Artículo Original de Investigación

Papel potencial de la psicología positiva en la estratificación del riesgo en pacientes con infarto

Potential role of positive psychology on risk stratification in patients with myocardial infarction

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INFORMACIÓN DEL ARTÍCULO

Recibido el 31 de Diciembre de 2022
Aceptado después de revisión
el 8 de Febrero de 2023
www.revistafac.org.ar

The authors thank the participants for their generosity and the reviewers for their work.

Funding. The study received funding from the Spanish Society of Cardiology (SEC). This study has been carried out with a pre-doctoral grant from the Spanish Ministry of Education (GM, FPU18/03606).

Conflicts of interest. HB receives research funding from the Instituto de Salud Carlos III, Spain (PIE16/00021 & PI17/01799), Sociedad Española de Cardiología, Astra-Zeneca, Bayer, PhaseBio and Novartis; has received consulting fees from Astra-Zeneca, Novartis; and speaking fees from Novartis and MEDSCAPE-the heart.org. IM, GM, RJB and MC have nothing to declare.

Palabras clave:
Psicología Positiva,
Factores de Riesgo Cardiacos,
Optimismo,
Infarto Agudo de Miocardio.

Keywords:
Positive Psychology,
Heart Disease Risk Factors,
Optimism,
Myocardial Infarction.

RESUMEN

Objetivo: El objetivo de este estudio fue evaluar si los factores de riesgo biológicos tras un infarto agudo de miocardio (IAM) se asocian a diferentes factores de psicología positiva (ej.: optimismo, bienestar emocional, afecto positivo), lo que podría ayudar a mejorar la estratificación del riesgo de cara a diferentes estrategias terapéuticas para promover cambios en el estilo de vida.

Métodos: 93 pacientes ingresados con infarto de miocardio se dividieron según el electrocardiograma (ECG) al alta (SCACEST vs. SCASEST) y la función cardíaca (FEVI ≥50% vs. <50%). Los pacientes fueron evaluados en estilos de afrontamiento, calidad de vida, niveles de ansiedad, depresión, estrés, optimismo, afecto positivo y negativo y bienestar psicológico.

Resultados: Los participantes SCACEST mostraron niveles significativamente más bajos de optimismo (p = 0,03) en comparación con los participantes SCASEST. Los participantes con FEVI <50 % mostraron niveles significativamente más bajos de afecto positivo (p = 0,02) que los participantes con FEVI ≥50 %.

Conclusiones: Los pacientes con IAM de alto riesgo biológico (es decir, SCACEST y FEVI <50 %) parecen tener niveles más bajos en variables de psicología positiva en comparación con los pacientes de menor riesgo biológico (SCASEST y FEVI ≥50%). Esto puede tener implicaciones futuras para la rehabilitación cardiaca de pacientes con infarto agudo de miocardio.

Potential role of positive psychology on risk stratification in patients with myocardial infarction

ABSTRACT

Aim: The aim of this study is to assess whether biological risk factors after MI are associated with different positive psychology factors (i.e.: optimism, well-being, positive affect), which could help refine risk stratification with regard to different therapeutic strategies to promote lifestyle changes.

Methods: Ninety-three patients admitted with MI were divided according to early electrocardiogram (STEMI vs. NSTEMI) and cardiac function (LVEF ≥50% vs. <50%). Patients were assessed in coping styles, quality of life, levels of anxiety, depression, stress, optimism, positive and negative affect and psychological well-being.

Results: STEMI participants exhibited significantly lower levels of optimism (p = 0.03) compared to NSTEMI patients. LVEF <50% participants showed significantly lower levels of positive affect (p = 0.02) than LVEF> 50% ones.

Conclusions: High biological risk patients with MI (i.e., STEMI and poor LVEF) seem to have lower levels of positive psychology factors compared to biological lower risk patients (NSTEMI and LVEF ≥50%). This may have future implications for the cardiac rehabilitation of patients with MI.

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INTRODUCTION

Myocardial infarction (MI) is the leading cause of global mortality, responsible for 16% of the world's total deaths[1]. Since 2000, the number of deaths by MI has risen by more than 2 million to 8.9 million deaths in 2019, and the relative risk for all-cause death is 30% higher at 1-5 years after MI than in a general reference population[1,2].

