of hemodynamic responses during standardized exercise tests may have important prognostic and diagnostic value in cardiopulmonary patients.

*Methods.* We gonducted standardized 6-min hall walk (HW) and stair climb (SC) tests every 2 weeks in 5 cardiopulmonary patients; 4 with chronic heart failure, 1 with chronic obstructive pulmonary disease. Heart rate (HR), right ventricular (RV) O2 saturation (O2 SAT), RV pulse pressure (PP), RV $dP/dt_{max}$ (dP/dt), estimated pulmonary artery diastolic pressure (ePAD) were recorded at 2 sec intervals for 10 min before, during, and for 15 min after the HW & SC tests using an implanted hemodynamic monitor (IHM) and an RV unipolar lead with multiple biosensors (RV pressure and O2 SAT); these devices are similar to a single chamber pacemaker in size and implant procedure. An example of stored data from the HW & SC test is shown below:
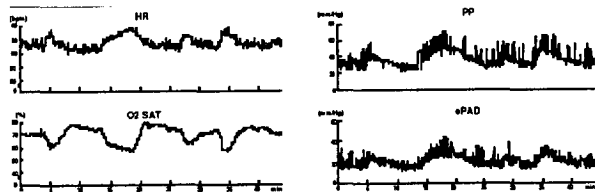


*Results.* 5–15 HW & SC tests were done in each patient over 13–36 weeks of follow-up. During HW tests, HR increased from 97 ± 19 to 129 ± 21 bpm (p = 0.009), O2 SAT decreased from 64 ± 9 to 39 ± 19% (p = 0.007), PP increased from 30 ± 7 to 45 ± 9 mmHg (p = 0.007), ePAD increased from 17 ± 3 to 27 ± 8 mmHg (p = 0.059) and dP/dt increased from 401 ± 91 to 765 ± 242 mmHg/sec (p = 0.009). Changes during SC were similar to those during HW.

*Conclusions.* Standardized, repeated exercise testing using implanted hemodynamic monitoring is feasible and further testing in larger patient groups may verify the diagnostic and prognostic value of such procedures.

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945-65    **Effect of Left Anterior Hemiblock on the Sensitivity of Exercise Stress Tests**

Olakunle O. Akinboboye, Donald C. Delisi Jr., Lihwa J. Leung, Roxanne Rodney, David K. Blood. *Columbia University, New York, N.Y.*

We had observed a relatively high frequency of false negative stress electrocardiograms compared with SPECT thallium scintigraphy in patients with LAHB. *Purpose:* To assess the effect of LAHB on the sensitivity of exercise induced ST depressions for ischemia compared with SPECT thallium scintigraphy. *Methods:* A 5-year retrospective analysis of all treadmill thallium stress tests performed in our exercise laboratory was performed. Patients with LBBB, RBBB, IVCD, LVH or <85% of maximal HR were excluded.
Study group : n = 25 (16 M, 9 F, ages 35–87)
Matched controls : n = 18.
*Results:* (1) The sensitivity of ST depressions for ischemia in the study group was 30% compared with 71% in the control group, the specificities were 90% and 75% respectively
(2) There was no significant association between presence of ischemia on ECG and on SPECT thallium scans in the study group, while an association was found in the control group (p < 0.01).
*Conclusions:* The sensitivity of exercise stress tests for ischemia is low in the presence left anterior hemiblock.

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945-66    **Combination of Left and Right Precordial Leads: A New Technique in Exercise Testing with the Highest Diagnostic Ability for the Detection of Coronary Artery Disease**

Andreas P. Michaelides, Zoi D. Psomadaki, Konstantina D. Aggeli, George A. Georgiades, Theodoros Argyriou, Pavlos K. Toutouzas. *Dept. of Cardiology of Athens University, Greece*

It is known that right precordial leads RV3, RV4, RV5 could detect Right coronary (RC) artery stenosis. The common exercise test (ET) has a low ability to detect RC disease especially as a single vessel disease (VD). The aim of this study was to improve the diagnostic accuracy of the ET for the detection of coronary artery disease (CAD) using a combination of Left (L) and Right (R) precordial leads. We studied 133 patients (pts) aged 32–73 (mean 48 ± 7) years (122 males and 11 females) who underwent treadmill ET using the Bruce protocol and coronary arteriography. We used two Exercise systems. The pts were walking on the treadmill of the one system. In the monitor of the first system the usual 12-lead ECG and in the monitor of the second system the additional R precordial leads (RV3, RV4, RV5) were simultaneously recording. The start and the end of the ET in both systems were done at the same time by two of the investigators. Thirty-four pts had normal coronary arteries, whereas 54 pts had 1-VD, 27 2-VD and 18 3-VD. Of the pts with 1-VD, 25 had Left Anterior Descending (LAD) disease, 16 had RC artery disease and 13 Left Circumflex (LC) artery disease. The sensitivies of the usual 12-

lead ET and of the combination of L and R precordial leads (new technique) for the detection of LAD disease were found respectively 76% (19/25) vs 92% (23/25), for RC disease 25% (4/16) vs 88% (14/16), for LC diseese 47% (6/13) vs 85% (11/13), for the detection of 1-VD were 54% (29/54) vs 89% (48/54), for 2-VD 63% (17/27) vs 96% (26/27), for 3-VD 83% (15/18) vs 100% (18/18) and for the detection of CAD 61% (61/99) vs 93% (92/99), p < 0.001, while the specificities were found the same 91% (31/34).

