

TECHNETIUM-99m ISONITRILE AND THALLIUM-201 ACTIVITY ARE COMPARABLE FOLLOWING 3 HOURS OF LOW FLOW ISCHEMIA.

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We have previously shown in a canine model of low flow ischemia that the initial uptake of Thallium-201 (Tl) and Tc-99m labeled methoxy-isobutyl-isonitrile (MIBI) are comparable and proportional to flow. It is unclear whether MIBI, in the presence of a critical stenosis, will redistribute similar to Tl, reflecting viability. Therefore, 8 open-chested dogs underwent 3 hr of partial LAD occlusion, with distal LAD pressure maintained at $45 \pm 3\%$ of baseline. Function, as assessed by an epicardial Doppler crystal, was reduced by 85% in the ischemic (IS) zone. Radiolabeled microspheres were injected at baseline, and following 30 min (LF1) and 180 min (LF2) of ischemia. All dogs were injected IV at LF1 with MIBI (7 mCi). 5 dogs received concurrent Tl (0.5 mCi). TTC staining demonstrated minimal endocardial necrosis in 4 dogs. Hearts were divided into 96 segments for gamma well counting, and activity and flow were normalized to nonischemic (NI) values. All segments were segregated based on normalized flow at LF1 as follows: severely IS (SEV-I, $<30\%$; n=35), moderately IS (MOD-I, $30-60\%$; n=37), mildly IS (MILD-I, $60-90\%$; n=178) and non-IS (NI, $90-120\%$; n=398). Mean \pm SD values were:

	SEV-I	MOD-I	MILD-I	NI
LF1	10 \pm 9	50 \pm 8	78 \pm 8	102 \pm 8
Tl	45 \pm 22*	81 \pm 11*	94 \pm 8*	99 \pm 5*
MIBI	42 \pm 24*	76 \pm 16*	96 \pm 21*	108 \pm 36*

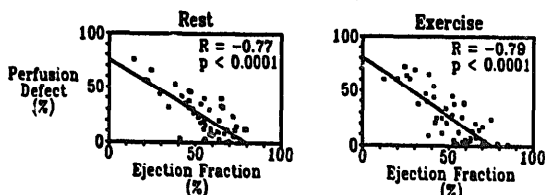
(*p<0.001 vs LF1; *p=0.08 vs Tl)

Relative myocardial activity of Tl and MIBI in all regions of ischemia are comparable 3 hrs following injection and significantly greater than flow.

Thus, the myocardial activity of MIBI and Tl are similar in the presence of a critical stenosis. The increased MIBI activity relative to flow may reflect both an increased extraction at low flow and a significant component of redistribution.

QUANTITATIVE ASSESSMENT OF MYOCARDIAL PERFUSION AND LEFT VENTRICULAR FUNCTION WITH Tc-99m HEXAMIBI. Salvador Borges-Neto, M.D., R. Edward Coleman, M.D., Robert H. Jones, M.D., F.A.C.C. Duke University Medical Center, Durham, NC.

New radiopharmaceuticals now permit simultaneous assessment of perfusion and function using a single tracer injection. The purpose of this study was to quantitate the relationship between myocardial perfusion and function at rest and during exercise in patients with coronary artery disease (CAD). Fifty patients with documented CAD were prospectively studied. A rest first-pass radionuclide angiogram (RNA) was performed with ten mCi of Tc-99m hexamibi (MIBI) and tomographic perfusion images were obtained sixty minutes later. A treadmill test was then performed and at the exercise endpoint a 30 mCi injection was made and RNA acquired. Tomographic perfusion images obtained 30 minutes later were processed using modifications of the Cedars-Sinai program to estimate the extent of perfusion abnormality.



Tomographic perfusion defect size correlated with ejection fraction at rest and at exercise in the group of patients. Wide variability in perfusion defect size was demonstrated in patients with similar LV function, especially those with normal or mildly depressed function. This independence between the two physiologic variables suggests that simultaneous assessment of perfusion and function may improve the diagnostic and prognostic power of noninvasive tests.

EVALUATION OF RIGHT VENTRICULAR REGIONAL PERFUSION WITH Tc-99m SESTAMIBI

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Scarring or ischemia of the RV is a negative prognostic indicator in patients with coronary disease. Imaging of the RV with thallium-201 (Tl) has been limited by low count density, photon attenuation, and scatter. To evaluate Tc-99m sestamibi (MIBI) as an alternative for perfusion imaging of the RV, 25 patients (pts) undergoing coronary angiography and 25 normal volunteers were studied with both exercise Tl and MIBI tomography (SPECT). Subjects received 3.5 mCi Tl at peak treadmill stress, with SPECT imaging 10 minutes and 3 hours thereafter. Separate 15 mCi MIBI injections were made during repeat treadmill stress and at rest, with SPECT imaging 2 hours following each dose.

In 6mm thick orthogonal tomographic slices the RV was much better visualized with MIBI than Tl. Although the RV-to-LV count ratio was similar for MIBI and Tl (mean = 1:3.5), absolute RV counts were three- to fourfold greater for MIBI. RV visualization was optimized by using a display algorithm masking the LV. RV MIBI images were adequate for interpretation in all pts and 22/25 volunteers.

Of 11 pts with $>50\%$ right coronary stenosis, inferior perfusion defects were present in the LV in 9, 6 of whom also had localized RV defects. Right coronary lesions were proximal in 4 of these 6. Reversibility of RV defects paralleled those in the LV, with 2 of 6 scans demonstrating redistribution in 3 hour delayed images. No RV defects were present in 8 pts with stenoses confined to other coronaries and in 6 pts with normal coronaries. Thus, MIBI SPECT is a promising new technique to evaluate RV regional perfusion.

Monday, March 19, 1990

10:30AM-12:00NOON, Room 26

Biochemical Mechanisms of Cardiac Function

EFFECTS OF CARDIAC GLYCOSIDES ON MYOCARDIAL FUNCTION AND ENERGETICS IN THE CONSCIOUS DOG

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The efficacy and physiologic characteristics of digitalis preparations as positive inotropic agents are controversial. Therefore, physiologic changes in left ventricular (LV) function and metabolic to mechanical energy transfer (ET) were examined in 9 conscious dogs during the administration of intravenous ouabain. LV pressure was measured with micromanometers, and LV volume with orthogonal ultrasonic dimension transducers. Pressure-volume loops were generated during transient vena caval occlusions at control and after increasing doses of ouabain. Doppler coronary flow and coronary sinus oxygen saturations were used to calculate LV oxygen consumption (MVO_2); total mechanical energy (TME) was computed as the sum of LV stroke work (SW) and the product of end diastolic volume (EDV) x mean ejection pressure. The slope (10^4 ergs/ml) of the SW-EDV relationship increased progressively with rising doses of ouabain from 6.92 ± 0.47 at control to 9.82 ± 0.79 after 0.75mg ($p=0.0047$), without a shift in the x-intercept (6.3 ± 1.8 ml to 3.6 ± 2.5 ml; $p=0.174$). Regression analysis of MVO_2 (ml/min/cm²) vs TME (ml/min/cm²) yielded a linear relationship (avg $r=0.88 \pm 0.02$) that did not change with 0.75mg ouabain ($p=0.844$ by Hotelling's T^2).

MVO_2 (y)-TME (x)	Control	.75 mg ouabain
slope	.620 \pm .054	.604 \pm .046
y-intercept	15.5 \pm 1.11	16.1 \pm 1.64

These data indicate that ouabain possesses a significant positive inotropic effect on intact LV myocardium and that this effect is accomplished without a change in ET efficiency or oxygen wasting.