

Psychological Characteristics of Patients Undergoing Percutaneous Coronary Interventions

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Abstract

Background: There is few data evaluating the prevalence and influence of adverse psychological characteristics on the prognosis of individuals submitted to percutaneous coronary interventions. No study has addressed this issue in Brazil.

Objective: To investigate the prevalence of depression, anxiety, psychological stress, and Type D personality and its association with cardiovascular events in patients undergoing percutaneous coronary interventions.

Methods: Psychological characteristics were evaluated by scales: Beck Depression Inventory, Beck Anxiety Inventory, Lipp Inventory for Stress Symptoms for Adults and Type D Personality Scale. The end-point of this study was the occurrence of major cardiovascular events in one-year follow-up.

Results: During March and May 2006, 137 patients were included. Type D personality was identified in 34% of the cases, 29% presented anxiety, 25% presented depression and 70% of the patients presented stress. In relation to the frequency of psychological characteristics according to the occurrence of major adverse cardiovascular events, there was no statistical difference between both groups of patients regarding depression (29% vs. 26% $p = 0.8$), anxiety (33% vs. 23% $p = 0.3$), stress (76% vs. 65% $p = 0.3$), and Type D personality (33% vs. 32% $p = 0.9$). However, the negative affectivity score was significantly higher in the group of patients presenting events (13.9 vs. 9.8 $p = 0.01$).

Conclusions: In patients submitted to percutaneous coronary interventions, the prevalence of adverse psychological characteristics was high. One-year major cardiovascular adverse events were associated with baseline negative affectivity, but not with the other psychological characteristics studied (Arq Bras Cardiol 2011;97(4):331-337)

Keywords: Angioplasty/psychology; stents/psychology; coronary disease; stress, psychological.

Introduction

Patients submitted to percutaneous coronary interventions (PCI) with stent implantation are at an increased risk of recurrent cardiovascular events, either due to progression of the disease or to restenosis in the vessel treated by the stent. Cardiovascular events related to restenosis are more frequent than disease progression in the first year after PCI with stent implantation¹. Several clinical and angiographic restenosis predictors have already been identified: diabetes mellitus, lesion length, small vessels, ostial lesions, residual stenosis after the procedure and use of multiple stents²⁻⁴. Recently, endothelial dysfunction has also been associated to the pathophysiology of restenosis, since it is considered one of the earliest events in the genesis of atherosclerosis and is related to intimal hyperplasia and disease prognosis^{5,6}.

Despite current knowledge, a substantial number of major adverse cardiovascular events (MACE) that may occur

after a PCI were not properly identified by the predictive models available. The assessment of other restenosis and new cardiovascular risk factors is necessary. Linked to endothelial dysfunction, psychological aspects have emerged as potential candidates⁷⁻⁹.

The prevalence of psychological characteristics, such as depression, anxiety, stress and Type D personality in patients submitted to coronary stent implantation was not properly studied. This analysis could help in the stratification of MACE risk in the long-term follow-up. This study sought to evaluate the influence of psychological characteristics in the long-term prognosis of patients submitted to PCI.

Methods

Patients

Patients considered for inclusion were those submitted to PCI with coronary stent implantation from March to May 2006 at a reference center for Interventional Cardiology in southern Brazil. Only hemodynamically stable patients with procedures scheduled to take place within business hours were enrolled. Clinical, procedural, angiographic and psychological

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characteristics were prospectively collected and registered in a dedicated database. Exclusion criteria included patients under 18 years old, patients with ongoing ST-segment elevation myocardial infarction (STEMI), post-procedural in-hospital MACE, unsuccessful procedures and restenotic lesions. Non-ST segment elevation acute coronary syndromes, including non-ST elevation myocardial infarction (NSTEMI) were included. The interviews were conducted by trained researchers in the study protocol during the index hospitalization.

The study was approved by the Ethics Research Committee of the institution, and informed consent was signed by all patients.