The implementation of effective therapeutic options, such as percutaneous coronary intervention and medical post-discharge treatments (Angiotensin Converting Enzyme Inhibitors – ACEIs – or Angiotensin Receptor Blockers – ARBs –, Statins, Beta-Blockers – BB – and antiplatelets) has led to a reduction in short-term mortality rates[3,4]. Most MI survivors have a heterogeneous mid- and long-term prognosis ranging from low-risk to high-risk patients[5]. Therefore, identifying the risk factors in MI survivors is key for planning secondary prevention and interventions to reduce mortality risk[6].

Key biological risk factors for MI risk stratification include early presentation in electrocardiogram (ECG), cardiac function or left ventricular ejection fraction (LVEF), age, the presence of in-hospital complications and medical history, among others[5]. ECG presentation is broad, and can be differentiated in two groups, ST elevation MI (STEMI) or Non-ST elevation MI (NSTEMI) with different in-hospital mortality rates and short-term mortality rates after discharge (6.7% vs. 4.7%)[7,8]. MI patients also differ in the degree of loss of cardiac function after MI, with mortality risk increasing with the decrease in cardiac function, measured as the left ventricular ejection fraction (LVEF) (36% mortality in patients with severe LVEF vs. 4% in patients with mild LVEF)[9,10].

In addition to biological risk factors, negative psychological variables also have an impact on post-MI prognosis. Factors such as stress, anxiety, anger or depression have been associated with a higher cardiovascular risk[11]. There is also a relationship between depression and loss of cardiac function identified by LVEF and increased depression and anxiety negatively affect the health-related quality of life post-STEMI[12,13]. Conversely, positive psychology factors, such as optimism, had been linked to a lower risk of cardiovascular mortality after MI and lower levels of inflammatory biomarkers of endothelial dysfunction[14,15,16]. Positive psychology factors have also been positively correlated with adherence to medical recommendations (diet, physical activity, medication and reducing stress)[17,18]. These results could point to the fact that a complete risk stratification should include not only biological risk factors but also psychological variables.

Thus, the aim of this study was to assess whether there is a relationship between key biological risk factors (ECG presentation or pre-discharge LVEF) and positive psychology factors in MI patients. That could improve identification of high risk patient profiles with higher need of medical and psychological interventions.

METHODS

Participants

We conducted a cross-sectional study with a convenience sample of 93 patients who had suffered a MI and have been admitted on a tertiary hospital in Madrid between January to May 2020. We selected only those participants who meet the inclusion criteria of this study (have a medical diagnosis of MI, be 18 years or older, have signed informed consent, present a sufficient level of understanding and expression of Spanish and have an adequate cognitive state) and none of the exclusion criteria (present cognitive impairment or a serious health condition that would make interaction difficult). According to the objectives of this study, after inclusion, all data collected from participants were first grouped by the early ECG (STEMI and NSTEMI) performed at the time of the diagnosis (sociodemographic data can be seen in *Table 1*). Secondly, regardless of the previous statistical analysis, all data collected were grouped by the LVEF variable, which was measured by echocardiography using the modified Simpson method (biplane methods of discs) during hospitalization, dividing the patients into LVEF <50% and LVEF ≥50% (sociodemographic data are shown in *Table 2*). This division considered the potential cardiovascular risk prediction of ECG and LVEF separately[8,9,10].

Ethics Approval and Consent to Participate. This study was approved by the Institutional Review Board of Hospital 12 de Octubre, with internal code CEI: 19/047 and conforms to the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants.

Variables and measures

Biomedical variables related to cardiovascular risk (body mass index -BMI-, total cholesterol, glycated hemoglobin -HbA1c-, number of affected vessels, presence of previous coronary disease and degree of heart failure associated with MI or Killip), patient's clinical history (history of MI, heart failure, stroke, presence of hypertension, hyperlipidemia and diabetes mellitus) and lifestyle (tobacco and alcohol consumption), were obtained from medical records and clinical interview to check for heterogeneity between groups *(Table 1 and Table 2)*.

For both four groups, the same dependent variables were considered: negative psychological factors (anxiety, depression, level of perceived stress and negative affect), positive psychology factors (dispositional optimism, psychological well-being and positive affect), coping styles and quality of life, which were obtained through the following validated instruments:

Anxiety and depression symptomatology. The Hospital Anxiety and Depression Scale – HADS (Spanish version Terol et al, 2007) is a 14-item self-report instrument specifically designed to quantify with adequate psychometric indexes the level of anxiety and depression in people who have a chronic health problem and / or are in the hospital[19]. It is made up of two scales: one for anxiety (HADS-A, odd items) and the other for depression (HADS-D, even items). Scores range from 0 to 21: scores between 8-10 could classify the patient as suspected anxious or depressive; below 8 (from 0 to 7), it is considered that there is no symptomatology.

