Diagnostic accuracy of peak exercise echocardiography in coronary artery disease : comparison with thallium-201 myocardial

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Diagno[illegible] accuracy of peak exercise ec[illegible]ocardi[illegible]graphy in coronary artery disease: Comparison with thallium-201 myocardial scintig[illegible]ap[illegible]y

To evaluate the [illegible]cy of exercise two-dimensional echocardiography for the recognition of coronary artery [illegible], 53 patients (46 men and 7 women, age range 35 to 69 years) without either pre[illegible] myocardial infarction or resting wall motion abnormalities, were studied. According to co[illegible] angiography 26 had normal coronary arteries, 14 had one-vessel, seven had t[illegible] and six had three-vessel disease. After withdrawal of any therapy, all patients underw[illegible] exercise stress test with a stress table during which cine-loop digitized echo[illegible] was acquired and 74 MBq of thallium-201 (Tl-201) were injected. Echo[illegible] images were evaluated at rest and at peak exercise. Three-view planar scintigraphic images were collected immediately after exercise and 4 hours later. For the overall recog[illegible]nary artery disease, exercise electrocardiography had 77.8% sensitivity and 65.4% specific[illegible] myocardial scintigraphy had 100% sensitivity and 92.3% specificity; and exercise [illegible]rdiography had 92.6% sensitivity and 96.2% specificity (both NS versus [illegible]oc[illegible] scin[illegible]aphy). Global accuracy was 71.7% for exercise electrocardiography, 94.3% for [illegible]raphy, and 96.2% for myocardial scintigraphy. For the classification of the individual involved coronary arteries, the sensitivity of myocardial scintigraphy was 84.8% and that of [illegible]chocardiography was 63% ($p < 0.01$); the related specificities were 98% and 98.2[illegible] esp[illegible]tive[illegible] (NS). It may be concluded that exercise echocardiography is highly accurate for th[illegible] of coronary artery disease, whereas it appears less sensitive in the identification of the involved vessels, particularly in patients with multivessel disease. (AM HEART J 1991;[illegible])

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In the last 10 years an ever-increasing interest has been focused on the use of echocardiography coupled with exercise stress testing for the diagnosis and evaluation of coronary artery disease. The well-known advantages of echocardiography over other

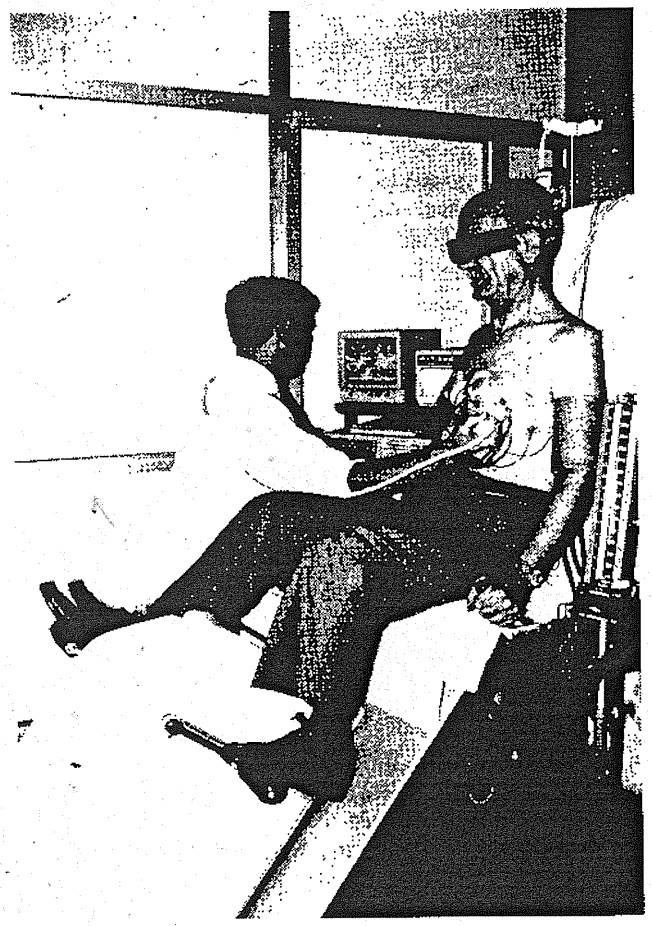

Fig. 1. Echocardiographic examination during upright bicycle exercise test with stress table.

