TCT-618
Fractional Flow Reserve Assessment of Left Main Stenosis in the Presence of Downstream Coronary Stenoses: Validation in Humans

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Background: Fractional flow reserve (FFR) measurement can aid in the assessment of left main coronary stenosis. We have previously shown in an animal model that the presence of downstream epicardial stenosis can affect left main FFR measurement. The aim of this study is to explore the effect of stenosis in a downstream epicardial artery on left main FFR assessment in humans.

Methods: After elective coronary intervention of either the left anterior descending (LAD) or left circumflex (LCX) artery, an intermediate left main stenosis was created using an un inflated “winged” balloon. Variable stenoses were then created in the downstream vessel using a balloon inflated within the newly placed stent. A total of 67 pairs of left main FFR assessments in 16 patients were obtained, before and after creation of a stenosis in the downstream vessel, with a pressure wire in the non-stenosed downstream vessel.

Results: The apparent left main FFR in the presence of downstream stenosis (FFRapp) was modestly higher than the true FFR in the absence of downstream stenosis (FFRtrue) (0.82±0.07 vs. 0.80±0.07, p<0.001). The difference between FFRtrue and FFRapp correlated with composite FFR of the left main plus stenosed artery (r=0.36, p<0.001), and this difference was only significant when FFRtrue was less than 0.80. Among the 67 measurements, only 2 (3%) had a difference between FFRtrue and FFRapp of >0.5, and the FFRtrue was <0.2 in both cases.

Conclusions: A clinically significant effect on the FFR assessment of left main disease occurs only when the stenosis in the other vessel is severe.

TCT-619
Single Bolus Regadenoson Injection Versus Central Venous Infusion Of Adenosine To Induce Maximum Coronary Hyperemia For Measurement Of FFR

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Background: Regadenoson is an A2A-receptor selective hyperemic stimulus known for its rapid onset and simple method of administration. We compared the hyperemic effect of single bolus regadenoson injection to central venous adenosine infusion for measurement of FFR true and FFRapp correlated with composite FFR of the left main plus stenosed downstream vessel.

Methods: Patients had a mean age of 65±18 years and 80% were male. The stenosis under investigation was located in the LAD, CX, and RCA in 60%, 28% and 11% respectively. There was no difference in FFR measured by adenosine or by regadenoson (R2 =0.981, ΔFFR =0.00±0.02, p<0.001), neither between repeated bolus injections of regadenoson (R2 =0.971, ΔFFR =0.00±0.02, p<0.001). The onset of hyperemia was achieved within 29±12s, maximum hyperemia lasted 151s with a wide variation between 15 and >600s. No noticeable side-effects of the drugs were observed.

Conclusions: Regadenoson is an excellent alternative for adenosine to induce maximum hyperemia. Its ease in administration, rapid onset and duration of maximum hyperemia make it an excellent hyperemic stimulus. Repeated injections of regadenoson are safe.

TCT-620
Mean Hyperemic Flow is Not Increased Following Adenosine Administration in Physiologically Significant Lesions

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Background: A central tenant of fractional flow reserve (FFR) is that flow increases following administration of vasodilators. However, animal studies show the increases in flow are limited to mild stenoses and unobstructed vessels, whilst the incremental benefit of vasodilator administration to more significant stenoses may be negligible. In this study, we assess this in humans, using FFR as a physiological measure of stenosis severity over various phases of the cardiac cycle.

Methods: Pressure and flow velocity were simultaneously measured at rest and during adenosine-mediated hyperemia using intra-coronary wires in 146 stenoses in patients undergoing stenosis assessment. Resting and hyperemic whole-cycle flow (FlowRwc and FlowHwc), resting wave-free flow (FlowRwf), and fractional flow reserve were calculated.

Results: In non-significant coronary lesions by FFR, hyperemic whole cycle flow was consistently higher than resting wave-free flow: ΔD=14±10.02m/min in lesions with FFR 0.81-0.90, and ΔD=22±10.04 in lesions with FFR 0.91-1.0 (p<0.001 for both). In contrast, in significant lesions by FFR the mean difference in FlowRwc and FlowHwc was 0.03±0.01 m/min when FFR<0.80 and 0.02±0.01 when FFR<0.75, both significantly less than when FFR>0.80 or >0.75 (p<0.001). Overall in physiologically significant stenoses defined by FFR<0.75 or FFR<0.80, resting FlowRwf represented 100%, and 97% of hyperemic FlowHwf, respectively. In contrast, resting whole cycle flow represented a significantly smaller fraction of FlowHwc in significant stenoses (76% and 74% respectively, p<0.01 for both) and was significantly lower than FlowRwf for both significant and non-significant stenoses (p<0.01 for all).

Conclusions: Adenosine does not significantly increase flow compared to the wave-free period in stenoses defined as significant by FFR. Adenosine only increases flow compared to resting whole cycle and wave-free period when stenoses are physiologically non-significant. This may have important implications for physiological stenosis assessment.

TCT-621
Advanced Computed Tomographic Modeling of Plaque Geometry for Prediction of Fractional Flow Reserve in Intermediate Coronary Lesions

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Background: There is still much room for improvement in developing a robust non-invasive model for predicting fractional flow reserve (FFR). We aimed to determine the application of advanced coronary computed tomography angiography (A-CCTA) for predicting invasive FFR in intermediate coronary lesions.

Methods: Sixty-one patients with 71 single intermediate coronary lesions (∼50-80% stenosis) on CCTA prospectively underwent coronary angiography and FFR. Advanced anatomical and morphometric plaque analysis was performed based on CCTA data set to determine optimal criteria for significant flow impairment. A significant stenosis was defined as FFR<0.80.

Results: FFR averaged 0.85±0.09, and 19 lesions (27%) were functionally significant. FFR correlated with minimum lumen area (MLA) (r=0.456, p<0.001), minimum lumen diameter (MLD) (r=0.326, p=0.006), reference LD (r=0.245, p=0.039), plaque burden (r=-0.313, p=0.008), lumen area stenosis (r=-0.305, p<0.001), lesion length (r=-0.692, p<0.001), and plaque volume (r=-0.169, p<0.001). There was no relationship between FFR and CCTA morphometric plaque parameters. By multivariate analysis the independent predictors of FFR were lesion length (beta=-0.581, p<0.001), MLA (beta=0.360, p=0.041), and reference LD (beta=0.255, p=0.036). The optimal cutoffs for lesion length, MLA, MLD, reference LD, and lumen area stenosis were >18.5mm,

Conclusions: Fractional Flow Reserve is a valuable tool for assessing hemodynamic significance of coronary lesions.