Perceived stress level. The Perceived Stress Scale – PSS

TABLE 1.
Differences between ECG groups (STEMI vs. NSTEMI) in sociodemographic, clinical and lifestyle profile (N = 93)

Sociodemographic variables	STEMI (n = 64) - % (n) / M (SD)	NSTEMI (n = 29) - % (n) / M (SD)	Statistical test / p-value
Sex			
Male	87.50 (56)	86.20 (25)	0.55
Female	12.50 (7)	13.80 (4)	
Age (years)	55.13 (9.86)	60.72 (11.70)	0.02
Civil status			
Single	11.10 (7)	7.10 (2)	0.55
Marital status	66.70 (42)	71.40 (20)	
With a stable partner	6.30 (4)	0.00 (0)	
Separated	3.20 (2)	7.10 (2)	
Divorced	7.90 (5)	3.60 (1)	
Widower	4.80 (3)	10.70 (3)	
Education level			
No studies	6.30 (4)	7.40 (2)	0.03
Primary	33.30 (21)	59.30 (16)	
Secondary	49.20 (31)	18.50 (5)	
University	7.90 (5)	14.80 (4)	
Postgraduate	3.20 (2)	0.00 (0)	
Employment situation			
Working	70.00 (42)	39.30 (11)	0.02
Unemployed	8.30 (5)	17.90 (5)	
Retired	21.70 (13)	42.90 (12)	
Socioeconomic level (€ per year)			
< 12,000	24.10 (13)	38.10 (8)	0.27
12,000 – 22,000	33.30 (18)	38.10 (8)	
> 22,000	42.60 (23)	23.80 (5)	
Clinical data at admission			
BMI	28.63 (3.90)	31.04 (5.55)	0.03
LVEF	51.70 (10.71)	54.97 (10.53)	0.18
Total cholesterol (mg/dl)	194.48 (6.04)	174.76 (14.64)	0.14
HbA1c (%)	6.14 (0.92)	6.67 (1.29)	0.13
Number of vessels affected			
1	39.70 (25)	44.40 (12)	
2	33.30 (21)	22.20 (6)	
3	27.00 (17)	33.30 (9)	
Killip			
I	83.90 (52)	87.50 (22)	0.52
II	8.90 (5)	4.20 (1)	
III	0.00 (0)	4.20 (1)	
IV	7.10 (4)	4.20 (1)	
Clinical history and lifestyle			
Coronary disease	76.60 (49)	75.90 (22)	0.94
Myocardial Infarction	0.00 (0)	3.80 (2)	0.09
Heart Failure	3.20 (2)	17.90 (5)	0.03
Stroke	3.20 (2)	10.70 (3)	0.17
Hypertension	39.10 (25)	57.10 (16)	0.11
Hyperlipidemia	54.70 (35)	57.10 (16)	0.83
Diabetes mellitus	15.60 (10)	25.00 (7)	0.29
Lifestyle			
Tobacco	43.80 (28)	27.60 (8)	0.12
Alcohol	9.40 (6)	10.70 (3)	0.56

TABLE 2
Analysis of the differences between groups regarding the degree of LVEF (<50% vs. > 50%) in sociodemographic, clinical and lifestyle profile (N = 93)

