RESULTS Fluoroscopy data: Dose-area product (DAP) was significantly lower in the low frame rate groups (7.5 frames / sec (FPS)) compared to standard practice of 15 FPS (294 vs 500 cGy.cm²). Cine angiography data: DAP was lower in the low pulse rate group (10 pulse/sec) compared to standard pulse rate cine angiography (15 pulse/sec) (1185 vs. 2111 cGy.cm²). Radiation dose was lower in low pulse group as compared to standard group (25.3 vs 16.3 mGy in Cine angiography and 3.3 vs 5.4 mGy in fluoroscopy). Similar reduction in estimated radiation doses were noted at all the sites as shown in Figure 1. We also found that steep angulation (40°) also contributed to a significant increase in radiation dose in comparison to 30° angulations across all groups (low BMI: 1522 vs. 1299; normal BMI: 3289 vs. 2111; and large BMI: 4506 vs. 2852 cGy.cm²).

CONCLUSIONS Lowering frame/pulse rate resulted in radiation dose reduction in our phantom study. Such changes should be implemented in routine catheter laboratory practice.

CATEGORIES CORONARY: Angiography and QCA

KEYWORDS Frame count, Radiation dose

FFR AND PHYSIOLOGIC LESION ASSESSMENT

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

Abstract nos: 287 - 312

TCT-287

The diastolic backwards-travelling decompression “suction” wave correlates with simultaneously acquired indices of diastolic function: corroboration of the origin of the suction wave

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BACKGROUND Wave intensity analysis can distinguish proximal and distal influences upon coronary blood flow and underpins the concept of the wave-free period. The predominant driver of coronary flow is thought to be the backwards expansion wave (BEW) (or suction wave), generated by myocardial microcirculatory decompression in early diastole. Simultaneous analysis with left ventricular (LV) pressure-volume (P-V) loop data in man has not been previously reported. We investigated the relationship between coronary wave intensity and simultaneous LV hemodynamics to confirm if there was a relationship between the BEW and LV diastolic function measured invasively.

METHODS Thirteen male subjects with single-vessel, type A coronary disease, and normal ventricular function had simultaneously measured LV P-V loops recorded with a conductance catheter as well as coronary pressure and flow velocity using a dual sensor tipped coronary guide-wire to derive coronary wave intensities (ComboWire, Volcano Corporation, San Diego, California). Simultaneous measurements were recorded at baseline (n=13) and at 30 minutes (n=12) after a 1 minute balloon occlusion. Systolic LV function was assessed by maximum rate of pressure generation: LV dP/dtmin and the time constant of LV isovolumic relaxation: τ.

RESULTS Peak BEW intensity correlated with greater indices of diastolic LV function: LV dP/dtmin (r=-0.55, p=0.04) and τ (r=0.52, p=0.008) (Figure 1); but not with systolic function. In those patients with paired measurements, LV dP/dtmax decreased from 1437±164 to 1299±153 mmHg.s-1 (difference -137.7(-28.3 to -247.0, p=0.02)) and τ increased from 48.3 to 52.4 ms (difference 4.1(3.6 to 6.9, p=0.01)) indicating LV stunning post balloon occlusion. The peak BEW intensity also decreased from 10.0±5.4 W.m-2.s-2 x 105 to 7.5±5.0 W.m-2.s-2 x 105 (difference -2.4 x 105(4.7 x 105 to -0.02 x 105, p=0.04) at 30 minutes post balloon occlusion.

CONCLUSIONS The magnitude of the BEW assessed by coronary wave intensity analysis is related to invasively derived indices of LV diastolic function and is influenced by temporal changes in LV lusitropy, confirming a link between the coronary BEW and LV diastolic function. This raises the hypothesis that impaired diastolic function will impair coronary flow.

CATEGORIES IMAGING: FFR and Physiologic Lesion Assessment

KEYWORDS Coronary flow, Coronary Physiology, Left ventricular function

TCT-288

Invasive Coronary Microcirculation Assessment In Aortic Stenosis: Index Of Microvascular Resistance

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BACKGROUND Recent studies have demonstrated the importance of the coronary microvascularature in various clinical settings. Patients with aortic stenosis (AS), can develop a microcirculatory dysfunction (MD). However the MD in AS has never been invasively assessed. The index of microcirculatory resistance (IMR) enables investigation of the coronary microvascularature directly with high reproducibility and reliability. The aim of the study was to invasively determine the IMR in AS patients.

