ORIGINAL ARTICLE

Influence of Factors Affecting Quality of Life on in-Hospital Cardiovascular Events of Patients with Acute Myocardial Infarction with and without ST-segment Elevation

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Abstract

Background: Acute myocardial infarction (AMI), with and without ST-segment elevation (STEMI and NSTEMI, respectively), is the principal cause of cardiovascular morbidity and mortality in Brazil and around the world. Modifiable risk factors (RF) and quality of life (QOL) may correlate with the type of AMI.

Objective: To evaluate the influence of QOL and RF on the type of AMI and in-hospital cardiovascular events in STEMI and NSTEMI patients.

Methods: This was an observational, cross-sectional study. Patients with AMI attending four referral hospitals (three private and one public) for cardiovascular disease treatment were assessed for QOL using the Brazilian version of the 36-item short form survey. A $p < 0.05$ was considered statistically significant.

Results: We evaluated 480 volunteers; 51% were treated in one of the private hospitals. In total, 55.6% presented with STEMI, and 44.4% with NSTEMI. Patients from the public hospital were 8.56 times more likely to have STEMI compared to those from the private hospitals. There was a higher prevalence of smokers in STEMI ($p < 0.028$) patients. QOL was not associated with the type of AMI. A negative patient perception of the physical health and pain domains was observed. Although a significant difference between the physical and the mental health domains was not observed, individual domains were correlated with some in-hospital outcomes.

Conclusion: There was a higher prevalence of smokers among individuals with STEMI. Domains of QOL showed a statistically significant relationship with the occurrence of in-hospital cardiovascular events, with no difference between the types of AMI.

Keywords: Cardiovascular Diseases/epidemiology; Coronary Acute, Syndrome; Myocardial Infarction; Myocardial Infarction; Medication Adherence ; Risk Factors.

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Introduction

The global scenario reveals an increase in the incidence of cardiovascular diseases.[1] According to a report by the Pan American Health Organization (PAHO) published in 2017, 17.7 million people died from cardiovascular disease in 2015, representing 31% of all deaths globally. It directly affects health-related costs, and causes reduction in job productivity and quality of life (QOL).[2,3]

Acute coronary syndromes (ACS), including unstable angina (UA) and acute myocardial infarction (AMI) with and without ST-segment elevation (STEMI and NSTEMI, respectively) are among the main cardiovascular diseases.[4] AMI is one of the leading causes of death and physical disabilities, and modifiable risk factors (RF) and QOL may correlate with the development of this disease.[5-7]

According to the PAHO report, most cardiovascular diseases can be prevented by addressing behavioral RF, such as tobacco use, unhealthy diet, obesity, lack of physical activity, and use of alcohol, by implementing strategies for the general population.[2] Additionally, control of RF and adherence to healthy habits can be associated with better QOL.[8]

QOL is related to the individual's perception of their own life, in connection with their goals and within the value system incorporated in decision-making.[9] It depends on individual's economic status, physical and mental health, social protection, political stability, and the environment.[10]

The measurement of QOL provides valuable information about the individual and helps clinicians to choose the best forms of treatment and rehabilitation. Despite the relationship between RF and the lifestyle of individuals with cardiovascular disease, recommendations to investigate parameters of QOL for estimation of cardiovascular events (CVEs), are not well established, and require further research. Therefore, the present study aimed to assess whether patient QOL affects the type of AMI and in-hospital outcomes.

Methods

Study design

This was a cross-sectional observational study, carried out from October 2013 to September 2015. This study is part of the research entitled "Adherence to drug treatment and lifestyle changes in patients with acute coronary syndrome" conducted in four renowned hospitals for cardiac treatments (three private and one public) in Aracaju, Sergipe, Brazil.[11]

Subjects

Patients who presented with STEMI or NSTEMI were recruited by convenience sampling. We included patients of both genders, aged 18 years or older, diagnosed with AMI, and excluded patients with cardiogenic shock, unstable angina (UA), or Alzheimer's disease.