Sociodemographic variables	LVEF <50% (n = 31) - % (n) / M (SD)	LVEF >50% (n =62) - % (n) / M (SD)	Statistical test / p-value
Sex			
Male	90.30 (28)	85.50 (53)	0.75
Female	9.70 (3)	14.50 (9)	
Age (years)	58.77 (10.79)	55.92 (10.65)	0.23
Civil status			
Single	6.50 (2)	11.70 (7)	0.72
Marital status	74.20 (23)	65.00 (39)	
With a stable partner	6.50 (2)	3.30 (2)	
Separated	0.00 (0)	6.70 (4)	
Divorced	6.50 (2)	6.70 (4)	
Widower	6.50 (2)	6.70 (4)	
Education level			
No studies	12.90 (4)	3.40 (2)	0.12
Primary	25.80 (8)	49.20 (29)	
Secondary	45.20 (14)	37.30 (22)	
University	12.90 (4)	8.50 (5)	
Postgraduate	3.20 (1)	1.70 (1)	
Employment situation			
Working	56.70 (17)	62.10 (36)	0.10
Unemployed	3.30 (1)	15.50 (9)	
Retired	40.00 (12)	22.40 (13)	
Socioeconomic level (€ per year)			
< 12,000	23.10 (6)	30.60 (15)	0.27
12,000 – 22,000	26.90 (7)	38.80 (19)	
> 22,000	50.00 (13)	30.60 (15)	
Clinical data at admission			
BMI	29.30 (5.32)	29.43 (4.24)	29.43 (4.24)
Total cholesterol (mg/dl)	168.21 (9.05)	201.04 (7.36)	201.04 (7.36)
HbA1c (%)	6.30 (1.02)	6.25 (1.06)	6.25 (1.06)
Number of vessels affected			
1	46.70 (14)	38.30 (23)	0.60
2	23.30 (7)	33.30 (20)	
3	30.00 (9)	28.30 (17)	
Killip			
I	83.90 (52)	87.50 (22)	0.52
II	8.90 (5)	4.20 (1)	
III	0.00 (0)	4.20 (1)	
IV	7.10 (4)	4.20 (1)	
Clinical history			
Coronary disease	74.20 (23)	77.40 (48)	0.73
Myocardial Infarction	3.20 (1)	1.60 (1)	0.56
Heart Failure	13.30 (4)	5.00 (3)	0.22
Stroke	0.00 (0)	8.20 (5)	0.17
Hypertension	41.90 (13)	45.90 (28)	0.72
Hyperlipidemia	51.60 (16)	57.40 (35)	0.60
Diabetes mellitus	22.60 (7)	16.40 (10)	0.47
Lifestyle			
Tobacco	41.9 (13)	37.10 (23)	0.65
Alcohol	9.7 (3)	9.80 (6)	0.65

TABLE 3.
Analysis of the differences between ECG groups in the psychological factors of cardiovascular risk and styles of coping (N = 93)

	STEMI (n = 64) - M (SD)	NSTEMI (n = 29) - M (SD)	Statistical test	
			p-value	Effect size (d)
Negative psychological factors				
Anxiety (HADS-A)	7.16 (3.57)	7.61 (4.32)	0.61	0.11
Depression (HADS-D)	3.92 (3.36)	4.54 (2.95)	0.41	0.19
Perceived stress (PSS)	28.31 (8.26)	28.48 (10.86)	0.94	0.02
Negative affect (PANAS)	10.93 (7.43)	11.28 (6.85)	0.84	0.05
Coping (COPE-28)				
Cognitive	12.92 (3.34)	13.30 (3.33)	0.63	0.11
Social support	8.84 (3.59)	8.70 (4.05)	0.88	0.04
Avoidance	11.03 (5.36)	12.08 (4.83)	0.39	0.21
Spiritual	1.55 (1.97)	2.15 (2.46)	0.23	0.27
Positive psychological factors				
Optimism (LOT-R)	13.67 (3.62)	15.52 (4.00)	0.03	0.48
Well-being (PWBS)				
Self-acceptance	15.79 (3.34)	17.07 (3.14)	0.09	0.39
Positive relationships	14.44 (4.28)	13.79 (4.87)	0.52	0.14
Autonomy	18.03 (5.19)	19.32 (4.58)	0.26	0.26
Environment domain	15.51 (2.54)	16.36 (3.26)	0.18	0.29
Personal growth	17.08 (3.22)	18.07 (3.82)	0.20	0.28
Purpose in life	17.27 (3.12)	16.79 (3.04)	0.51	0.16
Positive affect (PANAS)	25.12 (8.02)	23.54 (8.60)	0.42	0.19
Quality of life (SF-12)				
Physical	45.23 (7.03)	44.19 (8.84)	0.54	0.13
Mental	49.53 (6.15)	46.65 (7.20)	0.05	0.43

HADS-A: anxiety subscale of the Hospital Anxiety and Depression Scale; **HADS-D:** depression subscale of the Hospital Anxiety and Depression Scale; **PSS:** Perceived Stress Scale; **PANAS:** Scale of positive and negative affect; **COPE-28:** Coping Styles Questionnaire in the 28-item version; **LOT-R:** Life Orientation Test-Revised; **PWBS:** Psychological Well Being Scales; **SF-12:** SF-12 Health Survey.

