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Ineligibility for predischarge exercise testing after myocardial infarction in the elderly: Implications for prognosis

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This study describes the clinical profile and prognosis of elderly patients not eligible for predischarge exercise testing. The database consisted of 133 patients 55–64 years of age, and 111 patients older than 64 years of age who survived an acute myocardial infarction. Follow-up was one year. In the younger age group, 24 (18%) patients were unable to perform the test, in contrast to 63 (57%) of the elderly subjects. In these two groups, one-year mortality rates were 13% and 37%, compared with 6% and 4% for the respective patients eligible for stress testing. Clinical profile and radionuclide ejection fraction between ineligible patients in both age groups were similar. Ejection fraction measurement was the best predictor of late mortality in those patients who did not have an exercise test. It is concluded that ineligibility for predischarge exercise test identifies a high-risk group, especially in patients older than 64 years of age.

Introduction

The prognostic value of a symptom-limited predischarge exercise test in patients who survive the acute phase of their myocardial infarction has been well documented. Exercise-induced ST-segment changes, major ventricular arrhythmias, low workload and inadequate rise in blood pressure identify patients at high risk for subsequent cardiac death[1–5]. However, little or no attention has been paid to the prognosis of patients who are unable to perform the test[1–4]; furthermore, elderly patients have been excluded in a considerable number of studies[1,3,4]. Therefore, the present study was undertaken in an attempt to assess the one-year mortality in subgroups of elderly patients not eligible for exercise testing, and to evaluate whether clinical data or non-invasive measurements could predict the mortality in this group in the year following acute myocardial infarction.

Patients and methods

Between March 1981 and December 1982, 336 consecutive patients older than 54 years of age were admitted at the coronary care unit of our institute with a documented myocardial infarction. Diagnosis of a definite infarction was made by the usual clinical features, typical ECG changes and elevated serum creatine kinase levels.

During the initial hospitalization 58 patients died, whilst 34 underwent coronary artery bypass grafting or percutaneous transluminal coronary angioplasty. The remaining 244 patients form the basis for this report, and were divided in two age groups: a group of 133 patients between 55 and 64 years of age, and an older group of 111 patients older than 64 years of age.

The following variables were analysed: age, history of prior myocardial infarction, location of infarction, MIRU classification, late heart failure, angina pectoris and maximum creatine kinase levels.

Every attempt was made to ensure that as many hospital survivors as possible performed the predischarge exercise test. Nevertheless, 87 patients were considered ineligible for the test. Contraindications and reasons for ineligibility are summarized for both age groups in Table 1.

Before discharge, radionuclide ventriculography was performed in the 45° LAO view after an *in*

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Table 1 Reasons for ineligibility for predischarge exercise test

	No. of patients	
	55–64 yrs	>64 yrs
Cardiac contraindications:		
congestive heart failure	12	10
severe angina pectoris	1	2
other	—	2
Non-cardiac contraindications:		
peripheral vascular disease	2	6
cerebral vascular disease	1	3
other disease	5	10
poor general condition	—	29
other reason	3	1
Total	24	63

vitro labelling of the red blood cells with 15 mCi of Tc 99m.

Acquisition time was 6 min. An automated contour detector was used with correction for background activity.

Following hospital discharge, all patients were seen at regular intervals in the out-patient clinic: one-year follow-up for all subjects was complete.

STATISTICAL ANALYSIS

Univariate analysis with unpaired Student's t-test for continuous variables and chi-square or Fisher's exact test, when appropriate, was applied for the discrete variables. Receiver–operator characteristic (ROC) curves were used to compare the predictive value of the continuous variables.