METHODS 35 patients with severe AS, who were referred for cardiac catheterization were enrolled in this prospective study. Patients with severe aortic regurgitation or mitral valve disease were excluded. A pressure sensor/thermistor-tipped guidewire was used and IMR was calculated from the ratio of the mean distal coronary pressure at maximal hyperemia to the inverse of mean hyperemic transit time. In arteries with fractional flow reserve (FFR) <0.75, IMR was corrected for coronary wedge pressure using the method proposed by Yong et al. IMR and other physiological measurements were performed in the left anterior descending (LAD) artery. Maximal hyperemia was induced by adenosine perfusion (140mcg/kg/min).

CONCLUSIONS The magnitude of the IMR assessed by coronary wave intensity analysis is related to invasively derived indices of LV diastolic function and is influenced by temporal changes in LV lusitropy, confirming a link between the coronary BEW and LV diastolic function. This raises the hypothesis that impaired diastolic function will impair coronary flow.

CATEGORIES IMAGING: FFR and Physiologic Lesion Assessment

KEYWORDS Coronary flow, Coronary Physiology, Left ventricular function
RESULTS Baseline characteristics of patients are shown in Table 1. IMR was measured in 34 patients (one patient was excluded for a technical problem). 56% of the patients were males with a mean age of 70±15 years. All procedures were performed by radial approach. Pressure wire physiological measurements demonstrated a significant MD. IMR showed a median value of 32±16 with normal IMR in healthy humans being 20-30U (median value of 12.6). Coronary flow reserve (CFR) was also concordant with a MD and statistically associated with IMR (r = 0.40, p < 0.05). A significant association between IMR and BNP levels were found (r = 0.40, p = 0.03). A nonsignificant correlation with age and IMR was found (r = 0.32, p = 0.06). Interestingly a significantly lower IMR was found in patients in treatment with beta-blockers (p = 0.01). No significant relationship between IMR other clinical, biochemical, physiological or echocardiogram parameters were found.

Table 1

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Percentage/Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>26%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>17%</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>11%</td>
</tr>
<tr>
<td>Severe aortic calcification</td>
<td>16%</td>
</tr>
<tr>
<td>Beta-blocker treatment</td>
<td>40%</td>
</tr>
<tr>
<td>Obese / symptomatic</td>
<td>8.5%</td>
</tr>
<tr>
<td>FFR&lt;.75 at LAD</td>
<td>3%</td>
</tr>
<tr>
<td>Body mass index</td>
<td>28.9 ± 4.5 kg/m²</td>
</tr>
<tr>
<td>LV ejection fraction</td>
<td>62 ± 8.4%</td>
</tr>
<tr>
<td>Mean gradient</td>
<td>53 ± 16 mm/Hg</td>
</tr>
<tr>
<td>Index AVA</td>
<td>0.44 ± 11 cm²/m²</td>
</tr>
<tr>
<td>Ejection Time</td>
<td>0.299 ± 0.59 sec</td>
</tr>
<tr>
<td>FFR</td>
<td>0.87 ± 0.8</td>
</tr>
<tr>
<td>CFR</td>
<td>1.39 ± 0.6</td>
</tr>
</tbody>
</table>

CONCLUSIONS Invasive IMR measurement confirm that patients with AS have a high coronary resistance and MD. IMR showed a median value of 32±16 and was statistically associated with CFR and with BNP levels. Interestingly a significantly lower IMR was found in patients in treatment with beta-blockers.

CATEGORIES IMAGING: FFR and Physiologic Lesion Assessment

KEYWORDS Aortic stenosis, Coronary microcirculatory dysfunction, Coronary Physiology

TCT-289

Nicorandil as Hyperemic Agent to Evaluate Fractional Flow Reserve

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BACKGROUND Fractional flow reserve (FFR) is useful for determining the functional significance of epicardial coronary stenosis and may facilitate clinical decision making in patients with an equivocal coronary stenosis. Therefore, determining an efficient and safe method to achieve hyperemia is important for evaluating FFR.

METHODS We evaluated appropriate hyperemic dose of nicorandil (NIC) in 42 vessels (LAD:27 vessels, CX:8 vessels, RCA: 7 vessels) of 30 patients. Next, we compared the FFR induced by ATP and by 2-mg NIC in 170 vessels of 129 Japanese patients. Finally, we examined effect of adding NIC to ATP to evaluate FFR in 41 vessels (LAD:31 vessels, CX:4 vessels, RCA: 6 vessels) of another 35 patients.