(Spanish version of Remor, 2008) is a 14-item instrument that assesses individuals' perception of their control over the demands of their environment and the stress or discomfort that it has generated in the last month[20]. There are no cut-off points: the higher the total score, the higher the level of stress.

Dispositional optimism. The Life Orientation Test-Revised – LOT-R (Spanish version of Otero, Luengo, Romero, Gómez and Castro, 1998), a 10-item self-report questionnaire that, with adequate psychometric criteria, quantifies the level of dispositional optimism, the higher the score, the higher the level of optimism[21].

Positive and negative affect. The Positive and Negative Affect Schedule – PANAS (Spanish adaptation of Joiner et al., 1997) is a 20-item self-report questionnaire structured in two scales: the positive affect scale and the negative affect scale[22]. Both scales have no cut-off points: the higher the score, the higher the level of positive affect or negative affect, respectively.

Psychological well-being. The Psychological Well Being Scale – PWBS (reduced Spanish version of the PWBS developed by Díaz et al., 2006) is a 39-item self-report tool structured in six dimensions: self-acceptance, autonomy, personal growth, environmental control, purpose in life and positive relationships with others[23]. The higher the score in each dimension, the higher the level of that dimension.

Coping styles. The Coping Styles Questionnaire was used in its reduced version – Brief COPE-28 (Spanish version of Morán, 2010)[24]. The COPE-28 is a 28-item self-report questionnaire that, with adequate psychometric indicators, quantifies the frequency with which the person uses each of the four coping styles: cognitive coping, social support coping, avoidance or blocking and spiritual coping. The higher on each of the scales, the greater the degree of use of the coping style.

Quality of life. SF-12 Health Survey (Spanish adaptation of Vilagut, 2008)[25]. The SF-12 is the reduced 12-item version of the SF-36 questionnaire, and it quantifies, with adequate psychometric indices, the perceived physical and mental quality of life (QoL). The higher the score, the greater the mental or physical quality of life, respectively.

Procedure and statistical analysis

All participants completed the same assessment protocol regarding health, lifestyle and psychological measures that were self-administered on paper, after inclusion in the study, either during their first 48 hours of stay in the Coronary Care Unit (CCU) or in the general cardiology unit. Continuous variables were assessed for normal distribution using the

TABLE 4.
Analysis of covariance (ANCOVA's) of MQoL and the dimensions of positive psychology between EGC groups (N = 93)

	p-value	Eta2
Mental Quality of life (SF-12)		
Age	0.27	0.02
ECG presentation	0.048	0.06
Employment status	0.87	0.005
Educational level	0.81	0.03
BMI	0.79	0.001
Heart Failure	0.68	0.003
Optimism (LOT-R)		
Age	0.21	0.03
ECG presentation	0.0004	0.183
Employment status	0.71	0.01
Educational level	0.67	0.04
BMI	0.71	0.002
Heart Failure	0.38	0.01
Self-Acceptance (PWBS)		
Age	0.19	0.03
ECG presentation	0.33	0.02
Employment status	0.01	0.130
Educational level	0.11	0.11
BMI	0.14	0.04
Heart Failure	0.82	0.0009
Positive relationships (PWBS)		
Age	0.96	0.00004
ECG presentation	0.56	0.006
Employment status	0.64	0.02
Educational level	0.49	0.05
BMI	0.17	0.03
Heart Failure	0.36	0.01
Autonomy (PWBS)		
Age	0.94	0.00008
ECG presentation	0.43	0.01
Employment status	0.66	0.01
Educational level	0.25	0.08
BMI	0.54	0.006
Heart Failure	0.88	0.0004
Environmental domain (PWBS)		
Age	0.54	0.006
ECG presentation	0.02	0.081
Employment status	0.21	0.05
Educational level	0.84	0.02
BMI	0.75	0.002
Heart Failure	0.16	0.03
Personal growth (PWBS)		
Age	0.45	0.009
ECG presentation	0.07	0.05
Employment status	0.97	0.0007
Educational level	0.59	0.04
BMI	0.87	0.0005
Heart Failure	0.50	0.008
Purpose on life (PWBS)		
Age	0.51	0.007
ECG presentation	0.92	0.0002
Employment status	0.09	0.07
Educational level	0.92	0.02
BMI	0.81	0.0009
Heart Failure	0.92	0.0002
Positive affect (PANAS)		
Age	0.25	0.02
ECG presentation	0.74	0.002
Employment status	0.83	0.007
Educational level	0.35	0.06
BMI	0.15	0.04
Heart Failure	0.21	0.03

SF-12: SF-12 Health Survey; **LOT-R:** Life Orientation Test-Revised; **PWBS:** Psychological Well Being Scales; **PANAS:** Scale of positive and negative affect.