Clinical Assessment

Patient interview included the analysis of medical history, risk factors for coronary artery disease (CAD), and clinical presentation. Regarding the previous medical history, the following were registered: occurrence of previous MI, PCI or coronary artery bypass grafting (CABG). Regarding risk factors, presence of hypertension, dyslipidemia, smoking and diabetes mellitus were taken into account. Concerning the clinical presentation, patients were classified as: stable angina or acute coronary syndrome.

For CAD risk factors, the following definitions were used:

I) *Hypertension*: blood pressure at rest higher or equal to 140/90 or use of anti-hypertensive medications;

II) *Dyslipidemia*: fasting serum cholesterol higher than 240mg/dl or use of statins;

III) *Smoking*: regular smoking of tobacco or interruption of use over the last year;

IV) *Diabetes mellitus*: fasting glucose measure > 126mg/dl or use of drugs for the treatment of diabetes.

For the clinical presentation of the patients before stent implantation, the following definitions were used:

I) *Stable angina*: Constant angina caused by efforts, which can be associated to dyspnea. Duration from 5 to 30 minutes and disappearance or relief in 5 – 15 minutes with rest or use of nitrate. No rest pain without a changing pattern in the last 2 months.

II) *Acute coronary syndrome*: Angina at minimal efforts or at rest, persistent (>30 minutes) or not, or which increased frequency, duration or seriousness of the episodes. The EKG presents inversion of the T waves or ST segment shift \geq 1mm from baseline.

Variables related to the psychosocial profile were also assessed, such as number of years attending school, marital status, and home and workplace characteristics. Diagnosis or previous psychiatric treatment and use of psychiatric drugs were also registered.

Psychological assessment

The psychological assessment consisted of investigation of depression, anxiety, chronic psychological stress and Type D personality. For the investigation of depression, the Beck Depression Inventory (BDI) was applied¹⁰; for anxiety, the Beck Anxiety Inventory (BAI)¹¹. For the verification of the presence

of chronic psychological stress, the Lipp Inventory for Stress Symptoms for Adults (ISSL)¹². The Type D Scale-14 (DS14) tool was used in the investigation of Type D personality^{13,14}.

The BDI and the BAI are scale measures, whose sum of scores of individual items provides a total score that is classified in intensity levels. In the BDI, questions address feelings of sadness, depreciation, loss of perspective regarding future opportunities, soreness, loss of interest and pleasure in daily activities and human relationships. Sleep and eating disorders are also assessed. In the BAI, questions typically address psychosomatic symptoms: numbness and paresthesia, palpitations, fear of dying, nervousness and difficult to breathe. Both instruments can be used in patients from 17 to 80 years of age, psychiatric or non-psychiatric. The way of applying BDI and BAI is the same, with self-administration being possible (individually or in groups) and also by oral administration. In this study, we applied the oral questionnaire individually to each patient, and 20 points in the score was the cutoff value that classified patients as having moderate/serious depression and/or anxiety.

Two independent domains, negative affectivity (dysphoria, low self-esteem and cognitive distortions) and social inhibition (alexithymia, trend to avoid social contact and social anxiety) constitute the DS14. Each of these domains is made up by seven questions. The sum of the scores indicates the presence or not of one of the characteristics of each domain. Type D personality is characterized in the case in which there is a total score higher or equal to 10 in both domains.

The ISSL seeks to identify, in an objective manner, the presence of stress symptoms, the type of symptom existing (somatic or psychological) and the phase in which it is (alert, resistance, almost-exhaustion and exhaustion). The methodology for calculating the score according to the presence of stress (alert, resistance, almost-exhaustion, and exhaustion) and type of symptoms (physical symptoms and psychological symptoms) were described in detail¹².

Stent Implantation Procedure

All the patients were receiving platelet inhibitors at the time of intervention: aspirin (100-200 mg per day) and thienopyridines (clopidogrel 75 mg per day or ticlopidine 250 mg twice a day). In urgent cases, the drugs were administered before or during the procedure, and the bolus doses of clopidogrel were 300 mg. Bolus doses of heparin were administered during the procedure to maintain activated coagulation time higher than 300 seconds (or at 200 to 300 seconds for those who received IIb/IIIa glycoprotein inhibitors). The lesions were treated with standard PCI techniques and only bare metal stents were used¹⁵. All other technical aspects were left at the discretion of the operating physicians.

