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Published in:
American Journal of Cardiology

Document version:
Publisher's PDF, also known as Version of record

Publication date:
2005

[Link to publication](#)

Citation for published version (APA):
Aquarius, A. E., Denollet, J., Hamming, J. F., & de Vries, J. (2005). Role of disease status and Type D personality in outcomes in patients with peripheral arterial disease. *American Journal of Cardiology*, 96(7), 996-1001.

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Role of Disease Status and Type D Personality in Outcomes in Patients With Peripheral Arterial Disease

Annelies E. Aquarius, MA^{a,b,*}, Johan Denollet, PhD^{a,b}, Jaap F. Hamming, MD, PhD^c, and Jolanda De Vries, PhD, MSc^{a,b,d}

Patients with peripheral arterial disease (PAD) often experience diminishing quality of life (QOL) in many domains of their lives. However, factors associated with impaired QOL and perceived stress in these patients are not completely understood. The relative effects of disease status and type D (“distressed”) personality (tendencies to experience negative emotions and be socially inhibited) on these patient-based outcomes were examined. It has been argued that type D personality might depend on disease status; therefore, its effect was examined in a combined sample of 150 patients with PAD and 150 healthy controls. The Type D Scale-14, World Health Organization Quality of Life Assessment Instrument-100, and Perceived Stress Scale-10 Item assessed type D personality, QOL, and perceived stress, respectively. PAD severity (mild, moderate, or severe) was not associated with QOL or perceived stress. However, patients with PAD reported decreased QOL ($p < 0.05$) compared with healthy controls. Type D patients reported significantly poorer QOL than non-type D patients across PAD and healthy subgroups ($p < 0.0001$). After controlling for disease status (presence or absence of PAD), type D personality remained associated with increased risk for impaired QOL (odds ratio [OR] 7.35, 95% confidence interval [CI] 3.39 to 15.96, $p < 0.0001$) and perceived stress (OR 6.45, 95% CI 3.42 to 12.18, $p < 0.0001$). Hence, type D personality was associated with impaired QOL beyond the impairment already related to PAD and with increased stress in this high-risk population. In conclusion, type D personality is not merely a function of PAD but seems to represent a different determinant of patient-based outcomes. © 2005 Elsevier Inc. All rights reserved. (Am J Cardiol 2005;96:996–1001)

Assessing patient-based outcomes, such as quality of life (QOL), and identifying their determinants have become increasingly important in peripheral arterial disease (PAD). Patients with PAD often experience a substantial degree of functional impairment¹ and poor QOL.² However, the influence of psychologic factors in PAD is not clear yet. Psychologic stress has been related to cardiovascular reactivity³ and increased risk for cardiovascular events,^{4,5} indicating that stress may contribute to the atherosclerotic process³ and that therapy should be aimed at stress management.⁵ Type D (“distressed”) personality refers to the tendency to experience psychologic stress across time and situations and has been known to predict morbidity, mortality, and poor QOL in coronary artery disease.^{6,7} The present study examined the effect of type D personality and disease status (varying degrees of PAD) on QOL and stress in a combined sample of patients with PAD and healthy controls. We hypothe-

sized that type D personality is adversely related to patient-based outcomes, even after controlling for disease status.

Methods

Study population: PATIENTS WITH PAD: From September 2001 to October 2003, 190 patients presenting with intermittent claudication, a common form of PAD, were referred to the vascular outpatient clinic of the St. Elisabeth Hospital (Tilburg, The Netherlands), by their general practitioners for diagnosis. Intermittent claudication was defined as limitations in a patient’s walking capacity due to pain, caused by obstruction of the arteries in the lower limbs.⁸ Patients were diagnosed on the basis of a medical history, physical examinations, pain-free and maximum treadmill walking distances, and ankle-brachial pressure indexes. Five patients were excluded from the study because of cognitive impairment (2 patients), visual problems, illness, and participation in another trial. Of the remaining 185 patients, 150 (81%) agreed to participate (Table 1). The local ethics committee approved the study. All patients gave written informed consent.

HEALTHY SUBJECTS: It has been argued that type D personality might be dependent on disease status. Therefore, healthy subjects from the general population were included in this study. Exclusion criteria were co-morbidities, med-

^aDepartment of Psychology and Health, Tilburg University, Tilburg; ^bResearch Institute for Psychology and Health, Utrecht; ^cDepartment of Surgery, Leiden University Medical Center, Leiden; and ^dSt. Elisabeth Hospital, Tilburg, The Netherlands. Manuscript received March 4, 2005; revised manuscript received and accepted May 16, 2005.