Variables analyzed

The following variables, collected from medical records were analyzed: educational attainment, marital status, clinical presentation (type of infarction), comorbidities – dyslipidemia, systemic arterial hypertension (SAH), smoking, diabetes mellitus (DM), and family history of coronary artery disease (CAD) – and in-hospital events.

We performed anthropometric measurements – weight, height, waist circumference, and body mass index (BMI). We also analyzed physical activity records using the International Physical Activity Questionnaire (IPAQ, short version),[12,13] and QOL using the Brazilian version of the Medical Outcomes Study Questionnaire 36-Item Short-Form Health Survey (SF-36).[14,15]

Anthropometric measurements

Body weight, height, and BMI[16] of patients were determined. For body weight measurement, patients were dressed in light clothing, barefoot, standing on the platform of a digital scale (Filizola, 150 Kg) to the nearest 0.1 Kg. Height was measured to the nearest 0.1 m using a stadiometer (SECA).

Physical activity

We used the IPAQ – short version to assess physical activity. Habitual physical activity levels were classified based on the consensus proposed by the Physical Fitness Laboratory of São Caetano do Sul, which is the coordinating center of IPAQ in Brazil. Patients were then classified into very active, active, irregularly active, and sedentary.[12,13]

Quality of life

QOL was measured using the validated Portuguese language version[14] of the SF-36 questionnaire.[15]

The SF-36 consists of 36 questions that address eight domains (or dimensions) of two major components: the physical component that involves functional capacity (10 items), pain (two items), general health status (five items), and physical performance (four items), and the mental component that covers mental health (five items), emotional (three items), social (two items), and vitality (four items). There is also one question aimed to compare current health perceived by the patient with that of a year ago.[14,15]

Data analysis

We analyzed the data using the software R, version 3.5.1. Univariate descriptive analysis was performed by calculating the frequencies (absolute and relative) for the categorical variables, and mean and standard deviation for the continuous variables. Continuous variables that were not normally distributed were described as median and interquartile range.

Continuous variables with normal and without normal distribution were compared using the unpaired Student's t-test and the Mann-Whitney, respectively. Distribution normality was assessed using the Shapiro-Wilk test. For categorical variables, the chi-square test or the Fisher's exact test, with 95% confidence interval, was used as appropriate. The odds ratio (OR) was also calculated. Significance level was set at 0.05 ($p<0.05$).

Ethical aspects

The study was approved by the Research Ethics Committee of the Federal University of Sergipe – CEP/UFS on 06/07/2013 under nº 302.544. All procedures were performed following the 2013 update of the Declaration of Helsinki. Informed consent was obtained from all the participants included in the study.

Results

Characteristics of the subjects

A total of 480 patients were included. Out of these patients, 267 (56%) had STEMI, and 213 (44%) had NSTEMI. Among them, 235 (49%) were treated in the public hospital, and 245 (51%) in private ones. The study sample was predominantly elderly and male. Most of them had complete elementary school and were married or lived with a partner. Regarding RF, most patients were overweight and had a sedentary lifestyle, were non-smokers, had SAH, dyslipidemia, and family history of CAD (Table 1).

Considering the type of hospital, 189 patients who were treated in the public hospital were diagnosed with STEMI, compared with 78 patients with STEMI who were treated in private hospitals. Therefore, in the public health system, 80% of the patients with AMI were diagnosed with STEMI, compared to 32% in the private hospitals ($p < 0.001$), indicating a relationship between the type of AMI and the type of hospital. People treated in the public hospital were 8.56 times more likely to have STEMI compared to those treated in the private hospitals (Table 2).

In addition, 183 (60%) of men had STEMI, compared to 84 (48%) of women. Men had a 1.62 times greater chance of having STEMI compared to women ($p = 0.014$). Low educational attainment and age group (between 18 and 49 years) also showed a significant relationship with the severity of infarction (Table 2).

Smoking, DM, SAH, dyslipidemia, obesity/overweight (BMI), and physical inactivity showed a significant relationship with the development STEMI. In the univariate analysis, these variables did not show any statistically significant differences related to the type of infarction (Table 2).

QOL, AMI type, and in-hospital outcome

Considering that the SF-36 score ranges from 0 to 100 (with 0 being the worst state and 100 the best state), the mean scores for all domains ranged from 41 to 69. Only the physical aspects of the domains and pain had a mean value below 50. Social and mental health domains had the highest averages (Table 3)[16]. Comparisons of mean SF-36 scores between STEMI and NSTEMI showed no statistically significant differences (Table 4).[17]

Table 5 [18] shows the mean F-36 scores of AMI patients with and without in-hospital events. Functional capacity showed a statistically significant relationship in the univariate analysis with cardiovascular death ($p < 0.024$). Likewise, a statistically significant relationship between pain and acute and chronic renal failure ($p < 0.041$), and between cardiovascular death and physical performance ($p < 0.040$) was also found.

Table 1 – General characteristics of patients (n=480) with acute myocardial infarction, Aracaju, Sergipe, Brazil, 2019

Variables	Category	Frequency (n°) (%)
ACS type	STEMI	267 (56)
	NSTEMI	213 (44)
Health service	Public	236 (49)
	Private	244 (51)
Sex	Masculine	305 (64)
	Feminine	175 (36)
Color	White	164 (36)
	Black	64 (14)
	Brown	230 (50)
Educational attainment	Elementary School	266 (55)
	High School	142 (30)
	Higher Education	72 (15)
Weight excess	Yes	317 (67)
	No	159 (33)
Tobacco use	Yes	92 (19)
	Ex-smoker	170 (35)
	No	218 (45)
DM	Yes	169 (35)
	No	311 (65)
SAH	Yes	103 (21)
	No	377 (79)
Dyslipidemia	Yes	263 (55)
	No	217 (45)
History of CAD	Yes	276 (58)
	No	204 (43)
IPAQ	Sedentary	254 (53)
	Active	226 (47)
Age group	from18 to 49	63 (13)
	from 50 to 59	117 (24)
	from 60 to 69	158 (33)
	from 70 to 79	93 (19)
	80 or over	49 (10)
Marital status	Married/Stable union	315 (66)
	Divorced/Widow(er)/	101 (21)
	Single	63 (13)

ACS: acute coronary syndrome; AMI: acute myocardial infarction; STEMI: acute myocardial infarction with ST-segment elevation; NSTEMI: acute myocardial infarction without ST-segment elevation; DM: diabetes mellitus; CAD: coronary artery disease; IPAQ: International Physical Activity Questionnaire.

Table 2 – Relationship between types of acute myocardial infarction with qualitative variables, Aracaju, Sergipe, Brazil, 2019

Variable / Category	AMI		OR (CI 95%)	p-value*
	STEMI (%)	NSTEMI (%)		
Health Service				
Public	189 (80)	47 (20)	8.56 (5.64-12.99)	<0.001
Private	78 (32)	166 (68)	1.00	
Sex				
Masculine	183 (60)	122 (40)	1.62 (1.12-2.36)	0.014
Feminine	84 (48)	91 (52)	1.00	
Race (skin color)				
White	79 (48)	85 (52)	0.68 (0.45-1.01)	0.071
Black	40 (63)	24 (38)	1.22 (0.69-2.15)	
Brown	133 (58)	97 (42)	1.00	
Education				
Elementary school	174 (65)	92 (35)	2.97 (1.74-5.08)	<0.001
High school	65 (46)	77 (54)	1.33 (0.74-2.36)	
Higher education	28 (39)	44 (61)	1.00	
Overweight/Obesity				
Yes	171 (54)	146 (46)	0.85 (0.58-1.25)	0.476
No	92 (58)	67 (42)	1.00	
Tobacco use				
Yes	60 (65)	32 (35)	1.91 (1.15-3.16)	0.028
Ex-smoker	99 (58)	71 (42)	1.42 (0.95-2.13)	
No	108 (50)	110 (50)	1.00	
DM				
Yes	90 (53)	79 (47)	0.86 (0.59-1.26)	0.500
No	177 (57)	134 (43)	1.00	
Hypertension				
Yes	56 (54)	47 (46)	0.94 (0.61-1.45)	0.859
No	211 (56)	166 (44)	1.00	
Dyslipidemia				
Yes	136 (52)	127 (48)	0.70 (0.49-1.01)	0.071
No	131 (60)	86 (40)	1.00	
History of CAD				
Yes	151 (55)	125 (45)	0.92 (0.64-1.32)	0.707
No	116 (57)	88 (43)	1.00	
IPAQ				
Sedentary	139 (55)	115 (45)	0.93 (0.65-1.33)	0.742