Shapiro-Wilk test and were expressed as mean (SD). Categorical variables were expressed as frequencies and percentages. Levene's test was used to study homogeneity between groups. Chi-square test and Fisher's exact test (when the number of individuals in one category was less than 5) were performed to compare groups when variables were qualitative, and the Student's t-test when they were quantitative. The magnitudes of the differences were estimated by calculating the effect sizes using the Cohen´s (1988) d statistic, considering the criteria of 0.2, 0.5 and 0.8 to determine whether the magnitude was small, medium or large, respectively. The corresponding analysis of covariance (ANCOVA) were performed to assess the influence of the confounding variables on the differences in psychological variables between groups. A 2-tailed probability value of <0.05 was considered statistically significant for all these tests. All the statistical data was processed using the SPSS program, version 21.

RESULTS

Analysis of the differences between MI-patients based on the ECG.

Sociodemographic, clinical, health and lifestyle profile

Both ECG groups showed a similar sociodemographic profile, but statistically significant differences emerged between groups: age, education level, current job situation and clinical history of heart failure *(Table 1)*. STEMI participants had a significantly lower mean age, M = 55.13 (9.86) vs. NSTEMI M = 60.72 (11.70) (p = 0.02) *(Table 1)*. In STEMI, the majority were in employment (70%), while in the NSTEMI, the participants were split between those who were in employment (39.3%) or retired (42.9%) (p = 0.02). There were more patients with only primary education in the NSTEMI group (59.30%), and in the STEMI group more patients only have secondary education (49.20%) (p = 0.03). Regarding the clinical history and lifestyle, the STEMI group had a significantly lower BMI, M = 28.63 (3.90) than the NSTEMI, M = 31.04 (5.55) (p = 0.03), as well as a lower proportion of previous heart failure (3.20%) (p = 0.03).

Psychological profile of cardiovascular risk, coping styles, dimensions of positive psychology and quality of life

Regarding negative psychological factors and the coping style, both groups, were statistically similar *(Table 3)*.

A statistically significant difference emerged in relation to the positive psychology factors *(Table 3)*, with the STEMI participants showing a significantly lower level of dispositional optimism, M = 13.67 (3.62), compared to NSTEMI, M = 15.52 (4.00) (p = 0.03), difference of medium effect size (d = 0.48), according to Cohen (1988). As there were differences between groups in their profiles, the corresponding ANCOVAs were performed, including age, employment status, education level, BMI and previous heart failure as covariables and the ECG presentation as a between-subjects factor. Regarding the dispositional optimism, only the ECG presentation (p < 0.001) had a significant role, which explained the 18.3% (Eta^2 = 0.183) variability of dispositional optimism in this group of participants *(Table 4)*.

TABLE 5.
Differences between groups regarding the degree of LVEF (<50% vs. > 50%) in the psychological risk profile and styles of coping (N = 93)

	LVEF <50% (n = 31) / M (SD)	LVEF >50% (n =62) / M (SD)	Statistical test	
			p-value	Effect size (d)
Negative psychological factors				
Anxiety (HADS-A)	7.00 (3.97)	7.45 (3.72)	0.60	0.12
Depression (HADS-D)	4.94 (2.87)	3.68 (3.35)	0.08	0.40
Perceived stress (PSS)	28.03 (9.00)	28.53 (9.14)	0.80	0.06
Negative affect (PANAS)	11.13 (6.37)	10.98 (7.71)	0.84	0.02
Coping (COPE-28)				
Cognitive	13.26 (3.40)	12.91 (3.31)	0.64	0.10
Social support	8.29 (3.56)	9.07 (3.79)	0.35	0.21
Avoidance	11.16 (4.39)	11.45 (5.61)	0.81	0.06
Spiritual	1.71 (2.22)	1.74 (2.11)	0.95	0.01
Positive psychological factors				
Optimism (LOT-R)	13.68 (3.89)	14.53 (3.79)	0.31	0.22
Well-being (PWBS)				
Self-acceptance	16.29 (3.61)	16.13 (3.19)	0.83	0.05
Positive relationships	13.97 (5.19)	14.38 (4.06)	0.68	0.09
Autonomy	17.87 (4.52)	18.72 (5.28)	0.45	0.17
Environment domain	14.97 (2.27)	16.18 (2.95)	0.05	0.46
Personal growth	17.32 (3.10)	17.42 (3.61)	0.90	0.03
Purpose in life	17.26 (3.36)	17.05 (3.12)	0.77	0.06
Positive affect (PANAS)	21.79 (8.47)	26.13 (7.70)	0.02	0.54
Quality of life (SF-12)				
Physical	44.28 (6.85)	45.23 (8.84)	0.57	0.12
Mental	49.17 (5.68)	48.36 (7.03)	0.58	0.13

