pacing 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

Amith J. Desai, Amogh Bhat, Daljit Bagha, Mudulia 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 >10 mm ST segment depression 60-80 msec after the J point. A positive Ex ECG was defined as an 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 89% (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-Ex Echo test data associated with a negative Ex Echo included: ≤3 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 Thermodilutional Response to Exercise Substantially Impairs Exercise Tolerance Among Patients With and Without Ischemia on Myocardial Perfusion Single-Photon Emission Computed Tomography

Friedman A. LaPar, Veeranna Meria, Herve Charroux, Umer Surhan, Amy T. Armenia, George Reed, George Diamond, Allan Rozanski, St. Luke's-Roosevelt Hospital Center, New York, NY

**Background:** Whereas SPECT myocardial ischemia predicts patients’ outcome, exercise (Ex) duration generally adds substantial incremental information to event prediction. The pathophysiologic factors mediating this association are unclear. Paradoxical blood flow during exercise is associated with significantly reduced exercise duration among CAD patients. The relation between such vasoconstriction and Ex duration is not known. Methods: We employed PAT to assess flow pulse wave amplitude (PWA) at rest and continuously during Ex SPECT testing in 463 CAD pts (mean age 58 ± 10 years, 96% 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 constituting abnormality. Results: Abnormal flow pulse wave amplitude response to Ex was associated with a substantial reduction in Ex duration and achieved Ex METs grouped. Notably, the association was equally significant among patients with and without SPECT evidence of ischemia. Conclusions: Paradoxical reduction in flow pulse wave amplitude during exercise is associated with significantly reduced exercise duration among CAD patients. This abnormal peripheral vasoregulatory response may represent a potential, SPECT-independent, pathophysiologic mechanism linking exercise duration to cardiac events.

**1111-61** Using Estimated Functional Capacity to Optimize Stress Testing for Diagnosis and Prognosis of Cardiovascular Disease in Women: The NHLBI-sponsored WISE Study

Leelee J. Shaw, Marian Olson, Sheryl Kelsey, Bernard R. Chaitman, George Sopko, C. Noel Bailerly More, 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 2920 women with chest pain (average age 55 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 APGP protocols and average DASI functional capacity was 6 METS. 2.3-year cardiovascular outcomes (unstable angina, death, myocardial infarction, heart failure, or stroke) were reported in 37 women. Ex-induced ischemia occurred in 98% and 52% had a warranty stenosis ≥50% in women with DASI-predicted METS ≤ 4.7. 70% of negative ischemia occurred more (71% vs. 40%), with ≥50% predicted maximum heart rate more (24% vs. 5%) 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 was associated with an advanced prognosis. Use of the DASI prior to exercise stress testing may stratify candidates for exercise testing or pharmacologic stress.

**1111-62** High Treadmill Workload in Patients With Exercise-Induced ST Depression Predicts a Negative Result on Exercise Echocardiography

Amith J. Desai, Amogh Bhat, Daljit Bagha, Mudulia 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 performed Ex Echo in 110 consecutive Pts (110 males, 30 females; mean age 51 yrs [30-82]) referred for Ex Echo after a positive Ex ECG. Ex Echo was negative in 94% (131/140) of Pts and positive in 6% (9/140). 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-Ex Echo test data associated with a negative Ex Echo included: ≤3 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.

**1111-63** Impact of Obesity on Inflammation and Metabolic Syndrome in Coronary Patients and Effects of Cardiac Rehabilitation

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

**Background** Obesity is a systemic 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 ≥ 30 kg/m2) with 72 lean patients (BMI < 25 kg/m2).

Results: At baseline, obese patients had higher levels of LDL cholesterol (114 +/- 59 vs 100 +/- 27 mg/dl; p<0.07), abdominal girth (43.4 +/- 4.9 vs 35.2 +/- 4.0 inches; p<0.0001), % body fat (37.7 +/- 7.6 vs 24.9 +/- 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 +/- 16.8 vs. 36.7 +/- 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 concomitantly greater in the obese group (5.4 +/- 4.3 vs 5.0 +/- 1.6; 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 appeared 32% higher in obese patients (4.4 +/- 8.4 vs 5.4 +/- 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 [+5%; (p<0.01)], quality of life (+12%; p<0.001), 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 [-6%; (p<0.03). The TG/HDL ratio (17%; p<0.05) and the prevalence of MS fell (16% to 52%) in the obese group following CRET.

Conclusions: Obese patients with CAD had markedly abnormal risk profiles, characterized by MS and high levels of inflammation, which improved 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 Percutaneous Deterioration

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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 electrocardiographic and imaging results from 2137 patients undergoing acute testing (treadmill or dobutamine) and myocardial perfusion imaging with Tc99m Sestamibi.

Results: Abnormal T waves were present at rest in 636 patients of whom 71 patients (11%) had PNL during stress and 567 patients (69%) did not.

Conclusions: Normalization of abnormal resting T waves occurs infrequently during stress testing at sites of 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 Merklini, Ceristime Ficili, 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 of physical activity leads to a proatherogenic 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<0.001, respectively), whereas the increase in Group II GFC was less than that observed in controls (p=0.01). After 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<0.001).

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

Jayayn Ang, Imwra Atawar, Levent Sahiner, Bars Kaya, Late Tokgozoglu, Kenan Ovunc, Serapettini Kirazli, Ibrahim Haznedaroglu, Seng Kus, Senar Akaydak, 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<0.001, respectively), whereas the increase in Group II GFC was less than that observed in controls (p=0.01). After 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<0.001).

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

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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 (Vr, Vh, Vc and Vd). The test characteristics of the 12-lead, the 15-lead (12-lead, Vr, Vh, Vc, Vd), and the 16-lead (12-lead, Vr, Vh, Vc, Vd) ECG were compared with stress imaging.

Results: There were 907 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 17 additional subjects having an abnormal ECG response to exercise. The addition of Vr 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<0.01) for the 12-lead, 15-lead, and 16-lead ECG, respectively. In those with catheterization data (n=174), the sensitivity was 47%, 51%, and 51% (p<0.01) 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.

Conclusions: The addition of right-sided or posterior exercise 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 proved not to be used to replace imaging modalities for the detection of coronary artery disease.