11:15

DOES REDUCED REGIONAL FLUORODEOXYGLUCOSE UPTAKE WITH PROPORTIONATE REDUCTION IN BLOOD FLOW ALWAYS INDICATE NONVIABLE MYOCARDIUM IN CORONARY ARTERY DISEASE?

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Increased uptake of ^{18}F-deoxyglucose (FDG) relative to blood flow (FDG mismatch) indicates viable myocardium in pts with coronary artery disease and LV dysfunction. To assess whether some segments with moderately reduced FDG uptake and proportionate reduction in flow might also be viable, we studied 20 pts with coronary artery disease and LV dysfunction (ejection fraction 28±9%) by exercise thallium (TL) SPECT, gated magnetic resonance imaging (MRI) and PET imaging with FDG and $H_2{}^{15}O$. From matched TL, MRI and PET transaxial images, 220 myocardial regions were assessed, of which 96 had normal FDG uptake, 51 FDG mismatch, 48 reduced FDG uptake (50-79% of the activity in a normal reference region) with reduced flow, and 25 absent FDG (<50% of the normal activity). Of the regions with reduced FDG uptake, 4 were normal by TL, 38 (79%) showed reversible TL defects, and only 6 had fixed TL defects. Regional systolic wall thickening and end-diastolic wall thickness were assessed by MRI:

	Normal	Mismatch	↓ FDG	Absent FDG
Thickening (mm)	2.4±2.5	2.7±2.3	1.5±3.1	-0.4±1.9*
Thickness (mm)	10±3	11±4	10±3	7±3*

*p<0.01 compared to the other 3 groups

Thus, TL uptake and reduced but preserved systolic function indicate the presence of viable myocardial tissue in many regions with moderately decreased FDG uptake.

11:30

COMPARISON OF POSITRON EMISSION TOMOGRAPHY USING C-11 ACETATE WITH F-18 FLUORODEOXYGLUCOSE IN PREDICTING MYOCARDIAL VIABILITY.

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We have previously demonstrated that maintenance of oxidative metabolism [which can be assessed with PET and C-11 acetate (Ac)] is a prerequisite for mechanical recovery of dysfunctional myocardium after revascularization and may be superior to assessments using F-18 fluorodeoxyglucose (FDG) (which traces both anaerobic and aerobic glucose metabolism). To determine the accuracy of these two approaches for predicting functional recovery after revascularization, we evaluated 16 patients with coronary artery disease prior to revascularization with Ac, FDG, and O-15 water (to assess regional perfusion). Criteria for PET determined metabolic viability (Ac clearance and FDG uptake in relation to flow) were compared with changes in wall motion assessed before and after revascularization. Based on FDG criteria of viability, mechanical improvement was correctly predicted in 49% (20/41) of initially dysfunctional segments and lack of improvement was correctly predicted in 79% (11/14). The accuracy of Ac criteria of viability were better, correctly predicting improvement in 68% (17/25) and lack of improvement in 80% (24/30). In segments which were akinetic or aneurysmal prior to surgery, functional improvement was correctly predicted in 50% (7/14) and lack of improvement correctly predicted in 80% (8/10) with FDG and 100% and 88%, respectively with Ac. Thus, maintenance of oxidative metabolism as assessed with Ac appears to be a better predictor of recovery of myocardial function after revascularization compared with FDG, especially in regions with marked mechanical impairment.

11:45

POSITRON EMISSION TOMOGRAPHY MYOCARDIAL VIABILITY STUDIES IN PATIENTS WITH DIABETES MELLITUS

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Positron Emission Tomography (PET) comparing myocardial perfusion and glucose metabolism, as reflected by F-18 fluoro-deoxyglucose (FDG) uptake, has proven useful in the identification of viable myocardium which may benefit from revascularization. However, patients with diabetes mellitus (DM) often have low myocardial FDG uptake, limiting the utility of PET viability studies in this group of patients with a high prevalence of coronary artery disease. To evaluate the prevalence of uninterpretable FDG studies due to poor myocardial uptake compared to remaining blood pool activity and the relationship of such studies to DM, we reviewed 218 PET viability studies performed between April, 1988 and September, 1990.

Known DM was present in 36/218 Pts (16.6%, 23 managed with insulin). Uninterpretable FDG studies were obtained in 16/218 Pts (7.3%) but in 10/36 (27.8%) Pts with DM compared to 6/182 (3.3%) without DM (Chi-square=24.5, p=0.0001). Based on early experiences with FDG studies in DM, 17/36 diabetic Pts received supplemental insulin prior to FDG administration. Interpretable studies were obtained in 15/17 (88.2%), whereas 11/19 Pts (58%) not receiving insulin had interpretable results. Blood sugar levels at baseline (BSL1) and post-insulin (BSL2) were compared for the 36 Pts with DM grouped by FDG image quality;

	BSL1		BSL2	
Uninterpretable	(n=10)	180± 96	(n= 2)	233±78
Interpretable	(n=26)	190±109	(n=15)	131±98

Thus, although BSL were similar on presentation in Pts with DM with uninterpretable studies compared to those with interpretable studies, BSL were lower after insulin administration in the group with interpretable studies than in those without. This possibly indicated inadequate insulin dosage in the latter group. In patients not receiving supplemental insulin (n=19), baseline BSL were lower in Pts with interpretable studies than in those with uninterpretable studies (148±88 versus 207±73 mg/dl).

Conclusions: Pts with a known history of DM have a significantly higher prevalence of uninterpretable FDG-studies than Pts without DM. However, interpretable studies can be obtained in the majority of Pts with DM, especially if adequate insulin is administered prior to clinical FDG studies in Pts with elevated baseline BSL.

Tuesday, March 5, 1991
10:30AM–12:00NOON, Room 205, East Concourse
Control of Vascular Tone

10:30

ATP-SENSITIVE POTASSIUM CHANNEL MEDIATES ISCHEMIA-INDUCED CORONARY ARTERIOLAR DILATATION IN DOGS

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Previous studies have shown that myocardial ischemia causes vasodilatation of small coronary arterioles less than 100 μm. The purpose of this study was to evaluate the participation of the ATP-sensitive K^+ channel (K^+[ATP]) in arteriolar response during ischemia in situ. Experiments were performed in anesthetized open-chest dogs. Aortic pressure and heart rate were kept constant during the experiment by an aortic snare and atrial pacing. Epicardial coronary arterioles less than 100 μm were directly observed by means of intravital microscope with stroboscopic epi-illumination synchronized to cardiac cycle. Arteriolar diameters (AD), aortic pressure, left ventricular pressure, distal coronary arterial pressure (DCP), and transmural coronary flow (radioactive microsphere technique) were measured. A critical stenosis and complete occlusion of the left anterior descending artery were made by a screw occluder in the presence of topically applied glibenclamide (GLIB, 10^{-5}M, 5 dogs), a selective blocker of K^+[ATP], or of vehicle (0.01% dimethyl sulfoxide, 5 dogs). A critical stenosis and complete occlusion resulted in a significant decrease in coronary flow. GLIB completely blocked the dilatation of small arterioles.

	Critical Stenosis		Complete Occlusion	
	DCP mmHg	%Δ in AD	DCP mmHg	%Δ in AD
vehicle	42±1	10.7±1.5%(5)	26±5	15.9±5.1%(5)
GLIB	40±2	-3.4±3.5%*(6)	25±4	-12.0±4.3%*(5)

mean ± SEM, *:p<0.05 vs vehicle, ( ): number of vessels.

In conclusion, K^+[ATP] plays a crucial role in the coronary arteriolar responses to critical stenosis and coronary occlusion.