Angiographic Analysis

All angiographic analyses were performed in at least two orthogonal projections by experienced operators through quantitative angiography with previously assessed digital systems (Siemens Axiom Artis – Munich, Germany). Intracoronary nitroglycerin was routinely administered at a dose of 100-200 μ g before the measurements. The diameter

of the target vessel was defined as the average diameter of the lumen segments, proximal or distal to the lesion, and the stenosis severity was measured in two orthogonal views. The length of the lesion was measured “shoulder to shoulder”, and longer lesions were considered as a single lesion only when a normal segment < 10 mm long was between them.

Follow-up and study endpoints

Patients were followed up for at least 1 year either by clinical evaluation in the outpatient clinic or by telephone contact. Control angiography was performed only when symptoms or signs of recurrent myocardial ischemia were present. The decision to perform a revascularization procedure was taken by the attending physician. Major adverse cardiovascular events (MACE) were defined as death, MI or TVR. The need for a new TVR in the 1-year period after the index stenting procedure (either by PCI or by coronary artery bypass grafting) was registered.

Statistical Analysis

The data were analyzed in the SPSS 13.0 statistics program. Values considered significant were those with $p < 0.05$. The continuous variables were expressed as average \pm standard deviation, and the categorical variables according to percentiles. The groups of patients with MACE were compared by the Student *t* test for independent data in the case of continuous variables. Categorical variables were analyzed through the Chi-square test. Correlations between psychological scales were assessed by the Pearson coefficient.

Results

During the study period, 137 patients were included. In relation to the patients' clinical characteristics, the mean age was 60.2 ± 10.1 years and 63% were male (Table 1). Regarding risk factors for CAD, systemic hypertension was observed in 87% of the patients, diabetes mellitus in 25%, smoking in 25% and dyslipidemia in 57%. Concerning the past medical history, 35% had already undergone PCI, 35% had a previous history of MI, and 11% had been submitted to CABG. The clinical presentation before stent implantation was of stable angina in 16% and acute coronary syndrome in 84%.

The angiographic characteristics of the stent implantation procedure are also described in Table 1. The mean ejection fraction was $65 \pm 4\%$, and there was a higher frequency of lesion in two vessels (44%), followed by lesion in one vessel (38%). Lesions in 3 or more vessels totaled 18% of the cases. The lesions most frequently addressed were in the left anterior descending and in the right coronary arteries (48% and 26%, respectively), 19% were in the circumflex, 5% in vein grafts and only 3% in the left main coronary artery. The stents implanted had an average diameter of 2.97 ± 0.41 mm and an average length of 16.4 ± 5.6 mm. In 71% of the patients only one stent was implanted, in 25% of the patients 2 stents were implanted and only 4% received 3 coronary stents.

Regarding the psychosocial profile of the patients, 68% of the patients were married, 44% of them had completed Elementary School, 69% were not working at the time of the study interview, and 59% said to be retired. Most of the patients (76%) had never undergone psychiatric treatment, 31% reported current use of psychiatric medication and 12% had a previous diagnosis of depression.

In relation to the psychological characteristics according to the study interview (Figure 1), anxiety was observed in 29% of the patients, depression in 25%, stress in 70% and Type D personality in 34%, and 51% of patients had negative affectivity. It was also found that 27% did not present any of the psychological characteristics, 29% presented at least one, 17% presented two, 14% presented three and 13% presented all four characteristics investigated in this study.

One-year clinical follow-up was completed in 125 (92%) patients, and 19 patients (15%) presented MACE. Nine patients (7%) needed a new PCI, in another vessel, 7 patients (6%) needed a new PCI in the same vessel, 4 patients (3%) were submitted to CABG, 3 patients (2%) presented MI and 1 patient (1%) died due to cardiovascular causes.