* Corresponding author: Tel: 31-134662715; fax: 31-134662370.

E-mail address: a.e.a.aquarius@uvt.nl (A.E. Aquarius).

Table 1
Characteristics of 150 patients with intermittent claudication

Characteristic	Value
Mean age (yrs)	64.1 ± 9.5
Mean ankle-brachial pressure index	0.62 ± 0.15
Mean pain-free walking distance (m)	120.3 ± 155
Mean maximum walking distance (m)	384.4 ± 325
Men/women	97 (64.7%)/53 (35.3%)
Mild claudication	44 (29.3%)
Moderate claudication	54 (36.6%)
Severe claudication	52 (34.7%)
Diabetes mellitus	26 (17.3%)
Tobacco use	85 (56.7%)
Hypertension	63 (42%)
Hyperlipidaemia	84 (56%)
Cardiac status	47 (31.3%)
Carotid status	17 (11.3%)
Renal status	6 (4%)
Pulmonary status	11 (7.3%)

ication use, or recent hospitalization. Data were available for 209 healthy subjects; 150 subjects >40 years of age were selected on the basis of age and gender (97 men [64.7%], 53 women [35.3%]) as healthy controls for the 150 patients with PAD. Despite our attempt to match for age, the healthy subjects were significantly younger (mean 53 ± 5.2 years) than the patients with PAD ($p = 0.0001$).

Independent variables: DISEASE STATUS: Intermittent claudication was classified as mild, moderate, or severe according to the Society for Vascular Surgery/North American Chapter of the International Society for Cardiovascular Surgery.⁹ In all patients, pain-free and maximum treadmill walking distances and ankle-brachial pressure indexes (the ratio of the ankle systolic blood pressure to the brachial artery systolic blood pressure) were measured as indexes of the severity of PAD. The ankle-brachial pressure index has a normal value at rest of about 1.0¹⁰; a value of <0.9 is highly sensitive to detect PAD.^{11,12}

CO-MORBIDITIES: Ninety-five percent of patients with PAD may have ≥1 cardiovascular risk factor.¹³ These risk factors (diabetes mellitus, smoking, hypertension, hyperlipidemia, and cardiac, carotid, renal, and pulmonary status) were measured according to recommended standards.⁹

TYPE D PERSONALITY: The 14-item Type D Scale-14 was used to measure type D personality.¹⁴ The scale consists of 2 subscales: negative affectivity (the tendency to experience negative emotions, e.g., “I often find myself worrying about something”) and social inhibition (the tendency to inhibit self-expression in social interaction, e.g., “I am a closed kind of person”). The combination of high scores (≥10) on the 2 scales indicates type D personality. Test-retest correlations are 0.82 and 0.72 for the social inhibition and negative affectivity scales, respectively, indicating that type D personality is stable across time.¹⁴ It has been shown that the assessment of type D personality is not dependent on mood or health state.¹⁴

Patient-based outcomes: QOL: An abbreviated version of the World Health Organization Quality of Life Assessment Instrument-100 was used to measure QOL.¹⁵ This version has been validated in patients with intermittent claudication¹⁶ and includes 10 facets of QOL: physical health (3 facets), level of independence (4 facets), overall QOL, negative feelings, and participation in recreation and leisure. The instrument has good reliability and validity¹⁵ and is sensitive to treatment-related change.¹⁷

PERCEIVED STRESS: The Perceived Stress Scale-10 Item assesses the degree to which situations within a subject's life are appraised as stressful.¹⁸ The scale has good reliability and validity.¹⁸

Statistical analyses: To determine differences in QOL and stress as a function of disease severity (mild, moderate, and severe) in patients with PAD, analyses of variance were performed with age and gender as covariates. Next, Student's *t* tests for independent samples (continuous variables), and chi-square tests (nominal variables) were used to examine differences between patients with PAD and healthy subjects with regard to type D personality, QOL, and stress. Type D and non-type D patients (healthy subjects and patients with PAD) were compared with regard to QOL and stress using Student's *t* tests for independent samples. Subsequently, the role of co-morbidities on QOL and stress was examined in patients with PAD (co-morbidity was an exclusion criterion for our healthy sample). Significant co-morbidity variables were included into a multivariate logistic regression model. A multivariate logistic regression analysis (enter method) was used to examine the relative effect of disease status (having PAD or not) and type D personality on QOL and perceived stress, with age, gender, and co-morbidity variables as covariates. For this purpose, scores on the World Health Organization Quality of Life Assessment Instrument-100 were dichotomized into poor QOL (first quartile) and average or high QOL on the basis of the cut-off scores of the healthy reference group. Likewise, scores on the Perceived Stress Scale-10 Item were dichotomized into low scores (“never” to “sometimes” stress) and high scores (“often” to “always” stress). To determine differences in QOL and stress in respondent subgroups, analyses of variance were performed using post hoc Scheffé tests. All statistical analyses were done using the SPSS version 11.5 (SPSS, Inc., Chicago, Illinois).

