Investigating the Factors Affecting Short-Term Mortality Rate in Patients with Acute Chest Pain

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Abstract

Background: In developed and developing countries, coronary heart disease is considered as the main cause of illnesses and mortality. In this respect, chest pain is the most common early symptom in patients affected with coronary artery disease. Approximately 1.3 of deaths due to acute myocardial infarction occur one or two hours following the onset of early signs. Thus, the key priority in preventive medicine is to reduce or control factors affecting mortality rates among these patients. In this regard, investigating the causes and the factors affecting short- and long-term mortality rates in such patients is of utmost importance. Due to the significance of the time to receive treatment in these patients, as well as the small number of research studies, the time pattern and the effect of delay in the treatment of patients suffering from heart diseases were evaluated in this study.

Materials and Methods: In this follow-up cohort study; a total number of 3,229 eligible patients were selected out of the 7,432 phone calls to Tehran emergency medical services during the first six months of 2012; then the given variables were measured and the status of short-term outcomes following chest pain attacks was evaluated. Finally, the data from 2094 patients were analyzed. To evaluate the relationship between the selected variables and the given outcomes, the statistics of Chi-square test and correlation coefficient with a 0.05 significance level were employed.

Findings: The results revealed that 50.1% of patients were male and 49.9% of them were women. The most frequent request for help had occurred between 6 a.m. and 12 a.m. with the highest frequency rate recorded at 12 p.m., 11 p.m., 1 p.m., 10 p.m. and 11 a.m.; respectively. Furthermore, no significant difference (p-value=0.001) was observed comparing the time factors of one week and one month as well as the 24-hour cycle.

Conclusion: It was concluded that identifying the predictors and the factors associated with survival in patients suffering from acute coronary syndrome could affect their survival rates. In this study and following multivariate logistic regression analysis, time factors such as one-week period, one-month period, and the cycle of request times for day-and-night help did not have any impacts on survival rates in the given patients.

Key words: Acute Chest Pain,
Daily Cycle, Time Pattern,
Pre-Hospital Emergency Medical Services

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Introduction

Chest angina or chest pain and acute myocardial infarction are two of the most common manifestations of coronary heart disease (CHD) known as coronary artery disease. About 1.3 deaths resulting from acute myocardial infarction happen within one or two hours prior to the appearance of early symptoms and such patients usually die before their admission into hospitals. Thus, the main priority of preventive medicine is to reduce or control the factors affecting short- and long-term mortality rates in these patients (1, 2).

Since most cases of deaths due to cardiovascular events occur before admission into hospitals, improvements in hospital treatments have by themselves limited effectiveness in decreasing mortality rates. In this respect, investigating the causes and the factors affecting short- and long-term mortality rates among these patients can be of utmost importance. For example, factors such as age, gender, history of smoking, history of aspirin consumption, and presence or absence of underlying diseases can be taken into account as significant ones affecting the mortality of patients suffering from heart diseases and the subsequent disabilities in this group (3, 7). Despite the importance of the time of receiving treatment by these patients, the related studies in terms of time patterns and the effect of delay in providing heart disease treatment are not enough.

Thus, the present study was conducted in the form of a cohort research within a six-month period in 2012 in order to evaluate the factors affecting short-term mortality in patients suffering from acute chest pain. In this study, 2,094 patients with sudden chest pain at different hours of the day were investigated.

Materials and Methods

Patient Selection

Patients aged 45 years and over affected with heart pain attacks extended in precordial or substernal areas, prolonged 20 minutes or so and that lasted during the visit by the emergency medical services (EMS), with no other obvious diagnosis justifying chest pain were included in this study. All the patients with characteristics inconsistent with the defined criteria within the six-month study period were excluded.

First, the pre-hospital EMS personnel in the city of Tehran were trained in terms of how to record patient complaints about acute chest pains. In the next step in this study, all the phone calls containing complaints associated with discomfort in chest area and the specified keyword (heart disease) were recorded.

Data Collection Instrument

The data collection instruments were audio-taped files available for all patients at the time of their phone calls to the EMS. After listening to the conversations in 7,200 audio files obtained during the study, a total number of 3,725 files matched with the study criteria were identified. In this respect, pre-hospital forms had been also recorded for 3,229 cases which were distinguished as appropriate ones in order to extract the given issues and were then included in the present study. These forms contained personal information, time of records, vital signs, patient's clinical status, and transfer or non-transfer of the patients to hospital, which were completed by the trained EMS personnel in the city of Tehran.