Active	128 (57)	98 (43)	1.00	
Age group				
from18 to 49	41 (65)	22 (35)	3.51 (1.60-7.68)	0.016
from 50 to 59	71 (61)	46 (40)	2.91 (1.45-5.82)	
from 60 to 69	87 (55)	71 (45)	2.31 (1.18-4.49)	
from 70 to 79	51 (55)	42 (45)	2.29 (1.12-4.68)	
80 or over	17 (35)	32 (65)	1.00	
Marital status				
Married/Stable union	175 (56)	140 (44)	0.62 (0.35-1.10)	0.075
Divorced/Widow(er)/	49 (49)	52 (51)	0.47 (0.25-0.91)	
Single	42 (67)	21 (33)	1.00	

**Chi-square or Fisher's exact test. OR: Odds Ratio, AMI: Acute Myocardial Infarction; STEMI: Acute Myocardial Infarction with ST-segment elevation; NSTEMI: Acute Myocardial Infarction without ST-segment elevation; DM: Diabetes Mellitus; CAD: Coronary artery disease; IPAQ: International Physical Activity Questionnaire.*

Table 3 – Summary of quantitative variables of the SF-36 questionnaire of acute myocardial infarction patients (n=480)[16]

Domains	Average	Median	Standard deviation
FUNCTIONAL CAPACITY	54	55	32
PHYSICAL	41	25	42
PAIN	48	41	30
HEALTH	58	60	22
VITALITY	60	60	24
SOCIAL	68	75	29
EMOTIONAL	60	100	44
MENTAL	69	72	22

Unexpectedly, we did not observe a statistically significant difference between the mean scores of physical and mental health regarding the CVEs that occurred during hospitalization. We observed an association between emotional domain and congestive heart failure (CHF) ($p < 0.004$). Vitality was significantly related to the onset of CHF ($p < 0.045$), cardiovascular death ($p < 0.012$), and reinfarction ($p < 0.007$). The social aspect also showed a statistically significant relationship with CVEs, including angioplasty ($p < 0.049$), myocardial revascularization (MR) ($p < 0.033$), cardiovascular death ($p < 0.047$), and reinfarction ($p < 0.010$).

Discussion

The study sample was predominantly elderly and male, and a family history of CAD was found in 58% of the patients. These three factors (age, sex, and history of CAD) are classified as non-modifiable RF. Among the modifiable RF, the most prevalent were obesity, hypertension, dyslipidemia, and physical inactivity; most patients were non-smokers or ex-smokers.

In a multicenter study carried out in Brazil, most patients were also male, with an average age varying between 61 and 65 years.[19] International studies have also reported

higher incidences of AMI in male elderly populations.[20, 21] This may be related to the high life expectancy and men's health gap, which causes an increased prevalence of these chronic-degenerative diseases.

Regarding the type of infarction, there was a higher prevalence of STEMI (56%) compared to NSTEMI (44%). Marino et al.,[22] described the profile of patients with ACS and found a higher prevalence of STEMI patients (n = 214) compared with NSTEMI patients (n = 73).[22] The literature shows that the incidence of STEMI and NSTEMI varies across the world, and that, in European countries, the incidence of NSTEMI has been increasing.[23,24]

Regarding the type of hospital (public vs. private), the number of patients attending public (49.2%) and private hospitals (50.8%) was similar. Regarding the type of AMI, the number of STEMI cases was higher in the public hospital than in private hospitals. This may be explained by the fact that the public hospital where the study was conducted is a referral center for cardiac surgery in the Brazilian Unified Health System (SUS). In the patient selection process for surgery, higher priority is given to patients with STEMI.

