Research Article

Clinical Manifestation of Acute Myocardial Infarction: Classified by Age and Gender

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Abstract

Background: The purpose of the study was to evaluate clinical manifestations of acute myocardial infarction as classified by age and gender.

Methods: This cross sectional study was conducted in a coronary care unit of a regional urban medical center in northern Iran (Amol). A total of 366 patients diagnosed with acute myocardial infarction were recruited from January to June 2013. Patient demographic information, past medical history, and current symptom data were collected.

Results: Multivariate logistic analyses were performed to identify risk predictors of myocardial infarction patients classified by age and gender. Risk predictors for older patients were dyspnea, OR = 1.76 (95% CI 1.01, 3.06), weakness odds ratio = 2.35 (95% CI 1.31, 4.21), nausea odds ratio = 1.83 (95% CI 1.04, 3.20), vomiting odds ratio = 2.48 (95% CI 1.34, 4.57), fatigue odds ratio=1.87 (95% CI 1.02, 3.39), belching, odds ratio = 2.13 (95% CI 1.08, 4.20), and hiccups odds ratio = 2.81 (95% CI 1.25, 6.30). Sub group analysis in older women patients identified weakness odds ratio = 3.13 (95% CI 1.11, 8.85), and belching odds ratio = 34.70 (95% CI 3.86, 312.2) as risk predictors. Among older men patients, the predominant symptoms were sweating odds ratio = 3.74 (95% CI 1.06, 13.2) and vomiting odds ratio = 2.54 (95% CI 1.10, 5.91).

Conclusions: This study concludes that older acute myocardial infarction patients were more likely to have non-specific symptoms. Initial assessment for acute myocardial infarction should consider the possibility of non-specific clinical manifestations, such as weakness and belching in older women, and sweating and vomiting in older men.

Keywords: Myocardial Infarction, Age, Gender, Signs and Symptoms

1. Background

It is estimated that one in every 5 deaths worldwide is attributable to acute myocardial infarction (1), with $\geq$ 30% mortality rate in patients > 70 years of age (2). Unfortunately, cardiovascular disease rates are increasing in low-income, developing countries, largely due to modifiable risk factors (including sedentary lifestyle, obesity, tobacco use, high blood pressure, hyperlipidemia, and occupational-mental stress), and lack of adherence to health advice (3, 4). Overall, the prevalence of cardiovascular disease is 0.5% in men, 0.18% in women between 35 and 44 years; and 20.5% in men, 17.1% in women over the age

of 60 years (5). In Iran, there are approximately 3.6 million patients with cardiovascular disease; acute myocardial infarction is the most common cause of death, accounting for 46% of cardiovascular disease-related deaths, close to 150,000 people (6-8). The mortality rate in cardiovascular disease is decreasing in men, however, this trend is reversed in women in whom responses to treatment are poorer (9). Women are less likely to have their acute myocardial infarction symptoms detected and, consequently, hospital referrals are delayed (10). According to the world health organization report, approximately 25 million people will die due to cardiovascular disease in 2020 (11). The high burden of disease (DALY) associated with cardiovascu-

lar disease is particularly pronounced in young people (12) who are at greater risk of premature death in developing countries (13).

The clinical features of acute myocardial infarction in older patients differs compared to younger patients (2). The specificity of acute myocardial infarction symptoms declines with increased age and patients over 80 years old show similar symptoms (14). However, younger patients may also experience non-specific symptoms for weeks or months before a cardiac event (15). Precipitant acute myocardial infarction symptoms are also differentiated by gender; usually women will experience non-specific symptoms, which are associated with a worse prognosis than symptoms experienced by men (16). Also, based on available databases, there were no similar studies that assessed this issue in Iranian cardiac patients. Therefore, it is important to identify non-specific acute myocardial infarction symptoms and associated factors to assist achieving diagnostic certainty and appropriate treatment within 24 hours.

The aim of this study is to identify the clinical signs and symptoms of acute myocardial infarction by age and gender in Iranian acute myocardial infarction patients.

2. Methods

2.1. Design and Sample

A cross-sectional study design is optimum to ascertain point prevalence data (17) about symptoms of acute myocardial infarction with 366 patients (recruited between January and June 2013) who were diagnosed with acute myocardial infarction using a purposive sampling method. A sample size of 418 patients (G*Power 3.0.10) will be sufficient to detect a clinically important difference of 15% between men and women in the symptoms of myocardial infarction rate based on previous work (18), using a two-sided Z-test of the difference between proportions with 90% power and a 5% significance level. A total of 366 from 418 questionnaires were collected. The response rate was 87%.