imaging techniques, such as low cost, absence of radioactive exposure, and wide availability, would make this approach very attractive. Moreover, the remarkable technical advances of echocardiographic imaging and particularly the introduction of digital image processing with cine-loop and quad-screen format displays have simplified and made more accurate the comparison of baseline and stress data.

Several studies have already demonstrated the value of exercise echocardiography.[1-15] Some problems, however, remain to be solved in defining the true role of exercise echocardiography.[16, 17] The pre- and post-test referral biases limit the value of various previous reports.* Furthermore, many protocols have employed only post-exercise images† instead of those collected at peak exercise,[1, 3, 22, 23] which could be superior in identifying the magnitude of abnormalities.[21, 23, 24] Finally, few data[4] are available about the comparison of exercise echocardiography with a simultaneously performed reference method such as thallium-201 (Tl-201) myocardial scintigraphy. Therefore the aim of this study was to compare the accuracy of peak exercise echocardiography with that of Tl-201 myocardial scintigraphy performed during the same exercise test, with respect to both the recognition of coronary artery disease and to the classification of the involved vessels, using coronary angiography as the reference standard.

*References 2, 3, 5, 7, 18, and 19.
†References 4, 5, 10, 12, and 20 to 22.

METHODS

Patient population. From December 1988 through May 1990 among the inpatients and outpatients referred to our Nuclear Medicine Department for exercise myocardial scintigraphy with Tl-201 154 unselected patients were also simultaneously studied with exercise echocardiography. The indications for performing myocardial scintigraphy in these patients were the evaluation of typical or atypical chest pain in subjects with a nondiagnostic exercise electrocardiogram, the assessment of disease extent in patients with known coronary artery disease, and the prognostic evaluation of patients with previous myocardial infarction. The echocardiographic images were of good quality both at rest and during exercise in 144 patients (93.5%).

For the aims of the present study, patients presenting with the following features were selected: (1) absence of wall motion abnormalities on the resting echocardiogram; (2) no history of previous myocardial infarction, coronary artery bypass grafting, or coronary angioplasty; (3) those having recently undergone left heart catheterization with coronary angiography or being scheduled for it even before the results of myocardial scintigraphy were known; and (4) no history or investigational evidence (including two-dimensional echocardiography and color Doppler) of valvular heart disease or cardiomyopathy.

The final study group therefore included 53 subjects (46 men and 7 women; mean age 54.3 ± 7 years, range 35 to 69). Among them, 26 had a history of atypical chest pain, 22 of typical effort angina, and five of typical chest pain both at rest and during stress. According to the usual policy of our Nuclear Medicine Department for the diagnostic use of myocardial scintigraphy, β-blockers, calcium channel blockers, and nitrates were withdrawn in all patients 1 week, 48, and 24 hours, respectively, before the exercise study. Therapy was resumed after completion of the whole investigation. Informed consent to participate in the study was obtained from all patients.

Exercise testing. Exercise testing was performed in the morning after overnight fasting, using an electromagnetic braked bicycle ergometer equipped with a rigid and reclinable straight back that was set at a 75-degree angle (stress table, Fig. 1). A twelve-lead electrocardiogram and blood pressure readings were monitored throughout the whole exercise program. The location of the precordial electrodes was sometimes slightly modified to avoid interference with the optimal echocardiographic window. Exercise testing was performed starting with a 25 W work load, which was