Data Analysis Method of the Study

Out of the 3,229 patients with pre-hospital forms, 2,094 cases were evaluated and then the onset time of chest pain until the time of request for help from the EMS and its effect on short-time mortality rates (one week and one month) in patients suffering from acute chest pain, the time interval between request for help from the EMS and its impact on short-term mortality in patients affected with acute chest pain, as well as the time interval between the visit by the EMS and the admission into the emergency department and its effect on short-term mortality among patients with acute chest pain, were examined. In the next step, patient information was extracted from the special pre-hospital forms and then recorded in the pre-designed and specific forms for data record. The data collection method associated with mortality was conducted through telephone conversations with patients' attendants and the patients themselves as well as examination of hospital records belonging to patients admitted into some hospitals. The given data were finally inserted into Tables associated with statistical calculations.

To validate the data and to measure their accuracy, a total number of 332 patients with records available in the archives department of hospitals out of the total number of 400 patients referred to the three selected hospitals were investigated in order to compare and to evaluate the data extracted from the given records with the data recorded by the EMS personnel. Following the completion of the checklists, the data obtained for this study were entered into computers and analyzed through the SPSS Software. The time of phone calls to the pre-hospital EMS was similarly calculated via descriptive statistics tests. The differences in the given variables were also measured through t-test and Chi-square test. The relationship between the defined factors and the CHD mortality rates during one week or one month from the onset of the symptoms were considered significant based on the P-value lower than 0.05.

Findings

The results revealed that a total number of 1,135 cases were not transferred to hospitals due to reasons including patient refusal to be transferred to hospital, outpatient and in-home treatments, deaths during transfer, deaths before the arrival of ambulance, absence of patients after the arrival of the EMS personnel in the given location, or cancellation of the EMS mission to hospitals. Of these, 10 cases died before the arrival of ambulance or on the way to hospital, 45 individuals received outpatient and in-

home treatment, 95 patients were not transferred to any hospitals owing to lack of cooperation in terms of transfer after getting signatures from them by the EMS personnel, 115 cases were also not transferred to hospitals due to cancellation of missions, absence of patients at the time of the arrival of ambulance, transfer by personal cars, patient recovery, as well as wrong addresses. Thus, all these cases were excluded from the present study.

In total, 2,094 patients were admitted into 58 hospitals within the city of Tehran during this study. Besides, these patients were tracked following the appearance of the symptoms and making calls to the EMS in the city of Tehran.

The findings showed a relative sinus rhythm in 8-hour periods within the study population. The figure also illustrated three peaks at about 1 a.m., 12 p.m., and 12 a.m. The sinus rhythm in the requests during the 4-hour day-and-night periods revealed that the most frequent requests had been made within 8 a.m. to 12 p.m. and 8 p.m. to 12 a.m.

The frequency distribution of mortality within the first week based on the one-hour day-and-night periods demonstrated that the distribution of mortality rates in the first week and the most frequent mortality rates within the first week had taken place among those whose requests for help had been made near midday and then late at night. Moreover, the distribution of the mortality rates based on one-hour daily periods showed that the most frequent mortality rates within the first month had occurred among individuals whose requests for help had been filed near noon and then at midnight (Figure 1).

The frequency distribution of mortality within the first week in the given population based on 5-year age groups indicated that the mortality rates had a rising linear trend in terms of the increase in the age of those making requests for help. Thus, the most frequent mortality rates had happened in the age group of individuals over 80 years.

Moreover, the frequency distribution of the CHD mortality within the first month in the given population based on age groups revealed that the mortality rates had a rising linear trend in terms of the increase in the age of patients making requests for help. Therefore, the most frequent mortality rates had occurred in the age group of individuals over 70-79 years. In other words, late deaths had occurred in lower age groups compared with higher age groups (Figure 2 - next page).

Examining the age pyramid for the given population also suggested that the most frequent requests for help had been made between ages 45 and 50 years and then between 55 and 60 years. Therefore, those who had survived within the first week were in the age group of 60 to 65 years and the deceased ones were in the age group of 75 to 80 years. The major concentration of mortality rates were in the age groups over 65 years particularly with two peaks in the age groups of 70-74 years and over 85 years in the given population (Figure 3). However, the most frequent distribution of mortality rates within the first month was associated with the age groups over 65 years with stronger concentration of mortality rates in the age range of 70 to 79 years.