Results

Severity of PAD: Within the patient group, the severity of PAD was not related to type D personality. No significant differences were found between type D and non-type D patients with regard to ankle-brachial pressure index ($p = 0.531$), pain-free walking distance ($p = 0.467$), or maximum walking distance ($p = 0.437$). Type D personality was equally present in patients with mild, moderate, and severe PAD (37%, 35%, and 33%, respectively). With regard to

Table 2

Mean QOL and perceived stress scores (and SD) as a function of disease severity in the PAD population (n = 150), after controlling for age and gender

Variable	Mild PAD	Moderate PAD	Severe PAD	p Value
WHOQOL physical health	13.3 ± 2.8	12.9 ± 2.8	13.5 ± 2.0	0.483
Pain and discomfort*	12.1 ± 2.8	12.1 ± 2.7	12.4 ± 2.4	0.838
Energy and fatigue	12.6 ± 3.5	11.7 ± 3.3	12.8 ± 2.7	0.165
Sleep and rest	15.5 ± 4.1	15.0 ± 4.5	16.0 ± 3.8	0.484
WHOQOL level of independence	13.3 ± 2.8	12.7 ± 2.6	12.7 ± 2.5	0.508
Mobility	11.7 ± 2.7	11.3 ± 2.6	11.2 ± 2.7	0.621
Activities of daily living	14.1 ± 3.3	13.5 ± 3.3	13.5 ± 3.0	0.564
Dependence on medication or treatment*	10.8 ± 3.5	11.5 ± 3.5	11.2 ± 3.5	0.669
Working capacity	14.1 ± 3.8	13.4 ± 3.9	13.1 ± 3.8	0.540
WHOQOL separate facets				
Overall QOL and general health	13.5 ± 2.8	13.2 ± 3.1	14.0 ± 2.7	0.337
Negative feelings*	10.2 ± 3.3	9.0 ± 3.4	9.4 ± 2.9	0.175
Participating in and opportunities for recreation and leisure	13.8 ± 3.5	14.0 ± 3.2	13.8 ± 2.6	0.942
Perceived stress	19.7 ± 5.1	20.5 ± 5.8	19.9 ± 5.1	0.759

* The scores on the QOL facets pain and discomfort, negative feelings, and dependence on medication and treatment are inverted: high scores indicate low QOL.

WHOQOL = World Health Organization Quality of Life Assessment Instrument-100.

Table 3

Mean QOL and perceived stress scores (and SD) according to disease status and type D personality status

Variable	PAD	Healthy	p Value	Type D Personality	Non-Type D Personality	p Value
WHOQOL physical health	13.2 ± 2.6	16.1 ± 2.0	0.0001	12.6 ± 2.5	15.3 ± 2.4	0.0001
Pain and discomfort*	12.2 ± 2.6	8.2 ± 2.4	0.0001	12.3 ± 2.7	9.5 ± 3.1	0.0001
Energy and fatigue	12.3 ± 3.2	15.9 ± 2.2	0.0001	11.6 ± 3.1	14.9 ± 2.9	0.0001
Sleep and rest	15.5 ± 4.1	16.5 ± 3.1	0.016	14.4 ± 4.1	16.5 ± 3.4	0.0001
WHOQOL level of independence	12.9 ± 2.7	18.1 ± 1.4	0.0001	13.1 ± 3.3	16.3 ± 3.0	0.0001
Mobility	11.4 ± 2.7	17.8 ± 2.3	0.0001	12.1 ± 3.6	15.4 ± 3.9	0.0001
Activities of daily living	13.7 ± 3.2	17.7 ± 1.9	0.0001	13.2 ± 3.3	16.4 ± 2.9	0.0001
Dependence on medication or treatment*	11.2 ± 3.5	4.8 ± 1.7	0.0001	10.2 ± 4.1	7.2 ± 4.0	0.0001
Working capacity	13.6 ± 3.8	17.7 ± 2.0	0.0001	13.0 ± 3.9	16.5 ± 3.2	0.0001
WHOQOL separate facets						
Overall QOL and general health	13.6 ± 2.9	16.9 ± 2.1	0.0001	12.9 ± 2.8	16.0 ± 2.7	0.0001
Negative feelings*	9.5 ± 3.2	8.1 ± 2.4	0.0001	11.17 ± 2.7	8.0 ± 2.6	0.0001
Participating in and opportunities for recreation and leisure	13.9 ± 3.1	16.2 ± 2.2	0.0001	12.6 ± 2.8	15.8 ± 2.5	0.0001
Perceived stress	20.1 ± 5.3	17.6 ± 3.8	0.0001	22.5 ± 4.1	17.7 ± 4.4	0.0001

* The scores on the QOL facets pain and discomfort, negative feelings, and dependence on medication and treatment are inverted: high scores indicate low QOL.

Abbreviations as in Table 2.

QOL or perceived stress, no differences were found among mild, moderate, and severe PAD (Table 2). These findings warranted further analyses in which patients with mild, moderate, and severe PAD were merged into 1 category of PAD. None of the cardiovascular co-morbidity variables was associated with QOL or perceived stress (data not shown). Therefore, co-morbidity variables were not included in further analyses.

Patients with PAD versus healthy subjects: Patients with PAD were severely impaired in their QOL compared with healthy subjects (Table 3). For example, patients with PAD had a mean score of 12.9 on level of independence, whereas healthy subjects had a mean score of 18.1. Patients with PAD also reported more perceived stress than healthy subjects.

Type D personality and patient-based outcomes:

Type D subjects reported significantly poorer QOL across PAD and healthy samples (Table 3). For example, type D subjects had a mean score of 11.6 on energy, whereas non-type D subjects scored nearly 15, indicating better QOL. Type D subjects also reported more perceived stress than non-type D subjects.

Disease status and type D personality as predictors of QOL and perceived stress:

Type D personality was significantly more prevalent in patients with PAD than in healthy controls (chi-square 19.02, 1 degree of freedom; 34.9% vs 13.3%; $p < 0.001$). Therefore, multivariate analyses were performed to determine the relative influence of disease status (having PAD or not) and type D personality on outcomes (Table 4). PAD was associated with a substan-

Table 4
Predictors of impaired QOL and perceived stress in the total study group (n = 300) (multivariate logistic regression analyses)

Variable	Predictor	OR	95% CI	p Value
WHOQOL physical health	Age*	1.01	0.97–1.04	.709
	Female gender	1.67	0.94–2.96	.083
	Diagnosis of PAD	6.76	3.43–13.33	.001
	Type D personality	4.80	2.40–9.58	.001
WHOQOL level of independence	Age*	1.02	0.96–1.07	.582
	Female gender	1.01	0.49–2.09	.983
	Diagnosis of PAD	46.35	17.31–124.13	.001
	Type D personality	3.61	1.48–8.79	.005
WHOQOL overall QOL and general health	Age*	0.99	0.95–1.03	.572
	Male gender	1.63	0.86–3.08	.131
	Diagnosis of PAD	15.84	7.33–34.23	.001
	Type D personality	7.35	3.39–15.96	.001
Perceived stress	Age*	1.03	0.99–1.06	.187
	Female gender	2.64	1.49–4.68	.001
	Diagnosis of PAD	1.86	0.93–3.73	.081
	Type D personality	6.45	3.42–12.18	.0001

* Age was entered as a continuous variable.

CI = confidence interval; OR = odds ratio; other abbreviation as in Table 2.

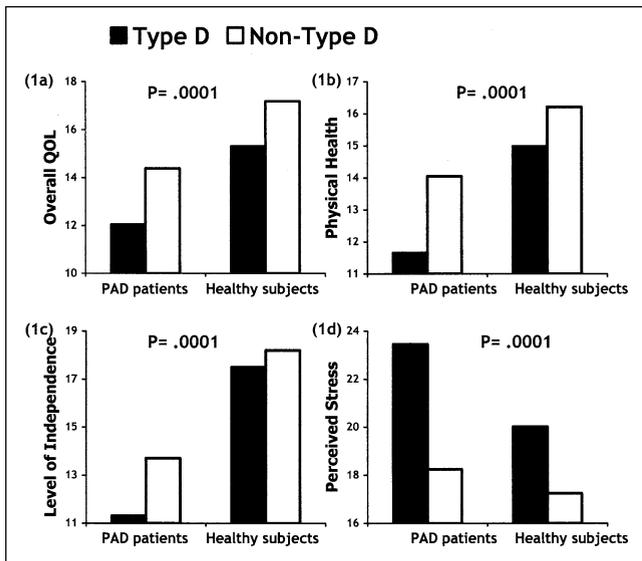


Figure 1. Overall QOL (A), physical health (B), level of independence (C), and perceived stress (D) stratified by disease and type D personality status.

