100 vessels from 95 patients with a post-procedural FFR≤0.85. Mean post-procedural Pd/Pa was 0.91±0.04 while under maximum hyperemia the mean FFR was 0.79±0.05. On IVUS, mean lumen area was 6.18±1.55mm(2) with a minimal lumen area of 2.53±1.04 mm(2). Minimum stent area was 4.27±1.65 mm(2). Significant focal lesions proximal to the stented segment were present in 29% of the vessels analysed while focal distal lesions were apparent in 30% of the patients. Stent underexpansion was present in 68% of patients according to the MUSIC criteria while malposition was present in 22% of the cases. In 54/100 patients clear focal signs of luminal narrowing were found.

CONCLUSIONS In patients with a post-procedural FFR ≤0.85 IVUS revealed focal signs of luminal narrowing in the majority of the cases. While additional treatment will optimize the longer term results of these patients remains to be determined.

OCT

CRT-300.04

Quantitative Assessment of the Reproducibility of Bright Spots Detection in Infarct-Related Artery of Patients with ST-Segment Elevation Myocardial Infarction by Optical Coherence Tomography

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BACKGROUND Bright spots in optical coherence tomography (OCT) images were correlated with a variety of plaque components, including macrophages, and thought to be linked to the degree of

systemic inflammation. Macrophages are abundant in culprit lesion/vessels and play a major role in the development of atherosclerosis and promotion of plaque vulnerability. The purpose of this study is, therefore, to investigate the change of bright spots signal detection by OCT in segments adjacent to culprit lesions.

METHODS A total of 29 non-culprit segments from 15 patients with ST-elevation myocardial infarction (STEMI) who had serial image acquisition at baseline and immediately after the percutaneous coronary intervention (PCI) by OCT were included. The pre- and post-stenting runs were exactly matched using anatomical landmarks as references for each patient. We applied an OCT bright spot quantitative algorithm which identifies a variety of plaque components. The light intensity, attenuation and backscattering data of bright spots within the most superficial 250 μm of the vessel wall were measured.

RESULTS Although a change in the bright spot density was witnessed (Figure), there was no significant difference observed in pre- and post-procedural maximum light intensity, attenuation, and backscattering (p=0.2196, 0.4147, 0.8249; respectively).

CONCLUSION While the variability of bright spots/macrophages detection in non-culprit segments by OCT after PCI could represent a true biological observation in the setting of the inflammatory response seen in STEMI patients, it could also be an artifact that is essential to be recognized in order to avoid inappropriate image interpretation.
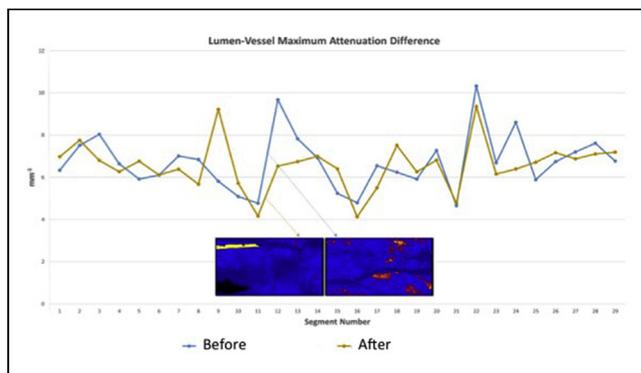
CRT-300.05

Impact of Intravascular Imaging Methods for Optimal Scaffold Implantation Reducing Thrombosis After Absorb Bvs in a Real World Setting: Identification of Factors Related to Stent Failure

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BACKGROUND Recently, bioresorbable vascular scaffolds (BVS) were related to an unexpected high incidence of thrombosis. The aim of this study was to analyze in a single center experience, the impact of intravascular imaging (intravascular ultrasound-IVUS; optical coherence tomography-OCT) identifying and treating mechanical factors related to stent failure that would act as possible predictors of thrombosis and MACE.