Data were collected through questionnaires after 24 hours of admission to the CCU (data were collected by interviewing illiterate patients). Patient diagnosis and admission criteria were determined by the cardiologist in relation to electrocardiographic changes in ST segment, ST-elevation myocardial infarction. ST-elevation myocardial infarction is characterized as: ST elevation more 0.2 mV in leads V1 - V4 or over 0.1 mV in leads I, II, III, aVL, aVF, V5, V6. Non ST elevation myocardial infarction is characterized as: 1) the existence of angina for more than 20 minutes along with an increase in a cardiac biochemical marker of myocardial necrosis (troponin or creatine kinase-MB); 2) > 1.0 mm but < 2.0 mm in V1 - V4; and 3) electrocardiographic changes in ST segment depression: > 1.0 mm depression at 80 ms following the J point and inverted T; pathological Q waves [duration _0.03s amplitude Q: R ratio _25%] (10); 4) no history of musculoskeletal pain for at least one week before manifestation of the symptoms; 5) no digestive diseases such as peptic ulcer and gastro esophageal reflux disease; and 6) no congestive heart failure (19).

By reviewing published studies about clinical symptoms of acute myocardial infarction obtained through PubMed, Medline, and CINAHL, as well as scientific information database during 2000 - 2012, a 2-part questionnaire was developed. The keywords used in the literature review were "acute myocardial infarction", "signs", "older", "middle-aged", and "clinical features". Part I of the 2-part questionnaire derived demographic information (Table 1), past medical history, and laboratory tests on admission. Part II identified signs and symptoms of acute myocardial infarction, pain radiation, type of myocardial infraction, and site of involvement. All data were obtained through a semi-structured patient interview and a focused review of the medical file.

All questionnaire items were cross-checked by an expert panel of 10 cardiologists whose recommendations were included in the final questionnaire. Scale content validity ratio and scale content validity index were calculated to perform quantitative content validity. For calculating Scale Content Validity Ratio, the expert panel was asked to assess each item using a 3-point Likert scale: 1 = essential, 2 = useful but not essential, and 3 = unessential. According to the Lawshe's table (20), items with content validity ratio score of 0.56 or above were selected for inclusion (21). For the Content Validity Index, based on Waltz and Bausell suggestions, the same panel was asked to evaluate the items according to a 4-point Likert scale; 1 = not relevant, 2 = somewhat relevant, 3 = relevant, and 4 = very relevant (22). A Content Validity Index score of 0.80 or above was considered satisfactory (23). The scale content validity index and content validity ratio was 0.89 and 0.83, respectively.

2.2. Ethical Considerations

This study was conducted according to the Helsinki statement (24) and has been approved by the associated Mazandaran University of medical sciences ethics committee on May 2013. All patients gave full written informed consent. Further, there were no specific therapeutic or diagnostic procedures or additional costs incurred as part of the study participation. All interviews took place in quiet private treatment rooms away from disturbances and other people. Confidentiality was maintained by assigning numeric codes to the patients.

2.3. Statistical Analysis

Data were analyzed using the SPSS version 13 software (released 2007; SPSS for Windows, SPSS Inc., Chicago, IL, USA) with statistical significance set at P < 0.05. Differences between the 2 age-groups on demographical and clinical details were assessed using Chi-square tests with odds ratios (95% Confidence Interval) presented. A logistic regression was performed on the clinical symptoms and pain sites comparing the age groups adjusting for demographics and type of myocardial infraction.

3. Results

Nearly 2/3 were men and more than 1/2 were older than 60 years. Nearly 1/2 of the patients had a Non ST elevation myocardial infarction presentation. Demographics and acute myocardial infarction clinical symptoms as a function of age (older > 60 years versus middle-aged ≤ 60 years) are shown in Table 1.

Pearson's χ^2 analyses indicated that patients over 60 years of age were more likely to have hypertension (χ^2 (1) = 24.91, φ = 0.22, odds ratio = 2.64), diabetes (χ^2 (1) = 5.32, φ = 0.10, odds ratio = 1.53), and hyperlipidemia (χ^2 (1) = 7.31, φ = 0.12, odds ratio = 1.64), than patients aged < 60 years of age. On the other hand, patients aged < 60 years were more likely to have a history of smoking than those aged > 60 (χ^2 (1) = 11.29, φ = -0.15, odds ratio = 0.54).