Results

Clinical variables of the four groups are presented in Table 2. One-year mortality in the younger age group was 10% (rate of reinfarction 7%), in the elderly patients 21% (rate of reinfarction 8%). Of 133 patients in the younger age group, 24 (18%) could not perform the exercise test, mainly because of cardiac limitations (Table 1). One-year mortality in this subgroup was twice as high as in the patients who did undergo exercise testing. However, as the total numbers of deaths was only

Table 2 Clinical profile of hospital survivors

	Patients in 55–64 year age group		Patients in >64 year age group	
	XT	no XT	XT	no XT
No. of patients	109	24	48	63
Age	60 ± 3	61 ± 3	68 ± 3	73 ± 5*
Previous MI (%)	23	37	33	39
Location MI (%)				
anterior	35	50	18	30
inferior	43	29	54	37
Non transmural	22	21	27	33
MIRU				
I or II (%)	98	62*	98	86*
III or IV (%)	2	38	2	14
Max CPK (IU l^{-1})	574 ± 456	863 ± 576*	383 ± 276	376 ± 273
Late heart failure (%)	13	37*	10	28*
Angina (%)	17	25	10	25*
Ejection fraction (%)	47 ± 15	38 ± 19*	49 ± 15	42 ± 16*

*$P < 0{\cdot}05$ *vs* stress test (XT) performed.
MI = myocardial infarction.

