

Predictors of In-Hospital Mortality After Acute Myocardial Infarction

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ABSTRACT:

BACKGROUND:

Acute myocardial infarction remains a major cause of adult mortality. A steady decline in the mortality rate appears to be due to a fall in the incidence of acute myocardial infarction, a fall in the case fatality rate, identifying those patients who are at increased risk, and more aggressive prophylactic cardiovascular treatments to prevent it from occurring.

OBJECTIVE:

To identify, patients who have higher risk of in-hospital mortality after the first acute myocardial infarction.

PATIENTS AND METHODS:

The hospital mortality for the first acute myocardial infarction (AMI) was evaluated for 112 patients who were admitted to the coronary care unit in Baghdad Teaching Hospital during a total period of six months duration, between March and Sept. 2001.

For each patient, history, clinical examination, electrocardiograms, fasting venous plasma glucose were done.

RESULTS:

Total mortality was 16.1%. The following factors were associated with higher in-hospital mortality: advanced age (more than 65 years), females, diabetic, and clinically evident heart failure. Other variables were not associated with increase or decrease in mortality: hypertension, smoking, admission heart rate, bundle branch block, previous angina pectoris, and the site of the infarction.

CONCLUSION:

Certain groups of patients tend to have higher mortality; patients older than 60 years, females, diabetic and patients with clinical heart failure. Other factors didn't affect survival; location of the AMI, the presence of bundle branch block, hypertension, angina pectoris, smoking and the high heart rate on admission.

KEYWORDS: acute myocardial infarction, mortality.

INTRODUCTION:

Acute myocardial infarction can be defined as deprivation of the blood supply to the heart (ischemia) for a period of time sufficient to produce structural damage to the myocardium, often as the result of a coronary occlusion (thrombosis) ⁽¹⁾. Coronary care units have reduced early mortality from acute myocardial infarction by approximately 50% by providing immediate defibrillation, more precise management of heart failure, cardiogenic shock and beneficial intervention, including intravenous medications and recanalizing infarct-related arteries, especially with stents ^(2, 3, 4).

Six independent variables were found to be predictive of early mortality; these are left

ventricular function score, ventricular fibrillation, bundle branch block, history of previous acute myocardial infarction, age and atrioventricular block, while three independent variables were found to be predictive of late mortality: age, anterior location of the acute myocardial infarction, and a low peak creatine kinase-MB level.

So the sets of independent risk factors for early and late mortality after acute myocardial infarction are substantially different, suggesting that different mechanisms are responsible for outcome ⁽⁵⁾.

PATIENTS AND METHODES:

Between March 2001 and Sept. 2001, all patients who were admitted to the coronary care unit at Baghdad teaching hospital and ultimately diagnosed as a first acute myocardial infarction (AMI) were enrolled in the study. One-hundred and twelve patients fulfilled the criteria of inclusion throughout the duration of the study.

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Acute myocardial infarction was diagnosed according to the WHO criteria of diagnosis that is at least two of the three findings should be present for diagnosis; ischemic chest pain, elevated cardiac enzymes and significant ECG changes^(2, 6).

Inclusion criteria involved any patient with typical ischemic chest pain lasting > 30 min. and ECG changes in patients who had no history or ECG findings of previous myocardial infarction (MI). Any patient with previous history and/ or ECG findings of (MI) was excluded from the study. Patients who were admitted to the CCU as having acute myocardial infarction (AMI) and they had left the hospital on their own, despite the advice of the medical and nursing staff, and those patients who received thrombolytic therapy or referred to other hospital or special center for interventional therapy, were excluded.

Finally, those patients who were admitted but they died before the diagnosis of acute myocardial infarction was done, were not included in the study.

Electrocardiograms ECG:

Standard 12 leads electrocardiograms were obtained for each patient. Infarction was classified as^(7, 8):

1. Anterior: ST segments elevation V1 to V4.
2. Inferior: ST segments elevation II, III, and aVF.
3. Posterior: R wave in V1 or V2.

Patient labeled as having bundle branch block if he has new or presumably new ECG findings of right or left bundle branch block. Left ventricular failure was defined as bi-basal crepitations or a third heart sound with or without cardiogenic shock^(9, 10). Regular smokers were those with a habit of regular smoking, ex-smokers as those who quit smoking

for at least three years, and nonsmoker as never smoked⁽¹¹⁾. Diabetes mellitus was defined as a history of diabetes⁽¹¹⁾ or fasting venous plasma glucose level equal or more than 126 mg/dl⁽¹²⁾.

Hypertension was defined as use of antihypertensive drugs or a seated blood pressure > 140/90 mmHg⁽¹¹⁾.

Heart rate patients were categorized into four groups⁽¹³⁾.

- 1) Rate of 60 beats/min.
- 2) Rate between 61-90 beats/min.
- 3) Rate 91-110 beats/min.
- 4) Rate above 110 beats/min.

Statistical analysis:

Statistical analysis was done using numbers, percents and means \pm standard deviation, usual Chi-square, t-test and ANOVA (analysis of variants). Multiple linear regression models were used to define the predictor factor(s) of the outcome. Back ward-stepwise method with exclusion of two-standard deviation above and below the means was used.

RESULTS:

The in-hospital mortality was 16.1%. Patients with advanced age (more than 65 years), females, diabetic, and with clinical evidence of heart failure, had significant higher mortality. While hypertension, smoking, admission heart rate, bundle branch block, previous angina pectoris, and the site of the infarction were not associated with increase or decrease in mortality.