The most common presenting symptoms were chest pain and sweating, regardless of age. Multivariate logistic regression analysis (adjusting for demographics and myocardial infraction presentation) revealed that patients aged > 60 years showed more commonly presenting symptoms of dyspnea, weakness, nausea, vomiting, fatigue, hiccups, and belching (Table 2). Subgroup analysis by gender showed that women aged > 60 years were more likely to experience weakness, sweating, and belching compared to younger women (Table 3). Older men (> 60 years) were more likely to experience vomiting than younger men (Table 3). Across the sample as a whole, the most common sites of pain were the sternum, left side of the chest, arm, shoulder, and scapula. There were no differences between the 2 age groups on the pain locations (not shown). In addition Figure 1 presented frequency of clinical symptoms in middle-aged and older patients.

4. Discussion

This study examined clinical presentation factors of older patients with acute myocardial infarction as compared to middle-aged patients. The clinical risk predictors for older patients were dyspnea, weakness, nausea, vomiting, fatigue, belching, and hiccups. Sub group analysis by gender demonstrated that predominant symptoms in older women were weakness, and belching compared to younger women. In contrast, older men were more likely to experience vomiting compared to younger men. These findings are supported by previous studies that have identified atypical symptoms of acute myocardial infarction (25). For example, Hwang et al. (2009) found that the odds of dyspnea, weakness, vomiting, and nausea were higher in older acute myocardial infarction patients compared to younger patients (26). However, other research has found that the odds of dyspnea, weakness, and vomiting for patients older than 60 years are greater than younger patients, results that are inconsistent with previous findings (27, 28). Nausea and vomiting may occur, presumably due to activation of the vagal reflex or stimulation of left ventricular receptors as part of the Bezold-Jarisch reflex (10). Importantly, cardiovascular disease in older patients is not seen in isolation as they generally have at least one other multiple chronic medical conditions. It is plausible that psychological changes associated with aging might also affect the presentation of symptoms. Importantly, the study results support the findings that age is a factor for atypical symptoms of acute myocardial infarction in Iranian patients (29, 30), and particularly with older age associated with diabetes and hyperlipidemia (31).

The results of this study found that older patients with acute myocardial infarction had statistically significantly increased odds of dyspnea, weakness, vomiting, nausea, and hiccups, which was several times greater than what was seen in middle-age acute myocardial infarction patients. The results of this study showed that chest pain occurs more often in younger middle aged acute myocardial infarction patients. In a study conducted by the Nobahar et al. (2005), chest pain symptoms were negatively correlated with age, with less chest pain complaints associated with increasing age (32). Accordingly, the results of other studies demonstrated that patients less than 65 years old reported more chest pain than older patients (33-36). In contrast, older adults with acute myocardial infarction are less likely to complain of chest, arm, or shoulder pain, which is also consistent with previous study (36). Hypothetically older patients often may have co-morbid conditions such as diabetes, and may have associated changes in pain perception thresholds, although further research is needed for the confirmation of this observation (37).

In the study of Majidi et al. (2011), which compared signs and symptoms of acute coronary syndrome in men and women patients, symptoms such as fatigue, lightheadedness, dizziness, nausea, dyspepsia, and fear were more common in women (38). In addition, other studies have
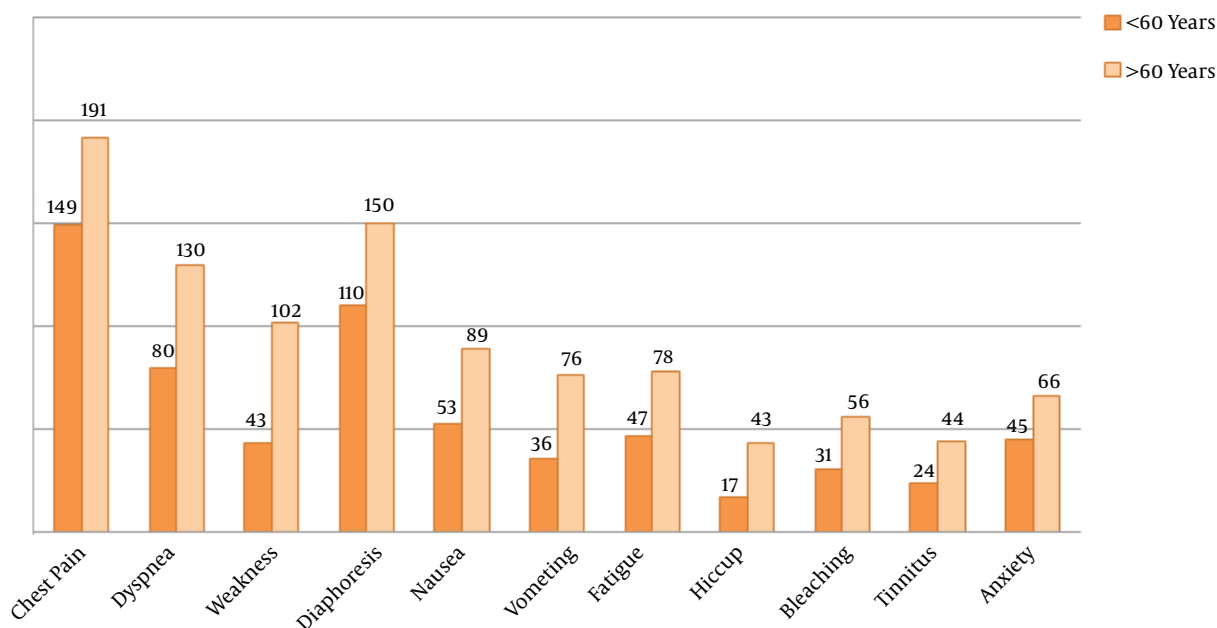
Figure 1. Frequency of Clinical Symptoms in Middle-Aged and Older Patients