HADS-A: anxiety subscale of the Hospital Anxiety and Depression Scale; **HADS-D:** depression subscale of the Hospital Anxiety and Depression Scale; **PSS:** Perceived Stress Scale; **PANAS:** Scale of positive and negative affect; **COPE-28:** Coping Styles Questionnaire in the 28-item version; **LOT-R:** Life Orientation Test-Revised; **PWBS:** Psychological Well Being Scales; **SF-12:** SF-12 Health Survey.

Regarding the quality of life *(Table 1)*, patients from the STEMI group perceived higher mental quality of life, M = 49.53 (6.15), compared to NSTEMI, M = 46.65 (7.20), but this difference did not reach statistical significance (p = 0.05).

No statistically significant differences were observed between groups in terms of well-being. However, the ANCOVAs revealed that differences in the employment status between groups explain 13% of variability of self-acceptance between groups (Eta2 = 0.13, p = 0.01) and ECG presentation did not have a significant role. Moreover, the ECG presentation explained 8% of variability between groups (Eta^2 = 0.081, p = 0.02) in terms of environmental domain *(Table 4)*.

Analysis of the differences between MI-patients based on the level of cardiac function (LVEF).

Sociodemographic, clinical, health and lifestyle profile

When groups developed according to LVEF (LVEF<50% and ≥50%) were compared, analyses showed both groups had a similar sociodemographic, clinical and lifestyle profile *(Table 2)*, except for total cholesterol. Thus, the participants who had LVEF ≥50% had total blood cholesterol levels, M = 201.04 (7.36), that were significantly higher than LVEF <50%, M = 168.21 (9.05) (p = 0.01). Finally, both groups had similar health history (history of heart attack, prior heart failure, stroke, previous diagnosis of hypertension, hyperlipidemia or diabetes mellitus), and health habits related to tobacco and alcohol consumption.

Psychological profile of cardiovascular risk, coping styles, dimensions of positive psychology and the quality of life

No significant differences were found for anxiety, depression, perceived stress, negative affect or coping styles *(Table 5)*.

In relation to the positive psychology factors, only one statistically significant difference emerged between these two groups related to positive affect *(Table 5)*. It was found that the participants with LVEF ≥50% had significantly higher scores in positive affect, M = 26.13 (7.70), compared to LVEF <50%, M = 21.79 (8.47) (p = 0.02). These differences were of medium size effect (d = 0.54).

Regarding the psychological well-being (PWBS), patients with LVEF ≥50% had higher levels of environmental domain, M = 16.18 (2.95), compared to LVEF<50%, M = 14.97 (2.27), but this difference did not reach statistical significance (p = 0.05). As there were differences in total cholesterol levels between groups, the corresponding ANCOVAs were performed, including total cholesterol as

TABLE 6.
Analysis of covariance (ANCOVA's) of MQoL and the dimensions of positive psychology between LVEF groups (N = 93)

	p-value	Eta2
Physical Quality of life (SF-12)		
LVEF	0.68	0.0023
Total colesterol	0.94	0.00007
Mental Quality of life (SF-12)		
LVEF	0.90	0.0002
Total colesterol	0.84	0.00057
Optimism (LOT-R)		
LVEF	0.56	0.0047
Total colesterol	0.81	0.00083
Self-Acceptance (PWBS)		
LVEF	0.92	0.00015
Total colesterol	0.82	0.0007
Positive relationships (PWBS)		
LVEF	0.89	0.00025
Total colesterol	0.89	0.00028
Autonomy (PWBS)		
LVEF	0.51	0.006
Total colesterol	0.60	0.0038
Environmental domain (PWBS)		
LVEF	0.11	0.034
Total colesterol	0.75	0.001
Personal growth (PWBS)		
LVEF	0.65	0.0029
Total colesterol	0.70	0.002
Purpose on life (PWBS)		
LVEF	0.68	0.0024
Total colesterol	0.40	0.0097
Positive affect (PANAS)		
LVEF	0.03	0.069
Total colesterol	0.70	0.002