Table 2 displays the clinical and angiographic characteristics according to the occurrence of clinical outcomes. In the group with MACE, women were predominant (62% vs. 34% $p = 0.01$), but there was no statistical difference in the frequency of diabetes mellitus, dyslipidemia, smoking or hypertension in the patients with or without MACE. Patients with MACE also presented significantly more previous PCI events (52% vs. 30% $p = 0.04$). Previous CABG, previous MI and clinical presentation before stent implantation were similar in both groups. Regarding angiographic characteristics, the average stent diameter was significantly lower in the group of patients with MACE (2.8 ± 0.3 vs. 3.0 ± 0.4 $p = 0.01$). There was no statistical difference between the two groups regarding the length of the stents (16.2 ± 5.1 vs. 16.4 ± 5.8 $p = 0.91$) and the ejection fraction (63% vs. 66% $p = 0.43$).

In Table 3, the psychological characteristics are presented according to the occurrence of MACE. There was no statistical difference between the groups with and without MACE regarding prevalence of Type D personality (33% vs. 32% $p = 0.90$), stress (76% vs. 65% $p = 0.31$), anxiety (33% vs. 23% $p = 0.30$) and depression (29% vs. 26% $p = 0.78$). However, when the absolute score of negative affectivity was considered, patients with MACE had a significantly higher score (13.9 vs. 9.8 $p = 0.01$) than those without a recurrent adverse event in the long-term follow-up. We observed an important correlation between the negative affectivity score and the depression score ($R = 0.64$, $p < 0.001$). There was also statistically significant correlations between social inhibition and depression scores ($R = 0.54$, $p < 0.001$), anxiety and negative affectivity scores ($R = 0.46$, $p < 0.001$), and anxiety and social inhibition scores ($R = 0.34$, $p < 0.001$).

Table 4 shows the occurrence of MACE according to the number of psychological characteristics presented by the patients. It is observed that the incidence of adverse events is increased in patients with 3 or 4 characteristics, when compared to those with none, 1 or 2 diagnosis.

Discussion

This study investigated the prevalence of depression, anxiety, psychological stress, negative affectivity and Type D personality and their influence on the prognosis of patients submitted to PCI. We could observe a high prevalence of adverse psychological characteristics and most of the patients presented at least one psychological diagnosis. During the one-year period of clinical follow-up, it was observed that those patients who presented MACE had higher scores of negative affectivity. Also, those patients with 3 or 4 psychological characteristics had more events than those with 2 or a smaller number of diagnosis.

Table 1 - Clinical and Angiographic Characteristics of the Study Population

	n=137
Male gender, %	63
Age, years	60,2 ± 10,1
Hypertension, %	87
DM,%	25
Dyslipidemia, %	57
Smoking, %	25
Previous Medical History	
PCI, %	31
CABG, %	11
MI, %	35
Clinical Presentation	
Stable Angina,%	16
Acute Coronary Syndrome,%	84
Number of Affected Vessels	
1	38
2	44
3	18
Target Vessel,%	
Left Main	3
Left Anterior Descending	48
Circumflex	19
Right	26
Vein Graft	4
Ejection Fraction,%	65 ± 4
Implanted Stents,%	
1	71
2	25
3	4
Stent Diameter, mm	2,97 ± 0,41
Stent Length, mm	16,41 ± 5,6

DM - Diabetes Mellitus; PCI - Percutaneous Coronary Intervention; CABG - Coronary Artery Bypass Grafting; MI - Myocardial Infarction.

Due to the importance of performing PCIs in clinical practice, it is necessary to investigate which groups of patients are at an increased risk of morbidity and mortality. In a previous study performed at our institution, predictors of new coronary artery bypass grafting of the target vessel were identified: diabetes mellitus, reference diameter of the target vessel and length of the lesion⁴. However, the diagnostic accuracy of the predictive risk model designed with these variables was modest, indicating the potential for the participation of other factors. Other studies have also reported a limited discriminatory ability of current models for prediction of long-term outcomes after coronary stent implantation¹⁶⁻¹⁸.

