

acing at each pacing site did not improve LV diastolic function.

Conclusion: LVP and BVP improved LV systolic function in patients with heart failure regardless of the baseline rhythm. In patients with AF, only BVP improved LV diastolic function. These results indicate that BVP may be more beneficial than single-site LVP in patients with heart failure and AF.

POSTER SESSION

1111 Exercise Testing: Cardiac Rehabilitation

Monday, March 31, 2003, Noon-2:00 p.m.

McCormick Place, Hall A

Presentation Hour: 1:00 p.m.-2:00 p.m.

1111-59 Predictors of Negative Exercise Echocardiography in Women With Positive Exercise Electrocardiograms

Amish J. Desai, Amogh Bhat, Daljit Bagha, Mrudula Guthikonda, Ezra A. Amsterdam, University of California, Davis Medical Center, Sacramento, CA

BACKGROUND: Exercise (Ex) electrocardiography (ECG) is the most widely used non-invasive test for evaluating symptoms suggestive of coronary artery disease (CAD). In women, however, Ex ECG has limited reliability due to an increased rate of false positive results. Therefore, a stress-imaging study is frequently the initial test for evaluation of chest pain in women. We have previously reported that certain exercise test variables predict a negative Ex echocardiogram (Echo). To further enhance this predictive value, we report additional exercise test variables predictive of negative Ex Echo.

METHODS: We analyzed the results of simultaneous Ex Echo and Ex ECG in women with no known cardiac disease as part of the initial evaluation for chest pain suggestive of CAD. All patients (Pts) had a normal resting ECG and adequate exercise capacity by history. All tests were symptom-limited utilizing a Bruce Protocol. A positive Ex Echo was defined as an Ex-induced regional wall motion abnormality and a positive Ex ECG was defined as Ex-induced ≥ 1.0 mm ST segment depression 60-80 msec after the J point.

RESULTS: The study group comprised 415 consecutive women (mean age 54 years [31-90]) evaluated by simultaneous Ex Echo and Ex ECG. Ex Echo was positive in 11% (48/415) and negative in 88% (367/415). Ex ECG was positive in 26% (108/415) and negative in 74% (307/415). In 64% (69/108) Pts with a positive Ex ECG, Ex Echo was negative, suggesting a false positive Ex ECG. In this group of 69 Pts, non-Echo Ex test data associated with a negative Ex Echo included: ≥ 7 METS, double product $>25,000$, ST depression <1.5 mm, no Ex-induced chest pain, ST segment resolution <1 minute into recovery, ≤ 3 leads with ST depression. Four or more of these factors were present in 88% (53/69) of the Pts with a positive Ex ECG and a negative Ex Echo. **CONCLUSIONS:** These results indicate that (1) Ex ECG was negative and concordant with Ex Echo in a majority of women and (2) $>85\%$ of positive Ex ECG associated with negative Ex Echo were characterized by multiple indicators consistent with a false positive or low risk result. The evaluation of chest pain in women can be simple and cost effective utilizing Ex ECG in those with a normal baseline ECG and adequate exercise capacity.

1111-60 Abnormal Peripheral Thermoregulatory Response to Exercise Substantially Impairs Exercise Tolerance Among Patients With and Without Ischemia on Myocardial Perfusion Single-Photon Emission Computed Tomography

Ehtasham A. Qureshi, Veeranna Merla, Pierre Charouqi, Umber Burhan, Amy B. Armenia, George Reed, George Diamond, Alan Rozanski, St. Luke's-Roosevelt Hospital Center, New York, NY