Timing of Hospital Discharge:

The average duration of hospitalization in this study was (6 ± 1.4) days. The average period between admission and in-hospital death was (2 ± 2.4) days.

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Table 1: The clinical predictors of in-hospital mortality

Clinical predictor	No. of patients (%)		P. V.
	Total	Died	
Male Gender	83(74.1%)	8(9.6%)	P < 0.05
Female	29(25.9%)	10(34.5%)	
Yes Diabetes	28(25.0%)	8(28.6%)	P<0.05
No	84(75.0%)	10(11.9%)	
Yes Heart failure	48(42.9%)	14(29.2%)	P < 0.05
No	64(57.1%)	4(6.3%)	
Anterior Site	77(68.8%)	13(16.9%)	NS*
Inferior	35(31.3%)	5(14.3%)	
Yes Angina pectoris	37(33.0%)	6(16.2%)	NS*
No	75(67.0%)	12(16.0%)	
Yes Hypertension	71(63.3%)	11(15.5%)	NS*
No	41(36.6%)	7(17.1%)	
Yes Smoking	79(70.5%)	13(16.5%)	NS*
No	33(29.5%)	5(15.2%)	
Yes Bundle branch block	36(32.1%)	7(19.4%)	NS*
No	76(67.9%)	11(14.5%)	

*Not significant

Table 2: The clinical predictor and statistical difference between patients survived from, and died in, the hospital

Clinical predictor	Survival no. (94)	Died no. (18)	P.V.
Age (Years) (Mean ± SD*)	(59.71 ± 11.44)	(66.33 ± 11.80)	P < 0.05
Admission heart rate (bpm•) (Mean ± SD*)	(86.15 ± 23.02)	(94.77 ± 32.03)	NS*

Standard deviation.

• beats per minutes.

* Not significant.

Table 3: Association between the gender of the patients and the presence of heart failure

	Gender		Total no. (%)
	Male no. (%)	Female no. (%)	
Present Heart failure	30 (36.14%)	18 (62.06%)	48 (42.85%)
Absent	53 (63.85%)	11 (37.93%)	64 (57.14%)
Total	83 (100%)	29 (100%)	112 (100%)

(P<0.05)

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Table 4: Association between gender and smoking

	Gender		Total no. (%)
	Male no. (%)	Female no. (%)	
Yes Smoking	64 (77.10%)	15 (51.72%)	79 (70.53%)
No	19 (22.89%)	14 (48.27%)	33 (29.46%)
Total	83 (100%)	29 (100%)	112 (100%)

(P<0.05)

Table 5: Admission heart rate and mortality rate

Heart rate (bpm)	Total no. of patients (%)	No. of patients died in the hospital	Mortality rate
< 60	20 (17.9%)	2	10%
61-90	44 (39.3%)	7	15.9%
91-110	35 (31.3%)	5	14.9%
>111	13 (11.6%)	4	30.8%
Total	112 (100%)	18	16.1%

bpm = Beats per minutes. , P = N.S.

DISCUSSION:

The in-hospital mortality was 16.1%. Over the world, many studies were done to clarify this point, some of these had the same figure, others had more, and the others had less mortality^(4, 14).

Timing of Hospital Discharge:

The average duration of hospitalization in this study was (6 ± 1.4) days. The average period between admission and in-hospital death was (2 ± 2.4) days. The time of discharge from the hospital is variable, patients who have undergone aggressive reperfusion protocols and have no significant ventricular arrhythmias, recurrent ischemia, or congestive heart failure have been safely discharged in less than five days⁽³⁾.

Age and mortality:

Advanced age was significantly associated with higher in-hospital mortality. Patients with age of lower than 65 years had lower mortality than patients with sixty five years and above. Others found similar results^(15, 16). This difference in mortality cannot be explained by different way of investigation and/or treatment for those above and below 60 years as Montague did⁽¹⁷⁾. Many other studies document higher mortality rate in older age groups^(15, 17, 18, 19, 20).

Gender and mortality:

Female patients had significantly higher in-hospital mortality than males (34.5% Vs 9.6%); it might be due to the coexistence of heart failure and diabetes mellitus in females more than males. These results were similar to most other studies; women's mortality rates from AMI are higher than those seen in men, due in part to women's older age at presentation and higher prevalence of co-morbid conditions such as diabetes⁽²¹⁾. In another study from this country⁽²²⁾, it was found that the mortality was also higher in women and it was significantly associated with the age of the patients, being more in those of 60 years and older and less in women below 50 years. Others found the difference in mortality no longer exist between male and female at the same age group^(20, 23, 24, 25). Goldberg RJ observed no significant sex differences in in-hospital survival⁽²⁶⁾.

Heart failure and mortality:

Heart failure was independently associated with increasing in-hospital mortality, and it was significantly more in female patients, (62% of patients with heart failure were female), and they

had higher mortality rate than male. Heart failure was also associated significantly with advanced age, and it might explain the higher mortality rate among those who are older age and female gender separately; while heart failure wasn't associated significantly with diabetic patients. Others found similar results^(27, 28, 29, 30). Berning found that only age and clinical heart failure had independent predictive value of death during hospitalization⁽¹⁶⁾. While Devlin suggested that more aggressive reperfusion strategies may improve prognosis⁽³¹⁾. Marcus found that the proportion of arrhythmic and myocardial failure deaths did not differ by treatment or age group⁽³²⁾.

Diabetes mellitus and mortality:

Diabetic patients had higher in-hospital mortality than others. As much as there was no significant association between diabetes mellitus and heart failure, gender of the patients, hypertension and advanced age, in the current study, this higher mortality rate will still need to be explained. One significant association between diabetes and increasