mmHg·beats/min·10^3, respectively). The normal subjects were younger than those with exercise-induced ST depression (37 ± 3 vs 57 ± 3 years, $p < 0.01$).

Conclusions: Endothelin-1, a potent vasoconstrictor, falls with exercise in normal subjects, but increases in patients with exercise-induced ST segment depression. Endothelin-1 may be one of the mediators of exercise-induced coronary insufficiency.

8:45

780-2 Exercise Increases Systemic Nitric Oxide Production in Men

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The effects of submaximal exercise on systemic nitric oxide (NO) formation, as assessed by measuring the urinary excretion rates of NO_3^- and of cyclic GMP, were compared in 10 endurance-trained and 6 untrained male subjects. Urinary excretion rates of NO_3^- (by gas chromatography) and cyclic GMP (by radioimmunoassay) were assesse before and after a 30 min exercise testdat 60% of each subject's individual maximal work capacity in hourly intervals. Urinary NO_3^- excretion in untrained and trained subjects was comparable at rest (104 ± 35 vs. 110 ± 19 μmol/mmol creatinine, p = n.s.). It more than doubled during exercise in both groups (to 236 ± 88 μmol/mmol creatinine in untrained and to 252 ± 39 μmol/mmol creatinine in trained subjects, each $p < 0.01$) and rapidly decreased to baseline within 2 hours after the test. Resting urinary cyclic GMP excretion was fourfold higher in the athletes than in the untrained subjects (21 ± 5 vs. 6 ± 1 nmol/mmol creatinine, $p < 0.05$). During exercise it increased about twofold in both groups (to 52 ± 12 and 10 ± 1 nmol/mmol creatinine, respectively, each $p < 0.01$), and returned to baseline after its end. There was a correlation between urinary cyclic GMP and NO_3^- excretion ($p < 0.05$) in both groups. We conclude that acute submaximal exercise increases the formation of NO in man, as reflected by the increased urinary excretion of NO_3^- and cyclic GMP. This may contribute to the vasodilation during physical exercise, and at least partly explain the beneficial effects of physical training in patients with cardiovascular diseases.

9:00

780-3 Does Estrogen Reduce the Accuracy of Exercise Electrocardiography in Women?

Anthony P. Morise, Robert Beto, George A. Diamond. *West Virginia University, Morgantown, WV*

It has been suggested that estrogen has a role in the genesis of false positive exercise electrocardiograms in women. We evaluated 1007 men and 832 women with suspected coronary artery disease concerning the accuracy of exercise electrocardiography. Women were grouped according to estrogen status (ES): ES− = postmenopausal and not on estrogen replacement and ES+ = premenopausal (Premen) or on estrogen replacement. Positive exercise ST criteria were ≥1 mm horizontal/downsloping or ≥1.5 mm upsloping depression. *Results:* Overall accuracy: sensitivity 44% and specificity 87%; receiver operating characteristic curve (ROC) area 76 ± 3. The following table compares the accuracy of men and subgroups of women.

	Number	Sensitivity	Specificity	ROC Area
Men	1007	52 ± 7	91 ± 2	84 ± 3
Women	832	34 ± 7	82 ± 2*	64 ± 6*
ES−	317	35 ± 12	79 ± 5*	61 ± 9*
ES+	515	15 ± 11	81 ± 2*	46 ± 15*
Premen	259	72 ± 40	91 ± 5**	90 ± 14†

*p < 0.01 vs Men; **p = 0.05 vs ES+ or ES−; †p < 0.05 vs Women, ES+, or ES−

The heart rate-pressure products for Men (26,600 ± 600) and Premen (26,500 ± 500) were the same (p = 0.58).

Conclusion: Concerning exercise electrocardiography, both ES+ and ES− women have lower accuracy than men. However, Premen women (a subgroup of ES+) had exercise performance and accuracy similar to men, especially concerning specificity. These results suggest that not all ES+ women have the same accuracy and argue against a role for naturally occurring estrogen as an etiology for false positive results.

9:15

780-4 ST Segment Depression Risk, Menopause, Hysterectomy and Exogenous Estrogen in Asymptomatic Women

Arfan J. Al-Hani, Alice Furumoto-Dawson *St. James Hospital & Health Centers, Chicago Heights, IL*

In a 1993 follow-up survey, the Women Take Heart Project assessed 1992 menopausal status, including hysterectomy, and validated exogenous estrogen use (both estrogen replacement therapy and birth control pills) in 5932 women (W) who were examined and treadmill stress tested during 1992. 5449 W provided complete data for these analyses.