Background: Whereas SPECT myocardial ischemia predicts patients (pts) to experience, exercise (EX) duration generally adds substantial incremental information to event prediction. The pathophysiological factors mediating this association are unclear. Paradoxical vasoconstriction in finger blood flow during EX has recently been demonstrated, using peripheral arterial tonometry (PAT), among CAD patients. The relation between such vasoconstriction and EX duration is not known. **Methods:** We employed PAT to assess finger pulsewave amplitude (PWA) at rest and continuously during EX SPECT testing in 463 CAD pts (mean age 58 ± 10 years, 90% males) divided into 270 pts with ischemic and 193 pts with non-ischemic SPECT studies. PWA patterns during EX were compared to previous normal limit values for EX PWA response; with values $<90\%$ confidence intervals (CI) constituting abnormality. **Results:** Abnormal finger blood flow response to EX was associated with a substantial reduction in EX duration and achieved EX METs (table). Notably, this association was equally significant among patients with and without SPECT evidence of ischemia. **Conclusions:** Paradoxical reduction in finger blood flow during exercise is associated with significantly reduced exercise duration among CAD patients. Accordingly, this abnormal peripheral vascular response may represent a potential, SPECT-independent, pathophysiological mechanism linking exercise duration to cardiac events.

GROUPS	# OF PATIENTS	EXERCISE DURATION (min)	MET's	PEAK HR
+ SPECT, $\geq 90\%$ CI	210	8.6 \pm 2.3	10.9 \pm 2.8	153 \pm 14
+ SPECT, $<90\%$ CI	60	6.8 \pm 2.2*	8.9 \pm 2.7*	146 \pm 13*
- SPECT, $\geq 90\%$ CI	166	8.7 \pm 2.6	11.1 \pm 3.1	150 \pm 15
- SPECT, $<90\%$ CI	27	6.0 \pm 2.2*	8.7 \pm 2.5*	151 \pm 12

*p<0.001 for $\geq 90\%$ CI vs. $<90\%$ CI subgroups

1111-61

Using Estimated Functional Capacity to Optimize Stress Testing for Diagnosis and Prognosis of Cardiovascular Disease in Women: The NHLBI-sponsored WISE Study

Leslee J. Shaw, Marian Olson, Sheryl Kelsey, Bernard R. Chaitman, George Sopko, C. Noel Bairey Merz, WISE Study Group, Atlanta Cardiovascular Research Institute, Atlanta, GA, University of Pittsburgh, Pittsburgh, PA

Background: Functional capacity, measured in METS, is an important component that affects the diagnostic and prognostic value of exercise stress testing. The aim of this study was to compare the prognostic value of predicted functional capacity based on the Duke Activity Status Index (DASI) compared with peak exercise METS.

Methods: From the NHLBI-sponsored WISE study, a total of 260 women with chest pain (average age=56 years) underwent exercise testing and completed the 12-item DASI questionnaire.

Results: Average exercise time was 5.7 ± 2.5 minutes on the (modified) Bruce or ACIP protocols and average DASI functional capacity was 6 METS. 2.3-year cardiovascular events (unstable angina, death, myocardial infarction, heart failure, or stroke) were reported in 47 women. Exertional ischemia occurred in 58% and 32% had a coronary stenosis $\geq 50\%$. In women with DASI-predicted METS $<$ and ≥ 4.7 , no inducible ischemia occurred more (71% vs. 40%), with $\leq 85\%$ predicted maximum heart rate more (24% vs. 9%) often in functionally impaired women (p=0.002); despite similar disease prevalence. In **Conclusion**, among women referred for coronary angiography for suspected myocardial ischemia, marked functional impairment estimated by a simple estimate of functional capacity is associated with an adverse prognosis. Use of the DASI prior to exercise stress testing may stratify candidates for exercise testing or pharmacologic stress.

2.3-Year Event Rates

%	<4.8	4.8-7.4	7.5-9.9	>9.9	p value
DASI-estimated METs	29	13	10	7	0.0001
Exercise METs	25	19	14	7	0.03

1111-62

High Treadmill Workload in Patients With Exercise-Induced ST Depression Predicts a Negative Result on Exercise Echocardiography

Amish J. Desai, Amogh Bhat, Daljit Bagha, Mrudula Guthikonda, Ezra A. Amsterdam, University of California, Davis Medical Center, Sacramento, CA

BACKGROUND: Although exercise (Ex) electrocardiography (ECG) is the most commonly employed initial test to assess patients with symptoms suggestive of coronary artery disease (CAD), it has limited diagnostic accuracy. Therefore, patients (Pts) with positive tests for myocardial ischemia are frequently referred for further evaluation by noninvasive stress imaging such as Ex echocardiography (Echo). A negative Ex Echo is considered evidence of absence of high risk CAD and of low clinical risk. It has recently been shown that functional capacity is a strong predictor of prognosis. Thus, in a group of Pts with positive Ex ECG but high treadmill workload, we investigated the results of secondary evaluation by Ex Echo. **METHODS:** We analyzed the results of 140 consecutive pts (110 males, 30 females; mean age 51 yrs [30-82]) referred for Ex Echo after a positive Ex ECG and a treadmill workload of ≥ 10 METS. All Pts had a normal resting ECG. Exercise tests utilized a Bruce protocol and were symptom-limited. A positive Ex ECG was defined as Ex-induced ≥ 1.0 mm ST segment depression 60-80 msec after the J point and a positive Ex Echo was defined by an Ex-induced regional wall motion abnormality. **RESULTS:** Ex Echo was negative in 94% (131/140) of Pts and positive in 6% (9/140). **CONCLUSIONS:** Ex ECG performed to a high workload is highly predictive of a negative Ex Echo and thus low prognostic risk in Pts referred because of positive Ex ECG. Pts with ST depression on Ex ECG, who achieve at least 10 METS during treadmill Ex, may not require additional noninvasive or invasive evaluation.

1111-63

Impact of Obesity on Inflammation and Metabolic Syndrome in Coronary Patients and Effects of Cardiac Rehabilitation

Carl J. Lavie, Richard V. Milani, Ali Morshedi, Ochsner Clinic Foundation, New Orleans, LA

Background: Obesity is epidemic in the US and represents a major risk factor for CAD and type II diabetes. Limited data, however, exist on the effects of obesity on such risk factors as inflammation and components of the metabolic syndrome (MS) as defined by ATP III in CAD patients, and the effects of cardiac rehabilitation and exercise training programs (CRET) in these patients.

Methods: We studied 235 consecutive patients who completed phase II CRET and compared data from 73 obese patients (BMI \geq 30 kg/m²) with 72 lean patients (BMI < 25 kg/m²).

Results: At baseline, obese patients had higher levels of LDL cholesterol (114 \pm 59 vs 100 \pm 27 mg/dl; $p=0.07$), abdominal girth (43.6 \pm 4.9 vs 35.2 \pm 4.0 inches; $p<0.0001$), % body fat (33.7 \pm 7.6 vs 24.9 \pm 7.3%; $p<0.0001$), and a much higher prevalence of MS (61% vs. 26%; $p<0.001$) and lower levels of HDL cholesterol (47.3 \pm 16.8 vs. 36.7 \pm 10.1 mg/dl; $p<0.0001$) than did the lean patients. In addition, the triglyceride (TG)/HDL ratio, a sensitive indicator of insulin resistance, was also considerably greater in the obese group (5.4 \pm 4.5 vs 3.0 \pm 1.8; $p<0.0001$). In the entire cohort, there was a weak, but significant, correlation between BMI and high-sensitivity C-reactive protein (HSCRP) ($r=0.12$; $p=0.05$). Although levels of HSCRP appear 37% higher in obese patients (7.4 \pm 8.4 vs 5.4 \pm 7.9 mg/l), these differences were not statistically significant ($p=0.15$). Following CRET, obese patients had significant improvements in HDL cholesterol (+7%; $p<0.001$), HSCRP (-42%; $p<0.01$), peak VO₂ (+9%; $p<0.001$), quality of life score (+12%; $p<0.0001$), several scores of behavioral characteristics (depression, anxiety, and somatization; all $p<0.01$), as well as obesity indices: weight (-2%; $p<0.01$), BMI (-2%; $p<0.01$), and % fat (-5%; $p=0.03$). The TG/HDL ratio (-17%; $p=0.08$) and the prevalence of MS also fell (61% to 52%) in the obese group following CRET.

Conclusions: Obese patients with CAD have markedly abnormal risk profiles, characterized by MS and high levels of inflammation, which improve significantly following formal CRET. These data provide further support for formal phase II CRET in the secondary prevention of CAD in obese patients.