LOT-R: Life Orientation Test-Revised; **PWBS:** Psychological Well Being Scales; **SF-12:** SF-12 Health Survey; **PANAS:** Scale of positive and negative affect.

covariate and the LVEF as a between-subjects factor. LVEF explained 7% of the variability of positive affect between groups (p = 0.03), whereas cholesterol levels do not explain variability of positive affect between groups *(Table 6)*.

DISCUSSION

According to these results, patients with STEMI present lower levels of dispositional optimism compared to NSTEMI patients. Although there were no differences between the ECG groups for the environmental domain (higher in NSTEMI), the ANOVA test revealed significant differences that were not explained by any other confounding variables. Patients with LVEF <50% present lower levels of positive affect compared to patients with LVEF ≥50%. This could indicate that the difference in patients with more severe LVEF and worse prognosis is more related to the positive psychological profile than to the negative psychological profile, with lower levels of positive psychology in LVEF<50% MI patients. According to other authors, after an episode of MI, all patients may present similar levels in negative factors, since they have all experienced a life-threatening event associated with high levels of uncertainty and acute effects during the hospitalization phase[26,27]. The lack of differences between groups in coping styles could be explained by the fact that this factor could have a more relevant role after the event, when the person has to activate specific strategies to handle difficulties and problems derived from this event and adapt as best as possible to the new situation, which could mark a better or worse individual recovery[28].

Studies on positive psychology have shown that dispositional optimism and positive affect are related to a better health prognosis, as well as to a better cardiovascular health[15,29,30,31,32]. Dispositional optimism seems to contribute to reducing the risk of new episodes of angina and predict a lower risk of future cardiovascular morbidity and mortality in MI[14,15]. Indeed, psychological interventions based on positive psychology have been recently developed to reduce cardiovascular risk in patients with cardiovascular diseases, complementary to medical and lifestyle modification treatments[33,34]. Psychological therapy based on the cognitive-behavioral paradigm and positive psychology seems to be effective reducing psychological risk factors, enhancing psychological well-being and reducing the risk of cardiovascular events, MI and angina in patients with CAD[35,36]. However, the underlying mechanisms by which optimism or positive emotions –among other factors of positive psychology– could perform this cardioprotective role are not yet conclusive. These effects could be explained by the fact that positive emotions may induce a better adaptation to the disease, adopting and maintaining better patterns of therapeutic adherence and healthy lifestyle habits, as well as having a general impact on greater social and psychological well-being[15,29,30,32].

The evidence provided by the present study reinforces the need to take into consideration positive psychology factors after MI in daily clinical practice, as we already do with negative psychological dimensions. Positive psychology factors may help improve risk stratification of MI patients and become additional adjustment variables in short- and long-term predictive models. This could improve the identification of high-risk patients (i.e.: presence of depression, lack of positive affect or low levels of optimism, STEMI, LVEF <50%) and, perhaps, form the basis for different psychological interventions to promote lifestyle changes. These interventions could be integrated in cardiac rehabilitation of MI patients, allowing better adaptation to the profile and psychological needs of the patient.

LIMITATIONS

As the questionnaires were administered in the context of a critical care unit and in the first days of admission, it was difficult to obtain all instruments from all patients and, consequently, we were unable to obtain the same sample size for all variables. The differences in sample size between the groups was controlled by comparing all the

characteristics of the subjects to check for heterogeneity.

Although other authors have reported relationships between STEMI or low LVEF and depression, this study has not found differences between groups in levels of depression[12,13]. This may be explained by the fact that the statistical power is low and could hinder certain trends (as in other variables such as mental quality of life or differences in domain of the environment in psychological well-being). Also, as this is a cross-sectional study, longitudinal studies should be performed to overcome this limitation and assess the effect of time on psychological status and compare the results with clinical predictive variables.

CONCLUSIONS

In conclusion, high biological risk patients with MI (i.e., STEMI and poor LVEF) seem to have lower levels of positive psychology factors compared to biological lower risk patients (NSTEMI and LVEF ≥50%). This may have future implications for the psychological rehabilitation of patients with MI.

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