Regarding the relationship between the type of AMI and RF, there was a significant correlation between STEMI and smoking. The nicotine present in tobacco is the most addictive psychoactive drug, and responsible for raising heart rate and blood pressure, in addition to promoting thrombogenicity. Approximately 21% of deaths are associated with tobacco. Smoking also interferes with individuals' QOL.[25,26]

With respect to perception of health-related QOL by all the respondents, the mean scores for the domains of physical component and pain were low when compared with the dimensions of vitality, and social, emotional, and mental health. Studies that evaluated QOL during hospitalization observed a negative perception of QOL in both physical and pain domains, as well as of sleep and emotional reactions. The latter two were related to the type of AMI and the process of hospitalization.[27,28] Angina, together with feelings triggered by hospitalization, can influence pain and physical aspects.

In the last decades, research investigating the QOL of cardiac patients has reported a decline in their physical capacity due to dyspnea and fatigue.[29, 30] The present study corroborates these findings and reinforces that these individuals require proper management not only of pain but also of the decline in physical capacity.

Contrary to expectations, we found no significant difference in QOL between the two types of AMI. Another similar study[23] also found no significant difference between the AMI types, corroborating our results. This study also observed a reduction in patient QOL for all domains, except for the general health domain, following in-hospital CVEs.[23]

Mollon and Bhattacharjee,[31] in a case-control study, identified that individuals who suffered AMI had lower QOL in the domains of general, physical, and mental health compared to individuals without AMI. In the domains of sleep, emotional support, and life satisfaction, there were no differences between AMI survivors and the control group.[31]

When analyzing the relationship between QOL and in-hospital outcomes of our patients, we identified that functional capacity, physical, social, and vitality domains were associated with cardiovascular death. New episodes of AMI were related to the vitality and social domains, and CHF was associated with the emotional and vitality domains. Regarding pain, higher scores were reported by the patients with acute and chronic renal failure.

Furthermore, in the present study, the occurrence of sepsis was related to functional capacity, and angioplasty and myocardial revascularization (MR) were associated with the social domain. Contrary to our expectations mean scores for the physical and the mental health dimensions were not different when the in-hospital events were considered.

Therefore, the social domain was related to a higher risk of in-hospital events. In a similar study, which evaluated the quality of life after MR surgery, we observed that the domain social relationships had the second highest score.[31] According to Souza et al.,[32] social support can act as a protective factor, by relieving stress during crises and facilitating the recovery from the disease.[32]

A major scientific challenge is the improvement in the evaluation of mortality predictors as well as the establishment of appropriate treatment. However, it is common sense to combine the established RF and the factors known to interfere with patient's QOL for the creation of educational programs. One of the relevant achievements of the present study was to identify the differences in the QOL scores according to in-hospital events. These findings can serve as a basis for new scientific projects. Moreover, they prove that psychosocial factors are involved in the development and recovery from the disease.

Table 4 – Comparison of quantitative variables of the SF-36 questionnaire between the types of acute myocardial infarction (n=480)[17]

Domain	STEMI			NSTEMI			p-value*
	Median	P25	P75	Median	P25	P75	
FUNCTIONAL CAPATICY	55	30	80	55	25	85	0.894
PHYSICAL	25	00	100	25	00	75	0.091
PAIN	41	20	72	41	20	62	0.688
HEALTH	62	42	77	57	42	72	0.544
VITALITY	65	45	83	60	40	75	0.065
SOCIAL	75	50	100	63	50	100	0.073
EMOTIONAL	100	00	100	100	00	100	0.564
MENTAL	72	56	88	72	52	84	0.285

**Mann-Whitney test. SD: Standard deviation; FC: Functional capacity; STEMI: Acute myocardial infarction with ST-segment elevation; NSTEMI: Acute Myocardial Infarction without ST-segment elevation*

Some limitations should be considered when interpreting the results. The QOL questionnaire was administered retrospectively, and hence participants' responses relied on their memories. Additionally, since this is a generic tool, it did not focus on characteristics of AMI, and did not include diet as a risk factor.

Conclusion

In the present investigation, we observed that, compared with NSTEMI patients, a higher prevalence of smokers was observed among STEMI patients. The other RF evaluated were associated with both types of AMI equally.