1111-64 Normalization of Abnormal T Waves During Stress Testing Does Not Identify Patients With Reversible Perfusion Defects

Henry S. Loeb, Nicholas Friedman, Hines VA Hospital, Hines, IL, Loyola University Medical Center, Maywood, IL

Background: The observation that abnormal T waves may become normal during stress testing, so called "pseudonormalization" (PNL) is well known but it remains uncertain whether PNL during stress should be considered evidence for myocardial ischemia.

Methods: To better define the significance of PNL during stress we analyzed the electrocardiograms and imaging results from 2137 patients undergoing stress testing (treadmill or dobutamine) and myocardial perfusion imaging with Tc99m Sestamibi.

Results: Abnormal T waves were present at rest in 638 patients of whom 71 patients (11%) had PNL during stress and 567 patients (89%) did not.

IMAGING RESULTS

DEFECT	PNL+ N=71	PNL- N=567	P
NONE	48%	46%	NS
FIXED	25%	30%	NS
REVERSIBLE	27%	24%	NS

Conclusion: Normalization of abnormal resting T waves occurs infrequently during stress testing and its presence or absence does not predict the results of myocardial imaging. It seems likely therefore that T wave normalization during stress testing is a nonspecific finding and since the majority of patients in whom T wave normalization does occur do not have a reversible myocardial perfusion defect it should not be considered as evidence for stress induced myocardial ischemia.

1111-65 Physical Activity Exerts Benefits in Coronary Heart Disease Through Autonomic Nervous System Modulation

Olivia Manfrini, Carmine Pizzi, Tiziana Aranzulla, Nicola Propato, Filippo Crea, Raffaele Bugiardini, University of Bologna, Bologna, Italy

Background: Exercise training has assumed a major role in both the primary and secondary prevention of coronary heart disease (CHD). Which mechanism mediates these benefits is still a matter of debate. This study sought to determine whether the intensity and frequency of recreational activity may influence autonomic nervous system balance, and exerts positive benefits in high risk CHD pts. **Methods:** 105 pts were selected from the "Italian Study about Prognosis of Unstable Angina" (SPA) which was designed to assess factors able to early identify pts at high risk for subsequent coronary events. Pts were followed for 6 months. Exclusion criteria were: previous history of CHD, low ejection fraction (<40%), diabetes mellitus, and atrial fibrillation. Health habits, medical history, recreational and work-related total physical activity as recorded by questionnaires were obtained at baseline and at 6 months follow-up. Vagal and sympathetic activities were assessed, at admission, by time domain measurements of heart rate variability (pNN50 and SDANN, respectively).

Results: Of the 105 pts 32 (Gr1) had a major coronary event (6 deaths, 8 non fatal AMI, 8 hospital readmission due to documented ischemic attacks, and 10 urgent CABG or PTCA). The remaining 73 showed good clinical outcome, and served as control (Gr2). Total weekly energy expenditure was stratified as low (< 600 kcal/wk), moderate (600-1500 kcal/wk), high (> 1500 kcal/wk). Twenty of the 32 Gr1 pts (62%) and 10 of the 73 Gr2 pts (14%) expended less than 600 kcal/wk. Analysis of the HRV showed that extremely low (<3%) values of pNN50 predicted mortality and total events. A pNN50 <3% was found in 18/32 Gr1 pts (56%) vs 2/73 Gr2 pts (0.8%). Significant relationship was found between kcal/wk and pNN50. These findings persisted after adjustment for other life style variable. **Conclusions:** (1) A shift in the autonomic balance with a loss of vagal tone (pNN50 <3%) may be observed in many pts having adverse outcome following

unstable angina. (2) This could explain coronary vascular instability, and more subsequent coronary events. (3) Even moderate physical activity is associated with favorable sympathetic-parasympathetic balance, and better CHD prognosis.

1111-66 Effects of Acute Exercise on the Fibrinolytic and Coagulative System in Patients With Chronic Ischemic Heart Disease

Tayfun Acil, Enver Atalar, Levent Sahiner, Baris Kaya, Lale Tokgözü, Kenan Övünç, Serafettin Kirazli, Ibrahim Haznedaroglu, Sirri Kes, Serdar Aksöyek, Hacettepe University, Ankara, Turkey

Background: As physical activity affects hemostasis, we aimed to find out whether acute physical activity leads to a prothrombotic state in patients with coronary artery disease (CAD).