METHODS Between 11/2014 and 10/2016, consecutive unselected patients (pts.) were treated with one or more Absorb BVS. Predilatation before stent deployment and post dilatation, IVUS and OCT were used in 99% of cases. Identified mechanical factors possibly related with stent failure were: stent malapposition, wall hematoma, stent underexpansion, border dissection, device fracture, thrombus and/or plaque protrusion. Customized measures were taken for each case. All pts. are under clinical follow up.

RESULTS 100 pts. (88% male, mean age 58,1 yo) were included in this analysis. Baseline characteristics show real world population (31% diabetics, 52% multivessel ds). A total of 141 lesions were treated (LAD 74%), being B/C class in 60%. Median SYNTAX score was 14,2±8.8. 190 Absorb BVS were implanted (1,9 stent/pt.). Further intervention following intravascular imaging with balloon optimization and/or new stent implantation was necessary in 16% of cases because of previously described mechanical factors, not seen by angiography. After optimal result was obtained, oral anticoagulation in addition to

double antiplatelet therapy was indicated during the first 45 days in those pts having thrombus and/or plaque protrusion in OCT analysis. With 100% procedure success, 100% completed 1 yr follow up. MACE shows definite/probable scaffold thrombosis in 0%, with 4% TLR and 3% TVR.

CONCLUSION The follow up analysis of this cohort of patients is showing no thrombosis so far, in a real world all comers setting. Detection of implantation defects by intravascular imaging and not seen by angiography, followed by customized treatment with balloon/stent, seems to be responsible for the low adverse event rate, caused in these pts., by focal restenosis.

OTHER

CRT-300.06

Myocardial Bridging is Underreported during Coronary Angiography

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BACKGROUND Myocardial bridging (MB) is an anatomical variant of the coronary arteries in which a portion of the coronary artery takes an intramuscular course and becomes covered by a "bridge" of myocardium. While usually asymptomatic, MB may be responsible for chest pain, acute coronary syndromes, left ventricular dysfunction and arrhythmias. The prevalence of MB reported on autopsy studies and on coronary computed tomography (CCT) varies but the mean prevalence is approximately 25%. There are very few studies reporting the prevalence of MB based on coronary angiography (CA). Our aim is to identify the epidemiological and morphological characteristics of MB based on our CA registry.

METHODS Data from 6779 angiograms performed between January 2006 and December 2015 were analyzed. All patients reported to have MB on CA were identified. Baseline characteristics, indications for CA and all procedural information were collected through a computerized database.

RESULTS Among 6779 CA performed, only 22 cases of MB were reported (prevalence 0.3%). Mean age was 58.8 years (range 38-75 years). Only 2/22 (9%) were females. The indications for CA were: chest pain [9/22 (41%)], abnormal stress test [9/22 (41%)], abnormal CCT [(2/22 (9%)], acute MI [2/22 (9%)]. 18 out of 22 patients (82%) had MB in mid-LAD. 4 out of 22 patients (18%) had MB in distal LAD. 5 out of 22 patients (23%) had obstructive CAD in addition to MB. 12 out of 22 (55%) patients had no CAD and 5 out of 22 (23%) had non-obstructive CAD.

CONCLUSION Based on our study, Myocardial Bridging is significantly underdiagnosed (reported prevalence 0.3%) during coronary angiography compared to the rates reported on CCT or autopsy studies (mean prevalence 25%). MB can have great clinical significance, especially in symptomatic patients and every effort should be made to report such lesions during coronary angiography.

CRT-300.07

Quantification and Depth Resolution of Lipid Core Plaques by Intravascular Photoacoustic and Ultrasound Dual-Modality Imaging

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BACKGROUND Current imaging tools lack sensitivity and depth resolution to accurately quantify lipid core content at different stages of disease. Here, we present an intravascular catheter which can produce co-registered images of morphology and depth-resolved lipid core content via ultrasound and photoacoustic modes, respectively.

METHODS We performed *in vivo* intravascular photoacoustic-ultrasound (IVPA-US) imaging of the iliac arteries of Ossabaw swine with dyslipidemia (*n*=3) and lean control swine (*n*=3) to investigate sensitivity to detect early atherosclerosis. We repeated imaging *ex vivo* with near-infrared spectroscopy (NIRS) for comparison to IVPA-US and histology. To investigate late-stage atherosclerosis, we