We observed a negative perception in the domains of physical aspects and pain of QOL in STEMI and NSTEMI patients, with no difference in QOL between these two groups. Regarding the association of QOL with in-hospital CVEs, a significant association was found of physical and mental health with the occurrence of events.

Author contributions

Conception and design of the research: Jesus MT, Costa IMNBC, Silva DG, Silva JRS, Buarque MDBM, Sousa ACS. Acquisition of data: Jesus MT, Costa IMNBC, Buarque MDBM, Andrade FA, Sousa ACS. Analysis and interpretation of the data: Jesus MT, Costa IMNBC, Silva DG, Silva JRS, Barreto Filho JAS, Almeida-Santos MA, Oliveira JLM, Sousa ACS. Statistical analysis: Silva JRS. Writing of the manuscript: Jesus MT, Silva DG, Almeida-Santos MA, Oliveira JLM, Sousa ACS. Critical revision of the manuscript for intellectual content: Jesus MT, Silva DG, Almeida-Santos MA, Oliveira JLM, Sousa ACS.

Potential Conflict of Interest

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

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Study Association

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Ethics approval and consent to participate

This study was approved by the Ethics Committee of the *Universidade de Sergipe* under the protocol number 302.544. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Table 5 – Distribution of SF-36 domain scores according to the occurrence of in-hospital events in acute myocardial infarction patients[18]

Variables		Domains							
		FC	Physical	Pain	Mental	Vitality	Social	Emotional	Health
Angioplasty	Y	54±32	42±42	49±31	69±22	61±24	70±29	60±44	59±56
	N	53±32	39±42	47±30	68±22	59±24	64±29	61±44	54±58
Myocardial revascularization	Y	53±32	32±40	42±26	70±23	59±23	60±30	55±47	54±24
	N	54±32	42±42	49±31	69±21	61±24	69±29	61±44	58±22
Overall deaths	Y	31±30	31±47	48±38	54±23	48±24	44±33	83±19	46±11
	N	54±32	41±42	48±30	69±22	60±24	68±29	60±44	58±22
Cardiovascular deaths	Y	38±34	21±36	40±20	61±26	48±24	58±23	60±39	54±17
	N	55±32*	42±43*	49±31	69±21	61±24	69±29	60±45	58±22
Re-AMI	Y	45±34	30±40	44±34	66±19	45±22	52±27	58±44	57±19
	N	54±32	41±42	48±30	69±22	61±24	69±29	60±44	58±22
Post-AMI Angina	Y	40±34	31±42	44±32	60±28	51±25	63±30	44±51	57±22
	N	55±32	41±42	48±30	69±21	61±24	68±29	61±44	58±22
CHF	Y	45±30	23±40	36±32	63±24	46±28	60±29	26±39	61±19
	N	54±32	41±42	49±30	69±22	61±24	68±29	61±44	58±22
CS	Y	50±30	25±43	50±30	66±21	58±18	73±22	60±37	57±20
	N	54±32	41±42	48±30	69±22	61±24	68±29	60±44	58±22
CRA	Y	44±30	21±32	42±18	63±30	53±24	63±29	60±37	57±23
	N	54±32	41±42	48±31	69±21	60±24	68±29	60±44	58±22
CVA	Y	42±42	50±50	48±12	68±10	53±6	58±38	67±33	60±7
	N	54±32	41±42	49±30	69±22	60±24	68±29	60±44	58±22
CRI or ARF	Y	37±21	8±14	17±6	45±23	42±15	38±22	56±19	47±16
	N	54±32	41±42	48±30*	69±22	60±24	68±29	60,17±44	58±22

*FC: Functional Capacity MR: Myocardial Revascularization; AMI: Acute Myocardial Infarction; CS: Cardiogenic Shock; CRA: Cardiorespiratory Arrest; CHF: Congestive Heart Failure; CVA: Cerebrovascular Accident; CRI: Chronic Renal Insufficiency; ARF: Acute Renal Failure; Y: yes; N: no. *: p value < 0,05.*

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