Methods: The study included 40 consecutive untrained patients with a positive treadmill exercise test and 15 healthy controls with a negative exercise test. Blood samples for testing global fibrinolytic capacity (GFC) and prothrombin fragment 1+2 (PF1+2) were drawn immediately before exercise, at peak exercise and 2 hours after rest. Patients were evaluated with coronary angiography.

Results: Patients were divided into 2 groups according their coronary angiograms (Group I with CAD). In all three groups GFC increased significantly with peak exercise and thereafter declined again reaching pre-exercise values within 2 hours. The increase in Group I GFC was less than in both Group II and controls ($p=0.001$ and $p=0.0001$, respectively), whereas the increase in Group II GFC was less than that observed in controls ($p=0.001$). At peak exercise PF1+2 increased in all three groups. However, while the PF1+2 of Group II and controls declined to pre-exercise levels within 2 hours after exercise, they were still significantly high in Group I ($p=0.0001$).

	Before Exercise		Peak Exercise		2 hours After Recovery	
	GFC (μ g/mL)	PF 1+2 (nmol/L)	GFC (μ g/mL)	PF 1+2 (nmol/L)	GFC (μ g/mL)	PF 1+2 (nmol/L)
Group I (n=24)	8,10 \pm 2,6	1,13 \pm 0,41	12,15 \pm 5,04	1,94 \pm 0,07	8,57 \pm 2,6	1,69 \pm 0,06
Group II (n=16)	14,88 \pm 3,65	0,72 \pm 0,20	19,04 \pm 4,29	1,93 \pm 0,08	14,99 \pm 3,37	0,74 \pm 0,22
Controls (n=15)	19,65 \pm 7,14	0,79 \pm 0,10	26,39 \pm 7,03	1,95 \pm 0,07	19,45 \pm 6,22	0,78 \pm 0,11

Conclusion: Acute exercise disturbs the equilibrium between coagulation and fibrinolysis in favour of coagulation in untrained patients with CAD. Although more pronounced in CAD patients all patients with a positive exercise test have an attenuated fibrinolytic response to acute exercise.

1111-67 The Addition of Posterior or Right-Sided Chest Leads Does Not Enhance the Sensitivity of Stress Testing

Eric A. Shry, Robert Eckart, James Furgerson, Karl Stajduhar, Brooke Army Medical Center, San Antonio, TX, Wilford Hall Medical Center, San Antonio, TX

Background: Exercise treadmill testing has limited sensitivity for the detection of coronary artery disease. Recently, there has been interest in using non-standard electrocardiographic (ECG) leads during exercise testing.

Methods: We consecutively enrolled patients undergoing exercise myocardial imaging with four additional leads recorded (V₄R, V₇, V₈ and V₉). The test characteristics of the 12-lead, the 15-lead (12-lead, V₇, V₈, V₉), and the 16-lead (12-lead, V₄R, V₇, V₈, V₉) ECG were compared with stress imaging.

Results: There were 807 subjects who met entry criteria. A total of 170 subjects had an abnormal 12-lead ECG during exercise. The addition of 3 posterior leads resulted in 7 additional subjects having an abnormal ECG response to exercise. The addition of V₄R resulted in only 1 additional patient having an abnormal ECG during exercise. The sensitivity for detecting ischemia as determined by stress imaging was 41%, 44%, and 44% (p=ns) for the 12-lead, 15-lead, and 16-lead ECG, respectively. In those with catheterization data (n=147), the sensitivity was 47%, 51%, and 51% (p=ns) for the 12-lead, 15-lead, and 16-lead ECG, respectively. The sensitivity of imaging modalities was 77% ($p<0.001$ compared to 12-, 15-, and 16-leads).

Conclusion: The addition of right-sided and posterior leads did not significantly increase the sensitivity of the ECG for the detection of myocardial ischemia. However, the addition of imaging to stress testing substantially increased the sensitivity for the prediction of coronary artery disease. Additional leads should not be used to replace imaging modalities for the detection of coronary artery disease.