reported that symptoms of acute myocardial infarction in men and women are different (39, 40). Diabetes, hypertension, and peripheral neuropathy are more common in women. Further, men and women are differences in nerve receptors and pain pathways, and understanding of unpleasant stimuli may differ as well (31).

In the study of Brieger et al. (2009), dyspnea was the most common sign of acute myocardial infarction in patients over 85 years and nausea and vomiting increased the odds of MI 2 fold (27). According to the study of Haro's et al. (2006), older patients experienced fatigue more commonly (41). Culic et al. (2002), stated that dyspnea, weakness, fatigue, coughing, and nausea can be due to neuropathy and dysfunction of autonomic nerve fibers (42). Older age of patients, especially associated with hyperlipidemia and diabetes, may be one explanation for atypical symptoms in patients with myocardial infraction (2). These previous research findings are consistent with the present study. Importantly, these other studies that were discussed did not appear to adjust their analysis for the effects of gender.

Goch et al. (2009), showed a high prevalence of diabetes, hypertension, and a lower prevalence of smoking and dyslipidemia in older myocardial infraction patients (2). However, Scoenenberger et al. (2011), identified that dyslipidemia and smoking are prevalent in younger myocardial infraction patients (43). Smoking is a risk fac-

tor, which plays an important role in early atherosclerosis (44), increases the oxidation of LDL cholesterol, and also damages vasodilatation of coronary endothelium (45). The results of this study showed that most patients smoked cigarettes, which are consistent with Shirashi's (2005) study. In the study of Shirashi, smoking in individuals younger than 40 years was the most important risk factor related to the disease. The risks associated with smoking is due to its role in increasing fibrinogen concentrations and platelet deficits, impairing fibrinolytic activities, decreasing reserved coronary flow, and the increased risk for vasospasm during smoking (46). In the study of Separhrhahm and Shemirani (2007), smoking was a more common risk factor than hypertension for coronary artery disease in young adults (47). Our findings are consistent with the previous findings that harmful effects of smoking behaviors can be an associated risk factor for cardiovascular disease.

A total of 6 important variables associated with atypical presentation were prior heart failure, prior stroke, older age, diabetes, being a woman, and nonwhite racial/ethnic group (29). There were no clear causes regarding occurrence of acute myocardial infarction without chest pain, although multidimensional mechanisms are likely responsible for this clinical manifestation. One potential theory is that the chest pain is caused by irritation of somatic or visceral nerve fibers (10). Visceral nerve fibers orig-

inate from the heart, blood vessels, and visceral pleura and enter the spinal cord at different levels. Stimulation of these fibers present symptoms that are not localized in a particular area and often they are difficult to describe by the patient (48). Some evidence shows that patients with silent acute myocardial infarction are more likely to have the disease go undiagnosed or be misdiagnosed, are less likely to receive reperfusion therapy, and also have a poorer prognosis (16).

4.1. Limitations

The study is limited by a convenience sample of self-selected patients presenting for cardiac treatment following an acute myocardial infarction. Further, it was not possible in this exploratory study to assess other factors, which affect acute myocardial infarction symptoms such as musculoskeletal disease, neurological and cognitive disorders, and lifestyle differences.