tial decrease in all aspects of QOL and with a decrease in the level of independence in particular. Type D personality was significantly associated with impaired QOL, adjusting for disease status, age, and gender. Type D personality and female gender, but not disease status, were significantly associated with perceived stress (Table 4).

Because disease status and personality were associated with QOL, we classified the subjects according to the presence or absence of PAD and type D personality, which led to 4 subgroups. Patients with PAD with type D personality were most impaired in their physical health, level of independence, and overall QOL and reported the highest levels of perceived stress (Figure 1). Subgroup analyses showed

no differences between healthy type D subjects and non-type D patients with PAD in overall QOL ($p = 0.469$), physical health ($p = 0.364$), and perceived stress ($p = 0.370$). Healthy type D subjects were equally impaired in their QOL and reported the same high stress levels as non-type D patients with PAD.

Discussion

In the present study, type D personality and PAD were associated with impaired QOL. Hence, type D personality was associated with impaired QOL, in addition to the impairment already related to having PAD. Type D personality and female gender, but not disease status, were associated with increased stress. Type D personality is not merely a function of PAD but seems to represent a different determinant of patient-based outcomes.

In line with the present findings, previous studies have shown that the relation between PAD severity indexes and patient-based outcomes is rather weak.^{16,19–21} Although measures of disease severity may predict functional impairment,¹ they only partially determine QOL.^{16,19,20} Unfortunately, little is known about the impact of personality factors on QOL in patients with PAD. In cardiac patients, it has been demonstrated that personality is associated with impaired QOL.⁶ Factors associated with impaired QOL in patients with PAD are not fully understood. However, the present study showed a significant relation between personality and QOL in patients with PAD.

To our knowledge, only a few studies have included personality characteristics in research on PAD.^{22,23} Results from the Edinburgh Artery Study showed that social deprivation and personality factors, such as hostility, were directly associated with baseline ankle-brachial pressure

index and indirectly associated with the progression of atherosclerosis.²² In addition, Deary et al²³ argued that hostile personality might be an independent risk factor for PAD. The results from the present study correspond with these findings. Type D personality had an adverse effect on health outcomes such as QOL and perceived stress, adjusting for demographic and disease variables. As already shown in cardiac patient groups^{24–26} and in PAD patients,² impaired QOL is associated with an increased rate of hospitalization. In addition, patients with high levels of perceived stress are at increased risk for stroke and coronary artery disease.⁴ Despite these findings, the influence of personality is still often ignored, whereas age and gender are traditionally included in cardiovascular research as patient difference variables. The present findings demonstrate the need to study risk factors that may predict poor QOL and perceived stress in patients with PAD. Our findings indicate the importance of including personality in research on PAD as a determinant of adverse health outcomes.

This study has some limitations. First, because of logistic reasons, pain-free and maximum treadmill walking distance and ankle-brachial pressure could not be measured in the healthy subjects. It has been shown that some patients with PAD have latent disease or are even asymptomatic.²⁷ Therefore, there is no guarantee that PAD was absent in the healthy group. Second, patients with PAD were significantly older than their healthy controls. Despite our attempt to match for age, it was not completely possible to find an age- and gender-matched control for each patient. Because this difference could influence our results, age was used as a covariate in our analyses. Third, patients with ischemic pain at rest or tissue loss were not included in the present study. Because patients with chronic critical limb ischemia are often elderly and frail, their long-term survival is worse than that of patients with intermittent claudication,²⁸ which could influence their QOL. Fourth, because of the cross-sectional study design, we cannot infer any causal relation between type D personality and QOL. However, the effect of type D personality on QOL is in accordance with previous prospective studies that used 5- to 10-year follow-up periods in patients with coronary heart disease.^{6,29} Therefore, the findings of the present study warrant future prospective research on type D personality in PAD.

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