Pedersen et al¹³ demonstrated that the diagnosis of a Type D personality significantly increased the incidence of death and MI in patients submitted to PCI, with an odds ratio of 4.73 (5.6% vs 1.3%). Differently as demonstrated by Denollet et al¹⁹ Type D attenuates the relationship between depressive and cardiac disorders. Type D "pure" patients without depression were less likely to have left ventricular dysfunction (OR: 0.47, 95% CI: 0.35-0.65, p<0.0001) than depressed patients without Type D. In our study, patients who presented MACE in the one-year follow-up had a significantly higher negative affectivity score, but no association was observed between adverse events and the other psychological characteristics studied. Other psychological characteristics were also associated with events in previous studies^{20,21}, but none of these

Table 2 - Clinical and Angiographic Characteristics of the Study Population (n=125) According to the Occurrence of MACE in the Long-Term Follow-up Period

	MACE	No MACE	P
Female, %	62	34	0,01
DM,%	33	25	0,4
Dyslipidemia,%	67	60	0,6
Smoking,%	38	24	0,2
Hypertension,%	86	84	0,8
Clinical Presentation			0,45
Stable Angina, %	14	19	
Acute Coronary Syndrome, %	86	81	
Previous Medical History			
MI, %	38	34	0,7
CABG, %	9	11	0,8
PCI, %	52	30	0,04
Ejection Fraction, %	63	66	0,4
Stent Diameter, mm	2,8	3,1	0,01
Stent Length, mm	16,2	16,4	0,9

MACE - Major Adverse Cardiac Events; DM - Diabetes Mellitus; MI - Myocardial Infarct; PCI - Percutaneous Coronary Intervention; CABG - Coronary Artery Bypass Grafting.

studies dealt specifically with patients submitted to PCI. In the large INTERHEART multicenter study²⁰, with more than 30,000 individuals, a psycho-social index based on factors such as stress and depression was associated with a risk 2.7 times higher for MI. In the meta-analysis performed by Rugulies et al²¹, depressive symptoms presented a relative risk comparable to the traditional risks for arterial coronary disease of the Framingham study. A recent meta-analysis performed by Roest et al²² showed that anxious individuals without psychiatric diagnoses were at risk 1.26 times for CHD and 1.48 times for cardiac death, regardless of demographic variables, biological risk factors, and health behaviors.

It is important to point out the high prevalence of psychological characteristics reported in this study, since 73% of the patients presented at least one diagnosis, and 13% presented all the characteristics investigated. This is an important piece of information for cardiologists who take care of patients submitted to coronary stent implantation. Previous studies have not focused on the prevalence of psychological diagnosis, with a prospective design using

specific and validated instruments, as we did in this study. The Beck scales (including BDI and BAI) and the ISSL are largely used for the diagnosis of depression, anxiety and stress in several clinical situations, including cardiovascular diseases. Its use is authorized by the Federal Council of Psychology in Brazil, considering its validity and reliability in our country.

Another aspect previously mentioned and investigated in our study was the correlation between depression and the negative affectivity score²³. This finding raises the possibility of associated mechanisms explaining the higher affectivity negative score in those patients with MACE, such as the lack of motivation to adhere to medical therapy²⁴ or the endothelial dysfunction associated to chronic stress^{5,6, 25}. However, the exact mechanisms underlying this association are not well completely known yet.

Considered as a stable factor, personality, or some personality traits can be modified. To make it possible, it is necessary to understand why patients react in a particular

Table 3 - Psychological Characteristics According to the Occurrence of MACE in the Long-Term Follow-Up Period (n=125)

	All patients	MACE	No MACE	P
Type D,%	34	33	32	0,9
Stress,%	70	76	65	0,3
Anxiety,%	29	33	23	0,3
Depression,%	25	29	26	0,8

MACE – Major Adverse Cardiac Events.