4.2. Implication for Health Policy/Practice/Research/Medical Education

Based on available databases, there were no similar studies that assessed this issue in Iranian cardiac patients. This study showed that various risk predictors of AMI are for older men (sweating and vomiting) and older women (weakness and belching). Be aware that atypical symptoms of AMI may result in earlier diagnosis and treatment further that. Therefore, nurses will be able to improve patients' lives through earlier diagnosis.

In conclusion, our results indicated inconsistencies between clinical manifestations of acute myocardial infarction between middle-aged and older patients while some symptoms were atypical. A lack of knowledge regarding different symptoms based on age and gender could be implicated with adverse clinical outcomes. Since investigating status of patients is one of the important nursing activities and nurses can play an important role in correct evaluation, treatment of angina and preventing its dangerous complications. Considering that nurses need to be concerned about symptom patterns, especially atypical symptom presentations, and the way of investigating them in providing nursing care for the patients, particularly for women. Understanding atypical presentation may lead to earlier diagnosis and treatment for patients with acute myocardial infarction. Therefore, identification of patients with presentation of atypical symptoms, especially in the older population, may prove relevant in improving prognosis. Earlier treatment and recovery from acute myocardial infarction will improve life quality for patients and can potentially offset economic and public health costs associated with Coronary Heart Disease disability. It is also essential that nurses provide patient education related to preventable risk factors such as smoking cessation and diet management.

Acknowledgments

Footnotes

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Table 1. Baseline Demographic and Clinical Characteristics of the Patients with Acute Myocardial Infarction (n = 366)

Variable	All Subjects (n = 366)	< 60 y (n = 159)	≥ 60 y (n = 207)	P Value
Age, y				-
Mean (SD)	58.7 (12.2)	47.6 (6.0)	67.22 (8.17)	
Range	32 - 94	32 - 59	60 - 94	
Gender				0.00
Male	231 (63.1)	114 (71.69)	117 (56.52)	
Female	135 (36.9)	45 (28.31)	90 (43.48)	
Marital Status				< 0.001
Single	19 (5.2)	14 (8.80)	5 (2.41)	
Married	310 (84.7)	138 (86.79)	172 (83.09)	
Widow	33 (9.0)	3 (1.88)	30 (14.50)	
Divorced	4 (1.1)	4 (2.51)	00 (0.00)	
Education				< 0.001
Illiterate	179 (48.9)	32 (20.12)	147 (71.01)	
Diploma	106 (29.0)	67 (42.13)	39 (18.84)	
Bachelor	67 (18.3)	47 (29.55)	20 (9.66)	
Master and Higher	14 (3.8)	13 (8.17)	1 (0.48)	
Body mass index				0.12
Thin (< 18.5)	11 (3.0)	4 (2.51)	7 (3.38)	
Normal (18.5 - 25)	167 (45.6)	62 (38.99)	105 (50.72)	
Over wight (25 - 30)	123 (33.6)	60 (37.73)	63 (30.43)	
Obesity (> 30)	65 (17.8)	33 (20.75)	32 (15.45)	
Physical Activity				0.16
Easy	188 (51.4)	80 (50.31)	108 (52.21)	
Light	125 (34.2)	49 (30.81)	76 (36.71)	
Moderate	39 (10.7)	23 (14.46)	16 (7.72)	
Hard	14 (3.8)	7 (4.42)	7 (3.38)	
Type of the acute myocardial infraction				
STEMI	193 (52.7)	73 (45.91)	120 (57.97)	0.02
NSTEMI	174 (47.5)	86 (50.57)	88 (42.50)	0.03
Necrosis Location of cardiac muscle				0.03
Anterior	106 (29.0)	37 (23.27)	69 (33.33)	0.15
Posterior	94 (25.7)	35 (22.01)	59 (28.50)	0.36
Inferior	101 (27.6)	40 (25.15)	61 (29.46)	0.54
Right	65 (17.8)	26 (16.35)	39 (18.84)	
Risk factors				
Hypertension	117 (32.0)	31 (19.49)	86 (41.54)	< 0.001
Diabetes	155 (42.3)	56 (35.22)	99 (47.82)	0.02
Hyperlipidemia	153 (41.8)	53 (33.33)	100 (48.30)	0.00
Anxiety	25 (6.8)	10 (6.28)	15 (7.24)	0.72
Smoking	175 (47.8)	92 (57.86)	84 (40.57)	0.00
Family history	186 (50.8)	90 (56.60)	96 (46.40)	0.05

Abbreviations: NSTEMI, non st elevation myocardial infraction; STEMI, ST elevation myocardial infraction.