*Conclusion:* It is concluded that this new technique based on two Exercise Systems has the highest diagnostic ability for the detection of CAD and it evokes the need for the creation of a new exercise system with 15 leads.

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945-67    **Diagnostic Significance of Exercise-induced ST-Segment Depression in the Lateral Limb Leads**

Taishiro Chikamori, Takashi Furuno, Jun Takata, Hiromi Seo, Fumiyasu Yamasaki, Toshikazu Yabe, Yoshihisa Matsumura, Hiroaki Kitaoka, Yoshinori Doi. *Kochi Medical School, Nankoku, Kochi, Japan*

To evaluate the diagnostic significance of ST-segment depression in the lateral limb leads (I and aVL), 366 consecutive patients suspected of having CAD underwent standard exercise testing. They were aged 34 to 85 years; 234 were men and 132 women. No patient had previous myocardial infarction. A significant ST-segment depression of $\geq 0.1$ mV were observed in the lateral limb leads in 57 patients (16%). In patients with ischemic ST-segment depression, those with the lateral limb lead ST-segment depression had a shorter duration of exercise (3.7 ± 1.6 vs 4.7 ± 1.8 min; p < 0.001), a slower peak heart rate (111 ± 20 vs 125 ± 20 beats/min; p < 0.001), a greater magnitude of the maximal ST-segment depression (0.29 ± 0.14 vs 0.16 ± 0.08 mV; p < 0.001), and a greater number of leads with ischemic ST-segment depression (6.6 ± 1.6 vs 3.6 ± 1.8; p < 0.001) than those without. Sensitivities to detect significant CAD were lower by the lateral limb lead ST-segment depression than by the anterior or inferior lead ST-segment depression (23 vs 75, 53%; p < 0.0001 for both). In detecting multi-vessel CAD, however, the lateral limb lead ST-segment depression had a higher specificity and a positive predictive value than the anterior (92 vs 54%; p < 0.0001 and 67 vs 47%; p < 0.01, respectively), or the inferior lead ST-segment depression (92 vs 68%; p < 0.0001 and 67 vs 50%; p = 0.03, respectively). In particular, a positive predictive value in detecting multi-vessel CAD was 82% in 44 patients with ST-segment depression in both lateral limb and inferior leads.

*Conclusion:* The lateral limb leads may be the last to develop ST-segment depression during exercise testing, which is regarded as a specific marker for severe coronary artery disease.

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945-118    **Validation of a Simple Exercise-Test Based Method for Early Identification of Multivessel Coronary Disease After Acute Myocardial Infarction**

Fabrice Leroy, Patricia Minet, Jean-Jacques Dujardin, Pierre Fievet, Benaissa Agraou, Eugène Mc Fadden[1], Jean-Marc Lablanche[1], Michel Bertrand[1]. *Hôpital de Douai, University of Lille, France;* [1] *Hôpital cardiologique, University of Lille, France*

The presence of multivessel coronary disease (MVD) is a powerful determinant of prognosis after acute myocardial infarction (AMI). The use of early exercise testing (ExT) in the detection of MVD has produced conflicting results in part due to the use of submaximal protocols and the selective use of angiography. We routinely perform coronary angiography after AMI irrespective of the results of ExT.

In this setting, we studied the use of multivariate analysis of clinical and exercise parameters derived from maximal ExT, to detect the presence of MVD in consecutive patients after AMI. Of 240 patients with AMI (October 1992–May 1994), 117 had both early (8 ± 2 days) maximal ExT and coronary angiography (13 ± 8 days) after uncomplicated AMI. No complications occurred related to ExT.

Using a discriminant analysis, a statistical model was established in the first 72 patients (learning group) and validated in the next 45 patients (testing group). Baseline variables were comparable in terms of age (56 yrs vs 59 yrs), Q-wave AMI (83% vs 76%), inferior AMI (65% vs 69%), use of thrombolytic therapy (64% vs 60%) and MVD (44% vs 36%).

Of 9 clinical and 15 exercise variables which were incorporated in the discriminant analysis, the number of METs achieved (p < 0.0005), maximal ST segment depression in V5 (p < 0.005) and maximal exercise heart rate were the only variables significantly associated with the presence of MVD in the learning group. The discriminant function, using these 3 variables, correctly classified 75% of patients with MVD in the learning group and 79% of patients in the testing group, whereas the use of maximal ST depression alone, the most conventional index, correctly classified only 60% of patients in the testing group (p < 0.005).

Thus, maximal ExT can be safely performed early after uncomplicated AMI. The accuracy of early ExT in the detection of MVD can be improved using