C-11 ACETATE KINETICS AS A MARKER OF RIGHT VENTRICULAR WORK.

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C-11 acetate kinetics have been shown to correlate with oxygen consumption by the left ventricular myocardium. Functional assessment of the right ventricle (RV) by both invasive and non-invasive modalities has been limited by its complex geometry. Metabolic imaging with C-11 acetate may provide non-invasive evaluation of RV oxidative metabolism and hence characterization of RV work. To test this hypothesis, 9 volunteers (Group I), 4 pts with valvular heart disease (VHD) and normal mean pulmonary artery pressure (mPAP) (Group II), and 5 pts with VHD and elevated mPAP (Group III), underwent dynamic C-11 acetate PET imaging. RV time-activity curves were analyzed using monoexponential least square fitting of C-11 clearance yielding clearance half-times in minutes (T1/2). The average mPAP, and systolic PAP together with T1/2 are listed below:

	T1/2	mPAP	sPAP
Group I (n=9)	23±5	-	-
Group II (n=4)	18±6	13±2	24±2
Group III (n=5)	15±5	29±10	45±20

In 2 patients with repeat studies less than 2 weeks apart the variability in RV T1/2 was less than 90 seconds. Thus, assessment of RV acetate kinetics is feasible using dynamic PET. Myocardial oxygen consumption as determined by T 1/2 tend to correlate with other independent markers of RV work. This metabolic imaging approach may be clinically useful to define RV oxygen demand in various cardiac and pulmonary diseases.

PREDICTION OF THE MAGNITUDE OF SILENT ISCHEMIA DURING DAILY LIFE BY STRESS TEST IN PATIENTS WITH CORONARY ARTERY DISEASE: IMPORTANCE OF THE EXERCISE PROTOCOL

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Controversy exists regarding the predictability of silent ischemia (SI) during daily life from analysis of the exercise treadmill test (ETT) in pts with coronary artery disease (CAD). To determine whether such predictive value of the ETT is influenced by the exercise protocol, 50 pts underwent 48-hour ambulatory ECG monitoring and 2 ETT's with either brisk (Bruce protocol, 0-10 Mets in 9 min) or gradual (NIH combined protocol, 0-10 Mets in 20 min) increments in treadmill slope and speed. All tests were performed after withdrawal of medications. Ischemic threshold (IT) was assessed from the ETT as time of exercise to 1mm ST↓. During monitoring, there was a total of 187 ischemic episodes (≥1mm ST↓ for ≥1 min); 78% were silent. Pts exercised longer under the NIH combined protocol (14±5 min vs. 7±2 min; p<0.001), but achieved a higher heart rate under the Bruce protocol (141±19 vs 132±22; p<0.01). A negative ETT was more frequently associated with absence of SI when using the NIH combined protocol (85% vs 62%). In 31 pts with positive ETT (≥1mm ST↓), the IT assessed from the NIH combined protocol showed a strong correlation with the number and duration of ischemic episodes during monitoring (r= -0.80 and -0.78, respectively; p<0.0001); however, no such relation was found using the Bruce protocol (r= -0.23 and -0.21). Thus, in pts with CAD, the predictability of SI by ETT is dependent on the exercise protocol. Abrupt increases in workload do not correlate with the occurrence of ischemic episodes. More gradual protocols allow a more precise estimation of the IT and therefore can predict the magnitude of silent ischemia during daily life.

Tuesday, March 20, 1990
10:30AM–12:00NOON, Room 36
Exercise Testing: Diagnosis

IMPROVED RISK PREDICTION IN THE FRAMINGHAM OFFSPRING STUDY BY HEART RATE ADJUSTMENT OF ST SEGMENT DEPRESSION

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We compared simple heart rate adjustment of ST segment depression during exercise (delta ST/HR index) and the pattern of ST depression as a function of heart rate during recovery (rate-recovery loop) with standard ECG criteria for prediction of coronary heart disease (CHD) events in 3192 asymptomatic members of the Framingham Offspring Study who were free of clinical and ECG evidence of CHD. During 4 years of follow-up, 66 developed new CHD endpoints (coronary death, infarction or angina). Using a Cox proportional hazards model with adjustment for age and sex, a positive test by standard criteria (≥ 0.1 mV horizontal or downsloping ST segment depression) was not associated with CHD event incidence (X^2=0.36, p=0.55). In contrast, stratification according to the presence or absence of a positive delta ST/HR index (≥ 1.6 uV/bpm) and positive (counterclockwise) rate-recovery loop was associated with CHD event risk (X^2=9.04, p=0.003) and separated pts into 3 groups with varying risks of CHD events: high risk, when both tests are positive (relative risk [RR]=3.5, 95% confidence interval [CI] 2.3 to 5.2); intermediate risk, when either the delta ST/HR index or rate-recovery loop alone is positive (RR=1.9, 95% CI 1.2 to 2.8); and low risk, when both tests are negative. After multivariate adjustment for age, sex, smoking, total cholesterol, diastolic blood pressure, and fasting glucose, the delta ST/HR index and rate-recovery loop remained predictive of CHD events (X^2=4.85, p=.03; high risk RR=2.5, intermediate risk RR=1.6). We conclude that heart rate adjusted indices of ST segment depression during exercise and recovery improve the prediction of CHD events by the exercise ECG.

COMPARISON OF ANGINA WITHOUT ST-DEPRESSION VERSUS ST-DEPRESSION WITHOUT ANGINA DURING EXERCISE TESTING

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To compare exercise-induced angina without accompanying ST-depression and exercise-induced ST-depression without accompanying angina (so-called "silent ischemia"), and their utility in predicting severity of angiographically documented coronary disease (CAD), 279 male patients were evaluated in a retrospective fashion who had undergone standard exercise testing and coronary angiography. Four groups were evaluated: group NORMS comprised 98 patients (35%) who had neither exercise angina or ST-depression; group APO had 37 patients (13%) with only angina brought on by exercise as their indicator of ischemia; group STO of 77 patients (28%) had only exercise ST-depression without angina; and group STAP of 67 patients (24%) had both angina and ST-depression with exercise. The following disease prevalence was found:

	NORMS	APO	STO	STAP
0-1 vessel	70%	70%	44%	42%
multivessel	30%	30%	56%	58%
3-vessel/left main	9%	11%	30%	31%

If one subsets the STO group into those with a past history of typical angina pectoris, but no angina during exercise testing, versus those without a prior history of angina ("true silent ischemics"), no significant difference in severity of CAD is found. It is concluded that exercise-induced ST-depression, with or without accompanying angina, is a better predictor of multivessel and three-vessel and/or left main disease than exercise angina without ST-depression (which predicts a higher prevalence of one-vessel and two-vessel CAD with nearly half being only single-vessel disease). Furthermore, patients who manifest silent ischemia with exercise have the same severity of CAD as those who have angina and ST-depression during exercise. "True silent ischemics" have the same severity of CAD as those patients with silent ischemia during exercise testing but who have a past history of typical angina pectoris.