Editorial

Exercise testing post-MI: still worthwhile in the interventional era

Mats Börjesson* and Mikael Dellborg

Sahlgrenska University Hospital/Ostra, 416 85 Goteborg, Sweden

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This editorial refers to 'The prognostic value of pre-discharge exercise testing after myocardial infarction treated with either primary PCI or fibrinolysis: a DANAMI-2 sub-study'† by N. Valeur et al., on page 119

Valeur et al.¹ report findings from a sub-study of the DANAMI-2 trial. The paper describes the prognostic importance of a pre-discharge maximal exercise test following acute myocardial infarction in the era of aggressive reperfusion treatment of ST-elevation myocardial infarction (STEMI).

Exercise testing has been validated and adopted for risk stratification before discharge in patients with acute coronary syndromes for several years.²,³ In addition to providing important prognostic information, exercise testing has also been used to select high-risk patients with provokable myocardial ischaemia (MI) suitable for revascularization.⁴ A pre-discharge exercise test also has significant impact on the patient’s rehabilitation; information on exercise capacity may facilitate tailored physical activity at a safe level, to be continued when the patient is at home.

Since its first introduction in the 1930s,⁵ stressing the heart by exercise testing has been an important routine investigation in known or suspected coronary artery disease. However, in the modern era of very aggressive interventional reperfusion strategies, exercise testing is somewhat out of fashion, and today only a minority of patients go through a pre-discharge exercise test after an episode of acute coronary disease. In addition, the emphasis has progressively shifted from the exercise capacity obtained during the test, towards signs of ischaemia (ST-segment changes).

Thus, when an exercise test is performed the information obtained on the individual exercise capacity may be overlooked because of the emphasis on ischaemia. This may be unfortunate since the exercise capacity is a strong independent risk factor for both cardiovascular and other mortality.⁶ Initially demonstrated in healthy subjects, a recent study by Myers⁷ showed that also in a clinical patient population referred for exercise testing with and without coronary artery disease, the peak exercise capacity was the strongest predictor for death.

In fact, exercise capacity seems to be the best single exercise variable for identifying patients with low risk for cardiac death post-MI, either pre-discharge or post-discharge.⁸ In a meta-analysis of pre-discharge risk stratification, post-MI markers of left ventricular dysfunction (such as exercise duration) were better predictors of adverse outcome than markers of ischaemia.⁹

The rehabilitation aspect of testing is often neglected and the angiogram is substituted as a marker of increased risk, with the perception that once the stenosis is fixed, the risk is gone. However, the prognostic importance of angiographic findings is often overestimated.¹⁰

The role of the exercise test in the modern era?

Most studies on the predictive power of the exercise test have been performed before the era of reperfusion therapy for STEMI. Studies regarding the influence of thrombolytic therapy on the predictive value of exercise testing post-MI have been conflicting. While the TIMI-II trial confirmed the efficacy for pre-discharge exercise testing post-MI,¹¹ other studies have failed to show the ability of the exercise test to select high risk patients after thrombolysis in MI.¹²

The main important message given by the present study is that the exercise test (specifically exercise capacity) is still a strong predictor for death and
re-infarction post-MI even in the modern era. After fibrinolytic treatment, ST-changes in relation to cardiac stress remain predictive of recurrent infarction while this was less clear after primary angioplasty. However, for prediction of death, exercise capacity was as powerful a predictor in either group irrespective of the primary treatment given.

This may not be so strange after all, since exercise capacity could be regarded as the net result of overall cardiac function (including residual pump function), but also partly the result of any concomitant co-morbidity. Inability to perform the exercise test at all may be regarded as the extreme end of low exercise capacity. Indeed, as has been shown repeatedly before, inability to perform an exercise test post-MI is a highly negative predictor. These patients have been shown in the TIMI-II trial to be older, to more often be of female gender, to more often have had earlier MIs, and to have more extensive coronary artery disease.11

The main limitation of the present study is that the authors did not use signal-averaged ECG at the exercise test. In practical terms, it means that their results may be more difficult to apply to everyday practice. Signal-averaging clearly makes the results of ECG-monitoring during exercise testing easier to interpret, providing results less dependent on interpretation by the physician performing the actual testing.

**Renaissance for the exercise test?**

For the physician, the potential benefit of obtaining results from an exercise test for the subsequent rehabilitation of the patient post-MI should not be underestimated. A recent study showed that the exercise capacity of middle-aged male cardiac rehabilitation candidates [post-MI, post-coronary artery bypass grafting (CABG) test] is very low (mean VO2-max 20.2 mL/kg min).13 The long-term prognosis was associated with exercise capacity, measured by cycle ergometer. In fact, exercise capacity was the best predictor of cardiac death together with smoking and digoxin use in this study.

Furthermore, exercise capacity is a modifiable risk factor. The risk may theoretically be altered by regular physical activity during the rehabilitation phase and onwards. In the study by Myers et al., each 1-MET (metabolic equivalent) increase in exercise capacity was associated with a 12% improvement in survival. Thus, the exercise test may give us valuable information for adequate exercise prescription post-intervention and post-MI. The results of the current study indicate that this also still applies in the modern era of aggressive reperfusion treatment.

**Summary**

Exercise testing post-MI is a class I recommendation (ACC/AHA). To ensure proper risk-evaluation and an optimal, individually tailored rehabilitation, exercise testing should remain a preferred option for all patients discharged after an episode of acute coronary disease, regardless of whether revascularization was performed or not. Specifically, exercise capacity still remains the most significant exercise variable in the modern era of aggressive reperfusion treatment. In this context, the exercise test seems worthy of a clinical renaissance.

**References**