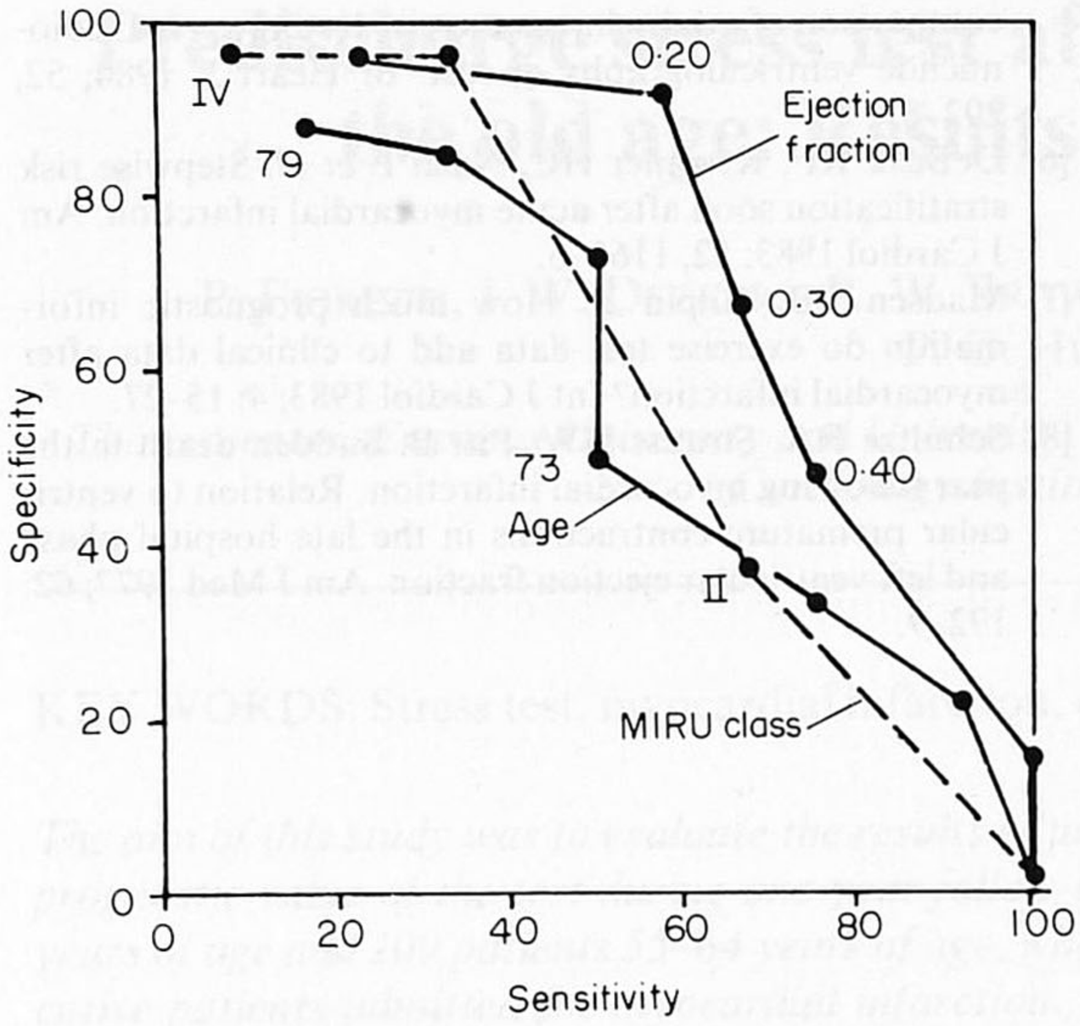

Figure 1 Specificity *vs* sensitivity (ROC curve) for late mortality for age, MIRU classification and ejection fraction in 38 patients >65 years ineligible for predischarge stress test.

three, no attempt was made to relate mortality with available clinical data. In all three subjects death was sudden.

In the older age group ($N=111$), 63 patients (57%) were judged not eligible for exercise testing, non-cardiac reasons being responsible in the majority of subjects (Table 1). This ineligibility implied a nearly ten-fold increase in one-year mortality, which was of cardiac origin in all subjects but one (thirteen sudden, four fatal reinfarctions, five congestive heart failure, one carcinoma). Mean age of survivors and non-survivors was not different (74 *vs* 72 yrs, NS).

Congestive heart failure and angina pectoris during hospitalization were associated with a higher one-year mortality; no relation was found between a history of previous infarction and one-year mortality.

In 38 of 63 elderly patients without exercise test, ejection fraction measurements were obtained. One-year mortality in this subgroup of patients was 34%. Ejection fraction in these 38 patients was superior to age and MIRU classification in predicting late mortality (Fig. 1).

A surprising similarity was noted between clinical profile and ejection fraction in patients in both age groups not eligible for the exercise test; nevertheless, despite smaller infarction size estimated by peak creatine kinase levels in the elderly, their one-year mortality was much higher.

Discussion

Only a limited number of studies have addressed the prognosis of patients ineligible for predischarge exercise testing[5–7]. DeBusk *et al.* evaluated 702 patients who survived an acute myocardial infarction[6]; the rate of cardiac events within 6 months and within five years was significantly higher in the 265 patients (38%) who did not perform the exercise test. Madsen and Gilpin recently compared the prognostic significance of variables from a symptom limited bicycle exercise test shortly after myocardial infarction with clinical variables[7]. Clinical exclusion criteria, applied in 49% of their study population of 886 patients, defined a high-risk group of 430 patients not eligible for exercise testing with a more than four-fold increased mortality (28·4% *vs* 6·6%). Fioretti *et al.* analyzed the relative merits of resting ejection fraction measurement and predischarge exercise testing in 214 hospital survivors of myocardial infarction[5]. The inability to perform the exercise test in 18% was the best predictor of mortality (23% *vs* 5%). However, in these studies, patients older than 69 years were excluded[6], and stratification of patients in different age groups as in the present study, was not performed[5,7].

Exclusion criteria for exercise testing as used in this study are similar to other studies[2–7]. The percentage of ineligible patients was 37% (18% in the younger, 57% in the older group): in view of the age distribution of our patients, this number seems even lower than the figures of the studies cited earlier[6–7].

The value of the resting ejection-fraction measurement as a predictor of late mortality is in agreement with other reports[5,8]. However, the value of this test in very old patients seems limited, as life expectancy in these patients appears short.

In conclusion, for elderly hospital survivors (1) eligibility for stress testing in patients older than 55 years of age defines a subgroup with a relatively low risk for late mortality, (2) ineligibility for stress testing identifies a high-risk group, especially in patients older than 65 years, (3) clinical variables such as angina pectoris and congestive heart failure during hospitalization, as well as resting radionuclide ejection fraction can be used to predict late mortality in patients unable to perform the exercise test.

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