Table 2. Comparing of Type of Symptom Between Middle-Aged Versus Older Patients with Acute Myocardial Infarction[a]

Symptoms	All Subjects (n = 366)	Age Group		Adjusted[b]
		< 60 (n = 159)	≥ 60 (n = 207)	Odds Ratio (95% Confidence Interval)
Chest pain	340 (92.9)	149 (93.7)	191 (92.3)	0.87 (0.29, 2.63)
Dyspnea	210 (57.4)	80 (50.3)	130 (62.8)	1.76 (1.01, 3.06)
Weakness	145 (39.6)	43 (27.0)	102 (49.3)	2.35 (1.31, 4.21)
Sweating	260 (71.0)	110 (69.2)	150 (72.5)	1.57 (0.86, 2.88)
Nausea	142 (38.8)	53 (33.3)	89 (43.0)	1.83 (1.04, 3.20)
Vomiting	112 (30.6)	36 (22.6)	76 (36.7)	2.48 (1.34, 4.57)
Fatigue	125 (34.2)	47 (29.6)	78 (37.7)	1.87 (1.02, 3.39)
Hiccups	60 (16.4)	17 (10.7)	43 (20.8)	2.81 (1.25, 6.30)
Belching	87 (23.8)	31 (19.5)	56 (27.0)	2.13 (1.08, 4.20)
Tinnitus	68 (18.6)	24 (15.1)	44 (21.2)	1.73 (0.83, 3.58)
Anxiety	111 (30.3)	45 (28.3)	66 (31.9)	1.04 (0.56, 1.92)

[a] Dependent variable of interest: type of symptoms (yes/no).
[b] Independent variable of interest: age > 60 vs age ≤ 60 (adjusted for: gender, marital status, education, Body mass index category, physical activity, Type of the acute myocardial infarction, necrosis Location of cardiac muscle and risk factors).

Table 3. Comparing of Type of Symptom Between Middle-Aged Versus Older Patients with Acute Myocardial Infarction by Gender[a]

Symptoms	Woman			Man		
	Age Group		Adjusted[b]	Age Group		Adjusted[b]
	< 60 (n = 45)	≥ 60 (n = 90)	Odds Ratio (95% Confidence Interval)	< 60 (n = 114)	≥ 60 (n = 117)	Odds Ratio (95% Confidence Interval)
Chest pain	39 (86.7)	80 (88.9)	3.60 (0.41, 31.3)	110 (96.5)	111 (94.9)	0.94 (0.14, 6.21)
Dyspnea	24 (53.3)	60 (66.7)	1.63 (0.58, 4.53)	56 (49.1)	70 (59.8)	1.68 (0.80, 3.54)
Weakness	17 (37.8)	56 (62.2)	3.13 (1.11, 8.85)	26 (22.8)	46 (39.3)	1.98 (0.88, 4.41)
Sweating	28 (62.2)	68 (75.6)	3.74 (1.06, 13.2)	82 (71.9)	82 (70.1)	0.91 (0.41, 2.03)
Nausea	16 (35.6)	41 (45.6)	2.37 (0.84, 6.75)	37 (32.4)	48 (41.0)	1.84 (0.85, 3.96)
Vomiting	12 (26.7)	33 (36.7)	2.48 (0.73, 6.54)	24 (21.0)	43 (36.8)	2.54 (1.10, 5.91)
Fatigue	15 (33.3)	43 (47.8)	2.18 (0.73, 6.54)	32 (28.1)	35 (29.9)	1.37 (0.59, 3.21)
Hiccups	5 (11.1)	26 (28.9)	4.94 (0.99, 24.5)	12 (10.5)	17 (14.5)	2.72 (0.81, 9.12)
Belching	3 (6.7)	32 (35.6)	34.7 (3.86, 312.2)	28 (24.5)	24 (20.5)	0.89 (0.35, 2.30)
Tinnitus	6 (13.3)	22 (24.4)	2.36 (0.59, 9.41)	18 (15.8)	22 (18.8)	1.66 (0.60, 4.60)
Anxiety	16 (35.6)	35 (38.9)	0.71 (0.22, 2.22)	29 (25.4)	31 (26.5)	1.64 (0.68, 3.93)

[a] Dependent variable of interest: Type of Symptoms (yes/no).
[b] Independent variable of interest : age > 60 vs age ≤ 60 (adjusted for: marital status, education, Body mass index category, physical activity, Type of the acute myocardial infarction, necrosis Location of cardiac muscle and risk factors).