Usefulness of type D personality in predicting five-year cardiac events above and beyond concurrent symptoms of stress in patients with coronary heart disease

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Usefulness of Type D Personality in Predicting Five-Year Cardiac Events Above and Beyond Concurrent Symptoms of Stress in Patients With Coronary Heart Disease

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Psychological stress and type D personality have been associated with adverse cardiac prognosis, but little is known about their relative effect on the pathogenesis of coronary heart disease (CHD). "Type D" refers to the tendency to experience negative emotions and to inhibit the expression of these emotions in social interactions. We investigated the relative effect of stress and type D personality on prognosis at 5-year follow-up. At baseline, 337 patients with CHD who participated in cardiac rehabilitation filled in the General Health Questionnaire (psychological stress) and the Type D personality scale. Patients were followed for 5 years. The end point was major adverse cardiac events, which were defined as a composite of cardiac death, myocardial infarction, and cardiac revascularization (coronary artery bypass grafting/percutaneous coronary intervention). There were 46 major adverse cardiac events at follow-up, including 4 deaths and 8 myocardial infarctions. Type D patients had an increased risk of death/infarction (odds ratio 4.84, 95% confidence interval 1.42 to 16.52, p = 0.01) compared with non–type D patients, independent of disease severity. Stress (p = 0.011) and type D (p = 0.001) were related to an increased risk of developing a major adverse cardiac event after adjusting for gender, age, and biomedical risk factors. Multivariate analysis yielded left ventricular ejection fraction ≤40%, no treatment with coronary artery bypass grafting, and type D personality (odds ratio 2.90, 95% confidence interval 1.42 to 5.92, p = 0.003) as independent predictors of major adverse cardiac events, whereas psychological stress was marginally significant (odds ratio 2.01, 95% confidence interval 0.99 to 4.11, p = 0.054). In conclusion, type D personality is a psychological factor that may optimize risk stratification in patients with CHD. Type D reflects more than temporary changes in general stress level because it predicted cardiac events after controlling for concurrent symptoms of stress. © 2006 Elsevier Inc. All rights reserved. (Am J Cardiol 2006;97:970–973)

High stress scores on the General Health Questionnaire (GHQ)[1] have been associated with an increased risk of cardiac death in patients after acute myocardial infarction[2] and in initially healthy patients.[3,4] The "distressed," or type D, personality (tendency to experience negative emotions and to inhibit self-expression) is also associated with a high risk of cardiac events in patients with coronary heart disease (CHD).[5–7] No study to date has examined the relative influence of stress as measured by the GHQ and type D personality on cardiac prognosis. Investigation of this issue is important for 2 reasons. First, it may be necessary to examine acute (e.g., stress) and long-term (e.g., type D personality) psychological factors to identify high-risk patients.[8,9] Second, examining different categories of psychological factors may help develop effective behavioral and pharmacologic treatment approaches for high-risk patients. In this study, we therefore examined the effect of stress and type D personality on 5-year cardiac prognosis.

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We previously reported on the role of psychological factors in 2 consecutive samples of patients with CHD from the University Hospital Antwerp (Antwerp, Belgium) who participated in rehabilitation.[5,6] The present study reports on a new sample of 337 patients with CHD (297 men and 40 women; age range 35 to 75 years, mean 57.0) who participated in the program between January 1993 and December 1997. This program comprised 36 sessions (3 × 1 hour/week) of electrocardiographically monitored exercise training, psychosocial group sessions for patients/spouses, and patient counseling.[10] Patients who had an acute myocardial infarction (n = 136), coronary artery bypass grafting (CABG; n = 211), or percutaneous coronary intervention (n = 92) within 2 months before entering rehabilitation were included in the study. Patients with a major medical

Table 1
Baseline characteristics according to five-year incidence of cardiac events

Baseline Characteristics	Major Adverse Cardiac Events*			
	Event Free (n = 291)	Cardiac Events (n = 46)	Odds Ratio (95% CI)	p Value[†]
Men	260 (89%)	37 (80%)	0.49 (0.22–1.11)	0.09
Age ≤55 yrs	128 (44%)	20 (44%)	0.98 (0.52–1.83)	NS
Index myocardial infarction	107 (37%)	29 (63%)	2.93 (1.54–5.59)	0.001
Left ventricular dysfunction (≤40%)	24 (8%)	9 (20%)	2.71 (1.17–6.27)	0.02
Poor exercise tolerance	156 (54%)	24 (52%)	0.94 (0.51–1.76)	NS
Multivessel disease	201 (69%)	30 (65%)	0.81 (0.37–1.79)	NS
No coronary bypass at baseline	93 (32%)	33 (72%)	5.40 (2.72–10.75)	0.0001

* Composite of cardiac death, recurrent myocardial infarction, CABG, or percutaneous coronary intervention.

[†] Univariate analysis; not significant at a p value >0.20.

CI = confidence interval.

co-morbidity, such as cancer or renal failure, were excluded. Medical care in the follow-up interval consisted of a cardiologic check-up every 6 months.

To control for cardiac disorder as a determinant of prognosis, we included acute myocardial infarction at baseline, left ventricular function, exercise tolerance, and multivessel disease as indexes of disease severity. A decrease in left ventricular function was defined as a left ventricular ejection fraction ≤40% and poor exercise tolerance as peak workloads ≤140 W for younger patients and ≤120 W for older patients (as assessed by using a symptom-limited exercise test 6 weeks after the index event). Treatment factors included thrombolytic therapy, CABG or percutaneous coronary intervention at baseline, and treatment with aspirin, β blockers, or statins at discharge from the program. Standard risk factors included gender, age, systolic/diastolic blood pressures, and levels of total cholesterol, high-density lipoprotein cholesterol, and triglycerides.

All patients completed psychological scales at entry to the rehabilitation program. The 12-item GHQ (GHQ-12) is a robust stress measurement[1] and was scored using the binary method, i.e., a subject received a score of 1 on a given item if he/she indicated experiencing the specific symptom of stress "more" or "much more" than usual. Patients obtained scores from 0 to 12 and were classified as having high stress if they scored in the upper quartile (score >6). By analogy with previous research,[6] we used the 16-item Type D Scale[11] to assess type D personality. The Type D Scale focuses on negative affect in general (depression, anxiety, and irritability) and provides additional information on a patient's level of inhibition. The 16-item Type D Scale is psychometrically sound, with Cronbach's $\alpha = 0.89$ and 0.82 for its subscales "negative affectivity" and "inhibition," respectively.[11] Only those who score high on the 2 components, according to previously established cutoffs of ≥9 on negative affectivity and ≥15 on social inhibition, are classified as having a type D personality.[6,11] In this study, 98 patients were classified as type D and 239 as non–type D.

The end point was a major adverse cardiac event, which was defined as a composite of cardiac death, myocardial infarction, and cardiac revascularization (CABG/percutaneous coronary intervention) at 5-year follow-up. Mortality, acute myocardial infarction, and CABG/percutaneous coronary intervention data were derived from hospital records and discussed with a patient's attending physician. Unpaired t test, cross tabulation, and logistic regression analysis were used to examine the effect of biomedical, and psychological factors on prognosis. Multiple logistic regression analysis was used to determine the independent predictors of cardiac events. Criteria for entry and removal were based on the likelihood ratio test, with limits set at p values ≤0.05 and >0.05. Patients were also stratified by left ventricular ejection fraction and type D to compare the effect of biomedical and psychological risk factors on cardiac events. All statistical tests were 2-tailed.

There were no patients lost to follow-up. After 5 years, 46 patients (14%) developed a major adverse cardiac event (cardiac death, n = 4; nonfatal acute myocardial infarction, n = 8; CABG/percutaneous transluminal coronary angioplasty, n = 34); this number corresponds well with the 15% (49 of 319) cardiac event rate reported in our previous 5-year follow-up study.[6] Index acute myocardial infarction, left ventricular ejection fraction ≤40%, and no invasive treatment with CABG were significant predictors of cardiac events at follow-up (Table 1). None of the medical treatment variables (thrombolytic therapy, aspirin therapy, β blockers, or statins) or cardiac risk factors (blood pressure and levels of total and high-density lipoprotein cholesterol and triglycerides) was significantly associated with the clinical end points.

Psychological factors were also associated with prognosis. Patients with high baseline levels of stress had a greater risk for major adverse cardiac events than did nonstressed patients (Figure 1). This finding was replicated with the type D measurement of psychological risk; type D patients had a greater risk for major adverse cardiac events than did non–type D patients (Figure 1). Consistent with previous research,[7,12] type D patients also had a significantly increased risk of death or acute myocardial infarction (odds ratio 4.84, 95% confidence interval 1.42 to 16.52, p = 0.01).
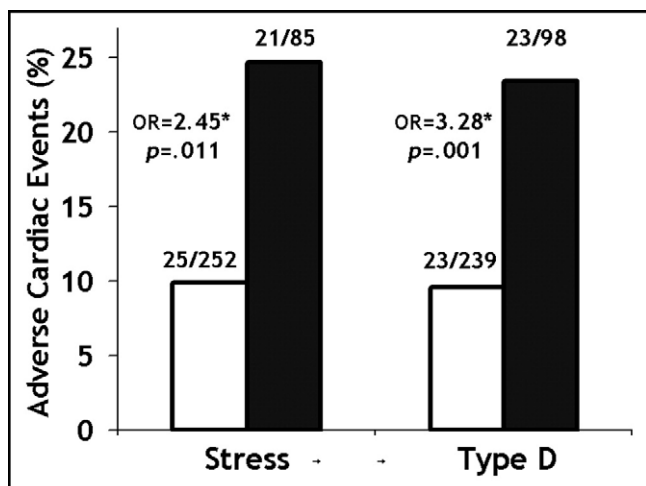
Figure 1. Association between stress, type D personality, and major adverse cardiac events in patients with *(solid bars)* and without *(open bars)* distress. Numbers of patients are presented on the top of each bar. *Adjusted for gender, age, index acute myocardial infarction, left ventricular dysfunction, and CABG. OR = odds ratio.

Table 2
Multivariable predictors of major adverse cardiac events*

Baseline Characteristics	Odds Ratio (95% CI)	p Value
Men	0.55 (0.22–1.35)	0.19
Age	1.01 (0.97–1.05)	0.67
Left ventricular dysfunction (≤40%)	4.63 (1.73–12.42)	0.002
No CABG at baseline	6.07 (2.33–15.81)	0.0001
Index myocardial infarction	1.13 (0.46–2.78)	0.79
Psychological stress[†]	2.01 (0.99–4.11)	0.054
Type D personality[‡]	2.90 (1.42–5.92)	0.003

* Multivariate logistic regression analysis (enter procedure); the dependent variable cardiac death, acute myocardial infarction, CABG, or percutaneous coronary intervention was coded as 1 (n = 46 of 337).

[†] A score >6 on the GHQ-12[9] is coded as 1.

[‡] Type D personality as measured by the 16-item Type D Scale[11] is coded as 1.

Abbreviation as in Table 1.

To examine whether stress and type D personality were independent predictors of major adverse cardiac events, we entered these psychological factors and the biomedical risk factors in a logistic regression model. Type D personality remained an independent predictor of major adverse cardiac events (Table 2), in addition to no CABG and a left ventricular ejection fraction ≤40%; stress was marginally significant. Analyses using continuous scores for the stress and type D scales did not change the results, nor did the use of a different cutoff for the GHQ-12 scale.

When stratifying patients by index acute myocardial infarction, the risk of major adverse cardiac events associated with type D personality was comparable to the risk associated with a left ventricular ejection fraction ≤40% in patients after acute myocardial infarction (Figure 2). This finding was replicated in patients with coronary disease who did not develop an acute myocardial infarction at baseline (Figure 2). Hence, the risk for major adverse cardiac events
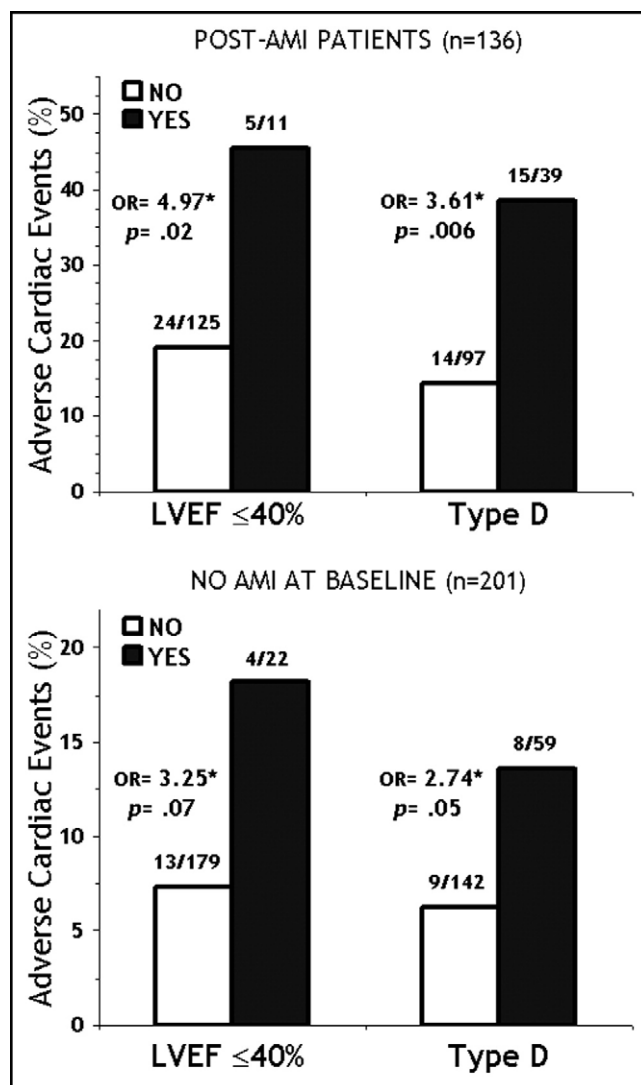

Figure 2. Association between left ventricular ejection fraction (LVEF) ≤40%, type D personality, and major adverse cardiac events as stratified by index acute myocardial infarction (AMI). Numbers of patients are presented on the top of each bar. *Adjusted for gender and age. Other abbreviation as in Figure 1.

associated with type D personality was not confined to patients after acute myocardial infarction and was of significant clinical magnitude when using left ventricular dysfunction as a benchmark.

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This is the first study to compare the effect of psychological stress with that of type D personality on cardiac prognosis. Findings indicated that type D personality predicted cardiac events in patients with CHD after adjusting for concurrent symptoms of stress and potential biomedical confounders. In univariate analyses, psychological stress and type D personality were associated with an almost threefold increased risk of a composite of cardiac death, acute myocardial infarction, CABG, and percutaneous coronary intervention at 5-year follow-up. When entering these factors in a mul-

tivariable model, type D personality remained an independent predictor of cardiac events in addition to left ventricular dysfunction and lack of CABG.

These findings may not be generalizable to women because they comprised only 12% of the sample. Further, all patients attended a rehabilitation program, which may have led to a decrease in distress in some patients that had a positive effect on their prognosis.[10] Evidence also suggests that exercise training by itself may result in improved survival.[13] We had no information on diabetes or renal failure, but previous research has shown that these co-morbid conditions do not modulate the detrimental effect of type D personality on prognosis.[7]

The present findings have important implications for clinical research and practice. First, they provide convincing evidence for the notion that we need to examine acute (stress) and long-term (type D personality) factors to identify high-risk patients.[8,9] Our findings not only confirmed the association between GHQ stress scores and increased risk of cardiac events[2–4] but also showed that inclusion of type D personality significantly improves risk stratification. Second, these findings emphasize the need to explore different behavioral and pharmacologic treatment approaches for high-risk patients. Others have shown that behavioral intervention decreases GHQ stress scores and improves markers of cardiac risk in patients with CHD.[14] Decreasing emotional distress through rehabilitation[10] or antidepressants[15] may also lead to improved prognosis.

The finding of an adverse effect of type D personality on cardiac prognosis was robust and could not be explained away by concurrent stress symptoms and thus confirms findings from other studies[5–7,12] and emphasizes the need to determine its biologic[16,17] and behavioral[18] characteristics that promote disease progression. The recent introduction of the 14-item Type D Scale[19] as a standard measurement of type D personality makes it possible to address these issues in clinical research and practice because this brief scale poses minimal burden to patients and has been shown to predict events.[7,18]

Previous research has shown that the personality traits that define type D personality do not depend on mood state but are stable over time.[19] This study confirms that type D personality reflects more than temporary changes in stress level, because it predicted events after controlling for concurrent stress symptoms and thus provides more evidence for the notion that it is a stable personality type.

In a recent report on the screening of psychosocial factors in clinical practice, the 14-item Type D Scale was recommended as a screening tool.[20] The present study clearly supports this recommendation.

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