RESULTS 76.2% of vessels achieved hyperemia with 2-mg NIC. If an accidental error was defined as a difference of 0.01 in the FFR measurements, hyperemia was achieved in 95.2% vessels when up to 2-mg NIC was administered. The FFR values obtained with ATP were significantly correlated with those obtained with 2-mg NIC (regression coefficient = 0.960, R2 = 0.918, P < 0.001). FFR value were not different in size of catheter (4Fr vs 5.6Fr), site of approach (TR vs TB,TF), and type of catheter (sones vs others). There were one hypotension case needing a vasopressor and two cases of transient second-degree atrioventricular block after ATP administration but not after NIC administration (0.6% vs 0.0%, 1.2% vs 0.0%, not significantly). The time taken to achieve hyperemia after NIC administration (17.7±8.7 s) was significantly shorter than that after ATP administration (196.2±60.9 s) (P < 0.001). Adding 2-mg NIC to ATP reduced FFR value, -0.017±0.035, but not reaching significance. Reductions of FFR value were not different in size of catheter (4Fr vs 5.6Fr), site of approach (TR vs TB,TF), and type of catheter (sones vs others), but FFR value in non LAD came down more than LAD (non-LAD: 0.039±0.034, LAD: -0.010±0.033, P=0.036).

CONCLUSIONS Intracoronary nicorandil administration is more useful and as safe as intravenous administration of ATP for evaluating FFR in Japanese patients.

CATEGORIES IMAGING: FFR and Physiologic Lesion Assessment

KEYWORDS Fractional flow reserve, Hyperemia, Nicorandil

TCT-290

Fractional Flow Reserve Measurement in Non-ST-Elevation Myocardial Infarction: Analysis of the National Inpatient Sample Database

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BACKGROUND Fractional flow reserve (FFR) measurement is being increasingly used in patients with coronary artery disease to guide treatment. However, limited data are available on the contemporary utilization rates and in-hospital outcomes of FFR measurement in patients with non-ST-elevation myocardial infarction (NSTEMI).

METHODS We queried the 2009-2012 National Inpatient Sample (NIS) databases to identify all patients admitted with the primary diagnosis of NSTEMI (ICD-9-CM code 410.71). Multivariate logistic regression and linear regression models were used to analyze the utilization rates and in-hospital outcomes of FFR measurement in NSTEMI patients undergoing coronary angiography.

RESULTS Of 1,605,295 (57.7% men, mean age 69±14 years) patients hospitalized with NSTEMI from 2009-2012, 992,183 (61.8%) underwent coronary angiography. Among NSTEMI patients who underwent coronary angiography, FFR measurement was performed in 9,086 (0.9%) patients. FFR utilization rates increased from 0.4% in 2009 to 1.5% in 2012 (adjusted OR per year, 1.46; 95% CI, 1.43-1.49; P<0.001). Among NSTEMI patients who underwent coronary angiography, those who had FFR measurement performed were less likely to undergo percutaneous coronary intervention (PCI) (54.2% vs 54.4%; adjusted OR, 0.91; 95% CI, 0.87-0.95; P<0.001) or coronary artery bypass grafting (CABG) (9.9% vs 11.5%; adjusted OR, 0.79; 95% CI, 0.73-0.85; P<0.001) compared to those who did not have FFR measured. In-hospital mortality was lower (0.8% vs. 1.8%; adjusted OR, 0.53; 95% CI, 0.42-0.67; P<0.001) and average length of stay was shorter (4.4 days vs 4.8 days; adjusted parameter estimate 0.96; 95% CI 0.95-0.98; P<0.001) in FFR group compared to the no FFR group. Average total hospital charges were higher in the FFR group compared to the no FFR group ($82,621 vs $79,019; adjusted parameter estimate 1.05; 95% CI 1.04-1.07; P<0.001).

CONCLUSIONS In NSTEMI patients undergoing coronary angiography, although we observed an increasing trend in the use of FFR measurement over the last few years, the absolute utilization rates remain exceedingly low. FFR measurement during coronary angiography is associated with lower revascularization rates, lower in-hospital mortality, shorter average length of stay, but higher average hospital charges.

CATEGORIES IMAGING: FFR and Physiologic Lesion Assessment

KEYWORDS Fractional flow reserve, Non-ST-elevation myocardial infarction

TCT-291

Comparison of Simplified and Comprehensive Methods for Assessing the Index of Microvascular Resistance in Heart Transplant Recipients

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BACKGROUND Coronary physiologic methods like coronary flow reserve, fractional flow reserve and the index of microvascular resistance (IMR) have emerged as complementary methods to angiography and intravascular ultrasound for assessing the physiological status of