

Preoperative and postoperative stress evaluation in the assessment of coronary artery bypass graft surgery

Ezra A. Amsterdam, M.D.
Dean T. Mason, M.D.

Davis, California

Exercise testing provides an objective, noninvasive approach to serial evaluation of the therapeutic efficacy of coronary artery bypass graft surgery in patients with angina pectoris due to coronary artery disease. This method affords assessment of the effect of coronary bypass surgery on (1) functional capacity, (2) myocardial ischemic threshold, and (3) indirect indexes of myocardial oxygen supply. During exercise testing these variables are determined respectively by measurement of (1) angina-limited duration and intensity of exertion, (2) electrocardiographic S-T segment response, and (3) the double product of heart rate x systolic blood pressure. Although the rate of success of coronary artery bypass graft surgery in alleviating symptoms of angina has been consistently high, the subjective nature of this response, even on standard stress testing, limits its value in assessing the physiologic efficacy of myocardial revascularization. Therefore, emphasis has been placed on the more objective parameters obtained by exercise testing; that is, ischemic electrocardiographic S-T response and the double product of heart rate x systolic blood pressure.^{1,2}

We have evaluated coronary artery bypass

graft surgery by the two latter approaches in 51 patients (45 men, 6 women; mean age 50 years, range 31 to 70 years). Postoperative exercise tests were performed at a mean period of 11.4 months after surgery. Before coronary artery bypass graft surgery, exercise resulted in ischemic S-T \downarrow in 27 patients. After coronary artery bypass graft surgery, 17 of these 27 patients had no S-T \downarrow and 8 had less S-T \downarrow at a greater intensity of exercise than precoronary artery bypass graft surgery. The double product of heart rate x systolic blood pressure in the 45 patients in whom this factor was obtained during exercise rose from 21,180, precoronary artery bypass graft surgery to 26,460 ($p < .05$), postcoronary artery bypass graft surgery. Further, in 17 patients coronary artery bypass graft surgery was followed by both abolition of angina and improvement or complete normalization of precoronary artery bypass graft surgery ischemic S-T \downarrow at a higher exercise double product of heart rate x systolic blood pressure. Postcoronary artery bypass graft surgery angiography was compared to exercise results: 13/14 (93%)

patients in whom S-T \downarrow was abolished or diminished had at least one patent graft, and the single patient with occluded grafts had had intraoperative infarction; 22/23 (96%) patients in whom double product of heart rate x systolic blood pressure rose post-coronary artery bypass graft surgery had patent grafts, and in two of two (100%) patients in whom postcoronary artery bypass graft surgery double product of heart rate x systolic blood pressure fell, all grafts were occluded. Systematic exercise testing is a reliable means of assessing coronary artery bypass graft surgery and correlates well with postcoronary artery bypass graft surgery angiography.

References

1. Grehl T, Amsterdam EA, Matthews E, et al: Evaluation of coronary bypass graft surgery by exercise testing; objective assessment by effect of ischemic ST depression, heart rate-blood pressure product and correlation with postoperative angiography. *Am J Cardiol* **39**: 268, 1977.
2. Amsterdam EA, Wilmore JH, DeMaria AN, eds: Indirect assessment of myocardial oxygen consumption, in *Exercise in Cardiovascular Health and Disease*. New York, Yorke Medical Journals, 1977.