Prehospital period in patients with myocardial infarction in Turkey

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ABSTRACT

Objectives: To identify the causes that affect the time from the onset of symptoms to admission to the hospital, in patients with a diagnosis of acute myocardial infarction (MI).

Methods: The study was carried out between January 2004 and January 2005 in the Emergency Room of the Uludag University Faculty of Medicine (UUFM) Hospital, Turkey. A total of 180 patients were included. Residents of the UUFM Department of Cardiology distributed a questionnaire to all patients. Socioeconomic level was determined by scoring the socioeconomic factors. For statistical analyses we used the SPSS 13.0 statistical software.

Results: Of the 180 patients, 79.4% (n=143) were admitted to the hospital within 6 hours of onset of symptoms and 20.6% (n=37) the time exceeded 6 hours of which 10% (n=18) admitted in more than 12 hours. Male patients seemed to present earlier than females ($p<0.05$ and $p<0.05$). The time to admission decreased as the socioeconomic level improved and the level of education increased. Patients with a history of MI, who had coronary angioplasty and had undergone coronary by-pass surgery admitted to the hospital earlier than those who did not have these factors $p=0.042$, $p=0.005$, $p=0.026$. Subjects who had anginal symptoms prior to acute MI ($p<0.001$) and patients with diabetes ($p<0.001$) had a significantly longer admission time.

Conclusions: It is essential to inform individuals with a low level of education and socioeconomic status; patients with anginal complaints and diabetic persons; particularly females, on the symptoms of MI and the importance of early hospitalization on the outcome.

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Even though chest pain usually results from insignificant causes, sometimes it can be due to life-threatening conditions. Serious problems may be encountered when approaching the patients since chest discomfort varies from one patient to another and symptoms can be masked by certain causes such as diabetes. The patient with chest pain can present either to the emergency room or to clinics. The major cause of chest pain in a patient examined by general practitioners is usually related to the musculoskeletal system, whereas the cause of a significant proportion (17-20%) of chest pains in patients referred or presenting to emergency services is of ischemic heart disease origin.[1] The clinical history of a patient with acute myocardial infarction (MI) is the most important diagnostic tool. Acute MI creates a sudden life threatening condition and there may not be sufficient time for history to be taken. Patient's history may reveal no prodromal symptoms beforehand. However, approximately half of patients

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experience prodromal symptoms that may be anginal in nature.[2] The mortality rate due to coronary heart disease has more than halved in many countries since 1960.[3,4] It has been argued that a third of this decline is the result of advances in treatments, the remaining two-thirds being the result of a decrease in risk factors for coronary heart disease.[5] Factors that affect survival following an MI are mostly rapid restoration of coronary blood flow and early treatment of complications.[6] About a half of the mortalities secondary to acute MI occur in the first 1-2 hours, mostly due to ventricular arrhythmia. Unfortunately, a significant proportion of patients are unable to receive medical care within the first 2 hours. The first medical care may be delayed as long as 12 hours in many patients.[7] Generally, the efficiency of reperfusion treatment is drastically decreased after 12 hours.[8] The principal goal in the management of patients with acute MI is the early initiation of treatment.[9] Studies with thrombolytic agents have shown the life saving effects of these drugs to be time-dependent.[10-13] On the other hand, there is a long time lapse between the onset of symptoms and the initiation of the treatment in many patients. Though some of these delays take place in the hospital, two-thirds of the delay period is spent between the onset of symptoms and reaching the hospital.[9] It has been shown that some 25% of the patients spent more than 6 hours before they presented to the hospital.[14,15] In many studies, the question as to why there were such delays remains unanswered. Previous studies have demonstrated that advanced age, female gender, and presence of diabetes played roles in the pre-hospital delay and that delay was associated with socio-economic features; however, this could not be fully characterized.[13-19] The aim of this study was to determine the time spent between the onset of the symptoms and the time they presented to the hospital, in addition to the factors responsible for delay among patients diagnosed with acute MI at the Emergency Units of Uludag University Faculty of Medicine (UUFM) Hospital.

Methods. This cross-sectional study was carried out between January 2004 and January 2005 on 180 patients who fulfilled the criteria, presented to UUFM Hospital, Emergency Service and diagnosed with MI. Patients who had presented to other health centers after the onset of symptoms and then referred to our hospital were excluded. To diagnose acute MI, at least 2 of the diagnostic criteria should have been present: determinants of necrosis (troponin I, myoglobin, CK-MB) with values over the normal limits; chest pain lasting more than 30 minutes, no response to intravenous or sublingual nitrate administration; Q-wave changes on 2 consecutive derivations of ECG (>0.04 sec); and permanent ST elevation or depression (>1 mm). Patients who presented to the hospital alive and those who had responded to resuscitation despite having suffered a "cardiac arrest" or "with no vital signs" were included in the study. Once all interventions had been carried out and treatments begun, information on the level of education, presence of pre-existing cardiac conditions (history of previous MI, coronary angioplasty, coronary artery bypass graft surgery, presence of anginal symptoms, congestive heart failure and stroke), presence of acute cardiac conditions (cardiac arrest, cardiogenic shock, acute heart failure), other accompanying clinical conditions (diabetes, hypertension, smoking, dementia, chronic obstructive pulmonary disease, renal diseases, recent surgery), family history of cardiac disease and the time lapse between the onset of the symptoms and time of admittance were obtained from patients and their friends/relatives. The socioeconomic status scale was used to establish the socioeconomic level.[20] Early thrombolysis was associated with lower overall mortality rate.[13] Thrombolytic therapy has played a major role in earlier treatment of acute MI. It has become definite that providing thrombolytic therapy after 6 hours of symptom onset would not be very helpful.[12] That is why our study groups were allocated into 2 groups; those presenting to the hospital within 6 hours after the onset of symptoms, and those after 6 hours. For statistical analyses the SPSS 13.0 statistical software was used. Student-t test was used to compare independent double samples; chi-square and the Fischer's exact test were used to explore the relationships between variables. Confidence interval was set at 95% and a p value of <0.05 was considered significant.

Results. Among 180 patients who presented to the Emergency Services of UUFM Hospital, diagnosed with acute MI and fulfilled the inclusion criteria of the study, 79.4% (n=143) were presented within 6 hours of the onset of the symptoms and 20.6% (n=37) after 6 hours. Socio-demographic, clinical and history characteristics of the patients are shown in **Tables 1 and 2.** The mean age of the patients was 60.36 ± 11.5 years. In our study, the mean age of male was 58.8 ± 1.2 years and the female was 65.3 ± 11.6 years. The difference between the mean age of male and female was significant (p<0.05). The mean age of patients who presented to the hospital before 6 hours was 59.6 ± 11.5 years and after 6 hours 63.2 ± 11.7 years. We did not find statistically significant difference between the mean age of both groups and the time of presentation to the hospital (p=0.10). Males

comprised 75.6% (n=136), and females comprised 24.4% (n=44) of the patients (**Table 1**). A statistically significant difference appeared between gender and the time of presentation to the hospital. The percentage of male patients was higher in the group that presented within the first 6 hours. There was a significant gender difference between the 2 groups (p=0.01). The percentage of females, on the other hand, was higher in the group that presented after 6 hours of the onset of the symptoms and the difference between the 2 groups was significant (p=0.01). As a result, the male was correlated with early presentation and the female was correlated with late presentation (**Table 3**). There was an inverse relation between the level of education and time of presentation to the hospital. As the level of education increased, the time between the onset of symptoms and presentation to the hospital decreased. Literate subjects comprised a higher proportion of the group that presented to the hospital late (p=0.001). The ratio of university graduates in the group presenting to the hospital early was significantly higher (p=0.006). No significant relationships existed between other levels of education and the time of presentation (**Table 3**). There was an inverse relation between the socioeconomic status of patients and the time of presentation to the hospital. The higher the socioeconomic status, the shorter was the time between the onset of the symptoms and the time of presentation. The percentage of patients with a very low or low socioeconomic status was higher in the group that presented to the hospital later than 6 hours. The difference between groups was significant (p<0.001 and p<0.001). The proportions of patients with average and high socioeconomic status were significantly higher in the group that presented to the hospital within 6 hours (p=0.001 and p<0.001). All 8 patients with a very high socioeconomic status presented to the hospital in the first 6 hours. However, due to the limited number of such cases, they comprised only 5.6% of cases that presented to the hospital within the first 6 hours; therefore no significant relationship was observed (**Table 3**). The percentage of patients who had previous MI, coronary angioplasty or coronary bypass surgery, was significantly higher in the group that presented the hospital within 6 hours (p=0.042, p=0.005 and p=0.026). It was found that patients with anginal symptoms prior to acute MI presented to the hospital more than 6 hours later, and the difference between 2 groups was significant (p<0.001). There was no significant difference between the presence of congestive heart failure, history of previous stroke and the time of presentation to the hospital (p=1.000, p=0.125) (**Table 4**). Patients with cardiac arrest and cardiogenic shock tended to go to the hospital within 6 hours after the onset of symptoms, but the difference between 2 groups did not reach the level of statistical significance due to the limited number of cases. The proportion of patients with acute heart failure in the group that presented to the hospital early was also significantly higher (p=0.012) (**Table 4**). The number of patients with diabetes who presented to the hospital later than 6 hours after the symptoms began, was significant (p<0.001) (**Table 4**). Two patients

Table 1 - Socio-demographic characteristics of the study group. (n=180).

Demographic characteristics	n	(%)
Gender		
Males	136	(75.6)
Females	44	(24.4)
Level of education		
Illiterate	12	(6.7)
Literate	19	(10.6)
Elementary school (5 years)	31	(17.2)
Junior High school (8 years)	22	(12.2)
High school (11 years)	44	(24.4)
University	52	(28.9)
Socioeconomic status		
Very low	31	(17.2)
Low	32	(17.8)
Average	55	(30.6)
High	54	(30)
Very high	8	(4.4)

Table 2 - History and clinical features of the study group.

Clinical features	n	(%)
History of cardiac diseases		
Previous myocardial infarction	48	(26.7)
Previous PTCA	26	(14.4)
Coronary bypass	18	(10.0)
Presence of Angina	67	(37.2)
Congestive heart failure	10	(5.6)
Stroke	10	(5.6)
Presence of acute cardiac conditions		
Acute heart failure	49	(27.2)
Cardiogenic shock	19	(10.6)
Cardiac arrest	15	(8.3)
Accompanying clinical conditions		
Diabetes	48	(26.7)
Hypertension	114	(63.3)
Smoking	116	(64.4)
Dementia	6	(3.3)
Chronic obstructive pulmonary disease	16	(8.9)
End stage renal disease	2	(1.1)
Surgery in the near past	6	(3.3)
Family history of coronary artery disease	53	(29.4)

PTCA - percutaneous transluminal coronary angioplasty,
CHF - congestive heart failure

with end-stage renal disease and on hemodialysis also sought medical attention more than 6 hours after the onset of the symptoms (p=0.045) (**Table 4**). All 16 patients with chronic obstructive pulmonary disease (COPD) reached the hospital within 6 hours after the onset of MI symptoms and this early presentation was statistically significant (p=0.041) (**Table 4**). The presence of hypertension (p=0.326), smoking (p=0.139), dementia (p=0.102), or recent surgery (p=0.604) was not significantly related to the time of presentation to the hospital. Similarly there was no significant relation between family history of heart disease and the time of presentation to the hospital (p=0.241) (**Table 4**).

Discussion. It is of paramount importance to keep in mind that time lost during assessment before being taken to the hospital or in the hospital is equivalent to myocardial tissue loss in a patient with a possible acute MI. Mortality depends on the extent of the infarction, loss of ventricular function, and the time between the occlusion of the vessel and TIMI 3 (thrombolysis in myocardial infarction) to restore blood flow.[21] Almost half of all mortalities related to acute MI occur in the first hour, i.e. before patients arrive at the hospitals.[7,22] Most of these early mortalities are the results of ventricular arrhythmia that can be prevented by defibrillation, either before they arrive at the hospital or at coronary intensive care units.[23] More than a fifth of patients included in the study presented to the hospitals more than 6 hours after the onset of acute MI symptoms. Half of them presented to the hospital more than 12 hours after the symptoms began. Delayed presentation is affected, not only by clinical parameters, but also by factors including the level of education, socioeconomic status and gender. Delay in hospitalization is a serious health problem in acute MI. Studies have shown that 20-35% of acute MI patients present to the hospital 6 hours after the onset of the symptoms.[11,12,15,16,17] In the present study, the ratio was relatively lower (20.6%). A study has demonstrated that advanced age was related to delayed presentation to the hospital following acute MI.[24] However, we could not find such relationship between the age and the time of presentation. In another study, age was related to the time of presentation in female patients.[25] In our study, mean age of male and female patients were 58.8 ± 11.2 years and 65.3 ± 11.6 years. The difference between the mean age of male and female was significant (p<0.05). This age difference is thought to be the reason for female patients presenting to the hospital later than males. There was an inverse relation between the level of education and time of presentation to the hospital. As the level of education increased, the time elapsed to reach the hospital decreased. This finding shows that it is important to inform the community about the symptoms of acute

Table 3 - The relationship between socio-demographic characteristics and the time of presentation to the hospital.

Demographic features	<6 hours (n=143)		>6 hours (n=37)		*P* value
	n	(%)	n	(%)	
Gender					
Males	114	(79.7)	22	(59.5)	0.011
Females	29	(20.3)	15	(40.5)	0.011
Level of education					
Illiterate	7	(4.9)	5	(13.5)	0.073
Literate	9	(6.3)	10	(27.0)	0.001
Elementary school	25	(17.5)	6	(16.2)	0.856
Junior High school	17	(11.9)	5	(13.5)	0.781
High school	37	(25.9)	7	(18.9)	0.380
University	48	(33.6)	4	(10.8)	0.006
Socio-economic status					
Very low	12	(8.4)	19	(51.4)	<0.001
Low	17	(11.9)	15	(40.5)	<0.001
Average	52	(36.4)	3	(8.1)	0.001
High	54	(37.8)	-	-	<0.001
Very high	8	(5.6)	-	-	0.209

MI. In many studies, low socioeconomic status was associated with delayed presentation to the hospital following MI, despite the presence of contradictory cases.[13,17,26,27] In our study, there was an inverse relation between the socioeconomic states of the patients and the time of presentation to the hospital. As the socioeconomic status improved the time spent between the onset of the symptoms and presentation to the hospital decreased, with an increase in the percentage of patients seeking medical attention within the first 6 hours. This may be due to better means of transportation and communication as the socioeconomic status improved. Other studies have shown that patients who suffered an MI, coronary bypass surgery or coronary angioplasty previously, reached the hospital earlier, whereas patients who had a history of stroke presented to the hospital late, just like those who had anginal symptoms prior to MI.[24] We found that patients who had a history of coronary angioplasty (p=0.042), previous MI (p=0.005), coronary by-pass surgery (p=0.026) represented a significantly higher proportion of patients comprising the group that presented to the hospital earlier. Patients in this group, having been informed about the symptoms and consequences of coronary artery disease during the course of the previous ailment, may have contributed to this result. Presence of congestive heart failure or history of stroke was not significantly related to the time of presenting to the hospital following MI. Similar to previous studies, we also found that there was an inverse relation between the presence of anginal symptoms before acute MI and the time of presentation to the hospital.[24] The percentage of patients with anginal symptoms was higher in the group that presented to the hospital late and the relation was significant (p<0.001). Patients with previous anginal symptoms possibly perceive pain of acute MI as another episode of angina. Factors contributing to this may include lack of sufficient information regarding coronary artery disease given or not knowing what to do during an attack. The fact that patients in this group are usually evaluated and followed-up in outpatient clinics may contribute patients not receiving proper attention due to time constraints. Patients who had presented to other health centers after the onset of symptoms and then been sent to our hospital were not included in our study. It was revealed that patients who had

Table 4 - The relationship between history and clinical features and the time of presentation to the hospital.

Demographic features	<6 hours (n=143) n	(%)	>6 hours (n=37) n	(%)	*P* value
History of cardiac diseases					
Previous myocardial infarction	43	(30.1)	5	(13.5)	0.042
Previous PTCA	26	(18.2)	-	-	0.005
Coronary bypass	18	(12.6)	-	-	0.026
Presence of Angina	44	(30.8)	23	(62.2)	<0.001
Congestive heart failure	8	(5.6)	2	(5.4)	1.000
Stroke	6	(4.2)	4	(10.8)	0.125
Presence of acute cardiac conditions					
Acute heart failure	45	(31.5)	4	(10.8)	0.012
Cardiogenic shock	14	(9.8)	5	(13.5)	0.550
Cardiac arrest	14	(9.8)	1	(2.7)	0.313
Accompanying clinical conditions					
Diabetes	25	(17.5)	23	(62.2)	<0.001
Hypertension	88	(61.5)	26	(70.3)	0.326
Smoking	96	(67.1)	20	(54.1)	0.139
Dementia	3	(2.1)	3	(8.1)	0.102
Chronic obstructive pulmonary disease	16	(11.2)	-	-	0.045
End stage renal disease	-	-	2	(5.4)	0.041
Surgery in the near past	4	(2.8)	2	(5.4)	0.604
Family history of coronary artery disease	45	(31.5)	8	(21.6)	0.241

PTCA - percutaneous transluminal coronary angioplasty

cardiac arrest or cardiogenic shock after acute MI presented to Uludag University Hospital, Emergency Service earlier. Fourteen of 15 patients who were revived after cardiac arrest, and 14 out of 19 patients who were revived after cardiogenic shock following acute MI had presented to our hospital within the first 6 hours. Similarly, among 49 patients with acute heart failure, 45 came to the hospital within the first 6 hours and this was statistically significant ($p<0.05$). These findings are in agreement with previous studies.[24] In the presence of acute cardiac situations following MI, early presentation to the hospital was something to be expected since these cases are transported to the hospitals by fastest means possible. Diabetic patients comprise a high risk group in acute MI.[13,15,16] Chest pain may be masked by diabetic neuropathy in these patients and hence, these patients presented to the hospital late.[24,28] We found a similar result whereby diabetic patients comprised a high proportion of the group that presented to the hospital late, and the difference was statistically higher ($p<0.001$). Therefore, diabetic patients should be informed about coronary artery disease and its symptoms. It has been shown that patients with terminal diseases and end-stage renal disease also presented to the hospital late after acute MI.[24] Possibly, these patients could not differentiate the symptoms of acute MI from the symptoms of their existing diseases. In our study, there were 2 cases with end stage renal disease who presented to the hospital after 6 hours, a difference that is statistically significant ($p=0.041$). Even though it has been shown that patients with COPD often presented to the hospital more than 6 hours after the onset of symptoms,[24] all 16 patients with COPD in our study arrived at the hospital within the first 6 hours ($p=0.041$). No significant relations were observed between hypertension, smoking, dementia, surgical operation in the near past and the time of presentation to the hospital. Even though patients with a family history of coronary heart disease were expected to have a better knowledge of MI and to consult a hospital when they had anginal symptoms, we did not find a significant difference between family history of heart disease and time of presentation to the hospital.

In conclusions and recommendations, the primary goal of pre-hospital treatment is prompt recognition and treatment of rhythm disturbances responsible for mortality in acute MI. Prognosis will be better if the thrombolytic treatment is begun early and it is very important to transfer the patients to the hospital as soon as possible. Patient should comprehend the symptoms, understand their possible importance and perceive the requirement for medical help. For many patients, it takes a while to make a decision due to lack of sufficient information. There are prodromal symptoms in two-thirds of acute MI cases. Patients should be trained to recognize these. In the view of the findings of the present study, female patients, especially those with a lower level of education and socioeconomic status, patients with chronic anginal complaints, diabetic patients and their families should be familiar with the symptoms of acute MI. Patients and families should be informed on how to react when possible symptoms of acute MI develops, what medications to use (nitroglycerin and possibly aspirin), mode of transportation to the hospital, and the location of the nearest hospital.

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