Table 4 - Number of Psychological Characteristics According to the Occurrence of MACE in the Follow-Up Period

Number of characteristics	MACE %	No MACE %
0	12,2%	87,8%
1	13,3%	86,7%
2	11,5%	88,5%
3	18,2%	81,8%
4	20,0%	80,0%

MACE – Major Adverse Cardiac Events.

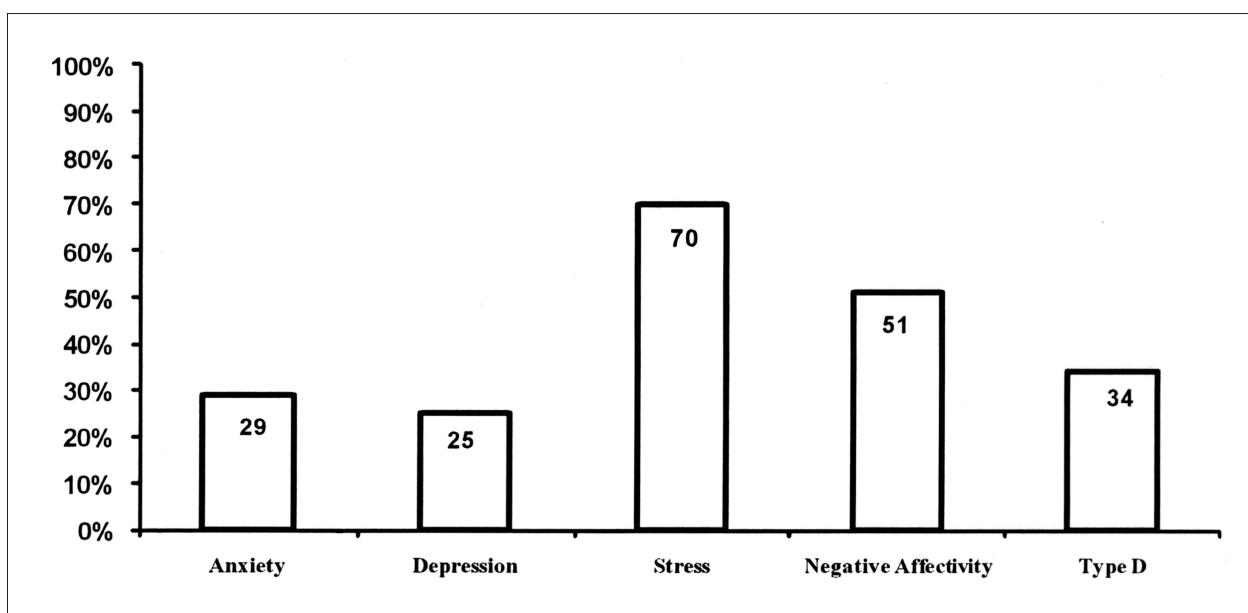


Figure 1 - Psychological Characteristics of Patients.

way and how the thought patterns learnt about themselves, their lives, others and their influence in the perception of situations²⁶. It is important that patients understood how their beliefs influence perceptions, emotional behaviors and physiological reactions. Therapeutic interventions, such as cognitive therapy, have showed variable results^{27,28}. The benefits on patients with Type D personality need to be investigated, as well as the effect on the MACE reduction.

Study limitations include small number of patients, the relatively short follow-up period and lack of contact with 8% of the study population. Since patients who presented with restenotic lesions, STEMI or suffered a post-procedural in-hospital MACE were excluded, our study population may not reflect the daily practice. Given the logistical aspects to administer psychological scales in all patients submitted to PCI, the study population was not composed of consecutive patients.

In summary, we demonstrated a high prevalence of adverse psychological characteristics in patients submitted to PCI and a significant association between negative affectivity

scores and the occurrence of MACE in the long-term follow-up. This is an important piece of information for cardiologists who take care of patients submitted to coronary stent implantation, and these findings also reveal the importance of correctly identifying this subgroup of patients in order to offer the best treatment options to reduce the cardiovascular risk effectively.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any post-graduation program.

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