Using logistic regression to estimate the relative likelihood of significant ST segment depression (1 mm at 80 msec) while taking into account age, body mass index (kg/m^2), cholesterol, resting heart rate, supine systolic blood pressure (SBP, mmHg), educational attainment and weekly aerobic exercise frequency as continuous variables, and employment, black race and smoking as categorical factors, the effects of estrogen and menopausal status (pre-menopausal: Pre, menopausal/post: M, and hysterectomy: Hyst) were examined. Hyst-W were younger than M-W at examination (mean age 56.4 vs. 59.3), and their mean age at hysterectomy was younger than either the mean age of menopause onset or completion that M-W reported (41 vs. 47 and 50 years old). The overall fit of the model was highly significant (model chi-square with 14 df = 211.67, $p < 0.0001$).

Variable	B	S.E.	df	Sig	Odds Ratio
Age (each addtl yr)	0.009	0.0047	1	0.0493	1.01
Estrogen Use	0.372	0.0775	1	0.0000	1.45
Reprod Status Overall			3	0.0048	
(Pre-menopause: reference category)					1.00
Menopausal/post	0.187	0.0582	1	0.0013	1.21
Late hyst (<35 yrs)	0.114	0.0636	1	0.0725	1.12
Early hyst	−0.254	0.0924	1	0.0059	0.78

Conclusions: 1) Post-menopausal status, independent of aging, appears to increase women's cardiovascular disease risk. 2) Exogenous estrogen appears to increase women's likelihood of responding to exercise stress testing with ST segment depression.

9:30

780-5 Training Level Comparison Study: Effects of Exercise Training Intensity on Insulin and Glucose Levels in Coronary Patients with "Clustering" of Risk Factors

Mary Ellen Sweeney, Gerald F. Fletcher, Albert Oberman, Barbara J. Fletcher, Sandra B. Dunbar, Jeannette Lee, Claire R. Rice *Emory University, Atlanta, GA; University of Alabama, Birmingham, AL*

Hyperinsulinemia has been associated with clustering of hypertension, glucose intolerance, elevated cholesterol and obesity. The effect of exercise training (Ex Tr) intensity on serum glucose (G) and insulin (I) was studied in 26 of 200 pts with documented coronary artery disease exhibiting risk factor clustering. Pts were prospectively randomized to high intensity (85% VO2max) Ex Tr or low intensity (50% VO2max) Ex Tr, 60 min., 3 × week. Groups did not differ by age, weight, elevated cholesterol, hypertension or glucose intolerance at baseline. G and I levels were analyzed in the fasting state and 1 hour post glucose load at baseline and after 6 mo. of Ex Tr. Data were analyzed by Wilcoxin signed rank number test and reported as medians with (ranges). There were no significant base to 6 mo. differences in fasting G and I levels in either group.

Post glucose load results:

	Base		6 Mo.	
	High Ex Tr (N = 14)	Low Ex Tr (N = 12)	High Ex Tr (N = 11)	Low Ex Tr (N = 8)
I (μIU/ml)	136 (9–532)	137 (37–1305)	66* (11–298)	100 (36–137)
G (mg/dl)	208 (161–508)	197 167–400)	178** (76–532)	182 (137–1305)

*p = 0.007 (within group), **p = 0.002 (within group)

We conclude high intensity Ex Tr appears more effective in altering post-absorptive I and G levels in coronary pts exhibiting clustering of risk factors.

9:45

780-6 Effect of Long Term Prostacyclin (PGI2) on Exercise in Patients with Primary Pulmonary Hypertension (PPH) Who Have Deteriorated on Maximal Conventional Therapy

David F. Wax, Robert Garofano, Welton M. Gersony, Robyn J. Barst. *Columbia University, New York, NY*

Continuous IV PGI2 has been shown to improve survival and quality of life in patients with PPH. We used cycle ergometry with continuous measurement of gas exchange to evaluate 15 pts (6–57 yrs) with PPH who were treated with PGI2 after having deteriorated on maximal conventional therapy (CT: oral vasodilators, cardiac glycosides, diuretics, oxygen and anticoagulation).

Column I shows the performance while on maximal CT 2 to 13 mos before starting PG12. Column 2 is the baseline performance immediately prior to starting PGI2. Data are presented as mean ± SD.