The analysis of the research hypothesis for the differences in the mortality rates within the first week and also within the first month in four-hour daily periods was not statistically significant even though these findings were visually of importance. Given the population size in this study with their pre-hospital files (2,094 patients), the CHD mortality rates within one week and one month were estimated as 1.3% and 4.88%; respectively.

Figure 1: Frequency distribution of mortality within the first month in the study population based on one-hour daily periods

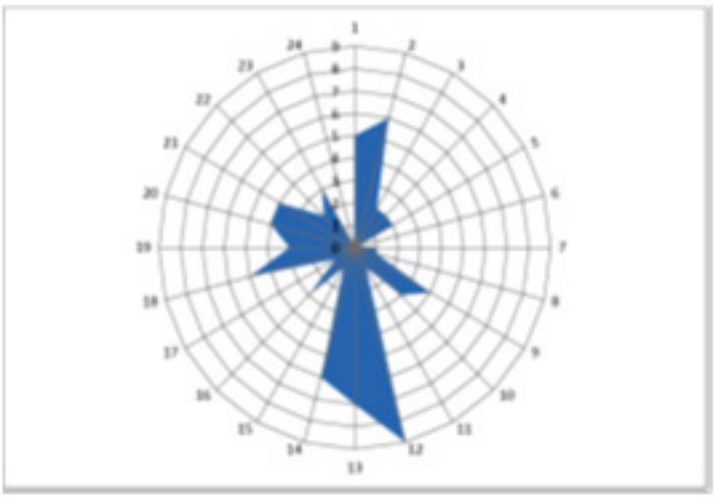


Figure 2: Frequency distribution of the CHD mortality in the study population based on 5-year age groups

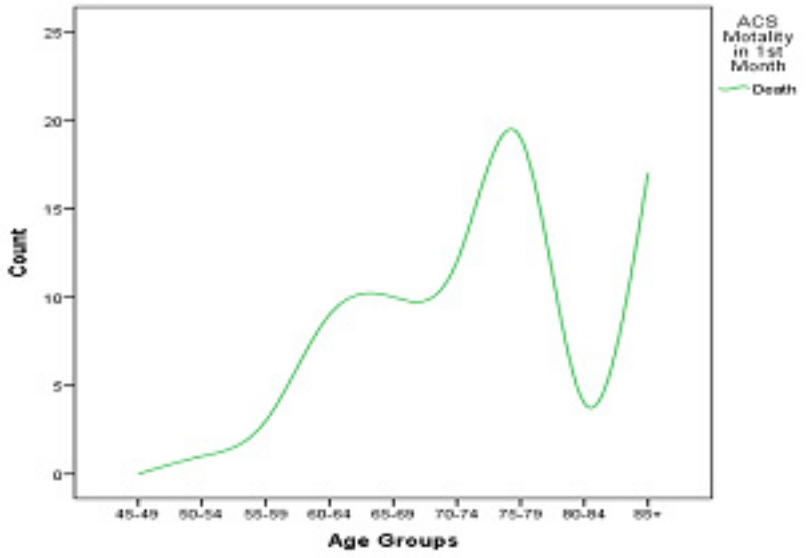
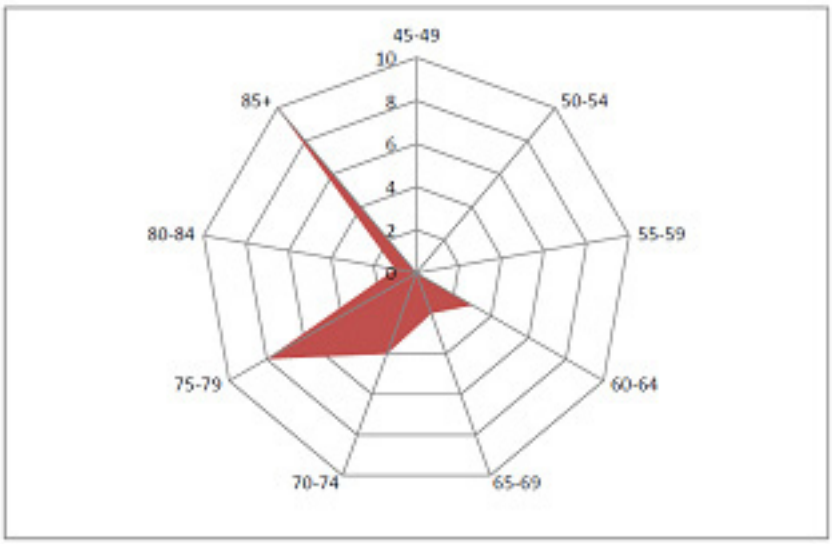


Figure 3: Mortality pattern within one week based on age groups in the study population



Discussion

The results of this study demonstrated that factors such as day-and-night periods, age range over 65 years, history of smoking, history of hypertension, symptoms accompanied by acute chest pain such as sweating and shortness of breath or a history of previous illnesses such as gastrointestinal diseases, and history of cerebrovascular attacks were among the most significant factors affecting CHD.

In this respect, a study on risk factors affecting survival rates in 2,020 patients suffering from acute chest pain in 2008 reported gender (masculinity), age over 65 years, and place of living as the most important risk factors affecting mortality among these patients. A statistically significant relationship was also observed between age, gender, place of living, occupation, and survival rate ($P<0.05$) (1). In reviewing the existing literature on patients with acute coronary syndrome from 1988 to 2009, higher mortality rates were similarly observed in women than in men (8). Gender-related differences in short-term mortality from cardiovascular events in 2009 were both reported in segment elevation myocardial infarction (STEMI) and age-related non-segment elevation myocardial infarction (NSTEMI) (9). Besides, some investigations had reported higher mortality rates among women with STEMI (10, 11). Thus, comparing the results of these studies with the findings of the related literature highlighted the role of age as a confounding variable in interpreting the results.

Age over 50 years, positive history of heart disease, typical heart pain, along with two factors of hospital evaluation (new ischemic ECG changes and troponin-positive) were also identified as factors with 100% sensitivity and 20.9% of predictive specificity of the CHD events within 30 days following the onset of symptoms (12). Moreover, the results of a study on 701 patients indicated that chest pain score greater than 11, age over 68 years, insulin-dependent diabetes, and a history of heart surgery were accompanied by serious short-term outcomes (13). Therefore, the findings of these studies were consistent with the results of the present study suggesting the role of old age and a history of cardiovascular diseases in predicting patient survival rates within one month.

The results of an investigation examining the relationship between pre-hospital delay time and short-term outcomes in patients with acute heart failure in 2011 also indicated that the time more than 45 minutes for the transfer of patients to healthcare centers was associated with the in-hospital mortality of patients (14).

Comparing the effect of history of smoking on the CHD mortality rates within one week and one month in the present study on chronic exposure to cigarette smoke in an inactive manner and the short-term outcomes (30 days) for hospitalized patients with acute coronary syndromes in Greece in 2007 on 1,003 patients exposed to such smoke showed a higher risk (61%) of the CHD events after hospital admission within 30 days following the onset of symptoms compared with those not exposed (15).

In an investigation in 2012; fear of death, sweating, as well as nausea were accompanied by decreasing 28-day mortality and increased syncope was associated with 28-day death. Presence of pain in the upper abdominal areas was also associated with reduced long-term mortality, shortness of breath, and increased mortality rates (16). In the present study; symptoms such as sweating and gastrointestinal discomfort as well as shortness of breath were accompanied by increased mortality rates within one week and one month.

The results of a study on 542,008 patients with myocardial infarction between 1994 and 2006 showed that, within the first manifestations of heart attacks, history of hypertension and smoking were considered as the most common factor and the lowest prevalence in this respect was associated with diabetes. History of diabetes and high blood pressure were also associated with higher rates of in-hospital mortality (17). In the present study, blood pressure and smoking were associated with increased mortality rates in the given population.

The findings of a study on gender differences in mortality rates following acute coronary syndrome also suggested that women with STEMI cases had higher 30-day mortality but they had lower 30-day mortality and unstable angina in the NSTEMI ones. Since the results were re-evaluated based on angiographic findings, no difference was found between women and men in terms of one-month mortality (18). The findings of this study were not in line with the results of the related literature in terms of increased chances of mortality in men three times more than that in women.

In the study on 2,172 patients, the incidence rate of acute coronary syndromes in men was three times more than that in women. The incidence rate of serious outcomes in both genders was also higher in the winter. Thus, the in-hospital mortality rate for women was higher than that in men. The 30-day mortality and readmissions in men and women were 17% and 16%, respectively. In total, women were older than men and spent more time between searches and getting their services; so, they were more likely to experience high blood pressure, obesity, and diabetes compared with men. In contrast, men had higher rates of smoking and physical activities compared with women (19). The results of this study were also in agreement with the findings of the present study.

In another study, blood pressure was identified as an independent predictor of short- and long-term outcomes of mortality rates in patients with acute coronary syndrome (20) that was in line with the findings of the present study.

Conclusion

Overall, it seems that important factors predicting and determining short-term survival (one week after the onset of chest pain) and moderate-term survival(one month after chronic chest pain) at the referral time included gender, age over 65 years, complaints about weaknesses, high blood pressure, presence of associated symptoms such as sweating, shortness of breath, and patient's medical history such as blood pressure, smoking, and taking aspirin. The given results were obtained after specifying the associated variables in a multivariate analysis of outcomes and then entering the data into a multivariate analysis in order to adjust the effect of each factor in the incidence of the outcomes.

The most important point in this study was attention to multivariate analysis and no satisfaction with the results obtained from the univariate analysis of possible predictors that had been less considered in the studies mentioned.

Using the pattern of history and lack of attention to para-clinical and diagnosis of enzymes among predictors of short- and moderate-term survival as the foundations of the study findings were also taken into account as some of the limitations in this study. Moreover, sample attrition due to the impossibility of sampling after the first phone calls was one of the other limitations of this study, so it was recommended to conduct a study using a sampling method rather than a census one in order to be able to better track the cases.

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Table 1: Evaluation of the relationship between findings associated with patient's medical history as well as history of diseases in patients with mortality in the first week and between the first week and the first month after tracking within the study population

Findings of patient's medical history	Outcomes within one week				Outcomes within one month			
	pre-hospital emergency		hospital		pre-hospital emergency		hospital	
	Statistic value	Significance level	Statistic value	Significance level	Statistic value	Significance level	Statistic value	Significance level
Weakness	259.40	0.000	227.64	0.000	354.59	0.000	311.96	0.000
Digestion	324.58	0.000	324.58	0.000	221.88	0.000	221.88	0.000
Blood pressure	106.12	0.000	98.02	0.000	160.86	0.000	148.81	0.000
Dizziness	18.14	0.001	17.57	0.000	24.76	0.000	24.159	0.000
Abdominal pain	23.53	0.000	23.53	0.000	32.287	0.000	32.28	0.000
Stroke	70.375	0.000	66.62	0.000	180.14	0.000	198.29	0.000
Asthma	3.06	0.22	3.16	0.21	4.054	0.132	1.338	0.507
Aspirin consumption	121.57	0.000	111.41	0.000	172.57	0.000	157.49	0.000
Smoking	24.44	0.000	18.89	0.000	25.2	0.000	27.08	0.000
Headache	25.42	0.004	19.29	0.001	20.72	0.000	21.11	0.000
Diaphoresis	26.7	0.000	26.7	0.000	44.29	0.000	42.91	0.000
Diarrhea	19.72	0.000	18.7	0.000	3.32	0.148	10.32	0.006
Cerebrovascular diseases	14.07	0.001	15.45	0.000	14.92	0.001	16.52	0.000
Vomiting	24.26	0.000	26.03	0.000	4.49	0.024	8.82	0.013
Shortness of breath	17.622	0.000	18.12	0.000	3.251	0.197	4.44	0.0103
Diabetes	10.4	0.005	9.87	0.007	2.109	0.335	2.65	0.266
Kidney diseases	10.76	0.003	11.32	0.003	4.89	0.86	5.22	0.0.73
Respiratory diseases	33.42	0.003	24.91	0.001	11.92	0.003	18.74	0.000
Mental illnesses	3.44	0.179	0.172	0.918	4.159	0.125	5.75	0.055
Allergies	25.11	0.000	25.11	0.000	0.75	0.69	0.75	0.69
Epilepsy	8.66	0.013	9.46	0.009	0.511	0.74	1.195	0.559
Surgery	29.91	0.022	17.72	0.000	29.91	0.000	19.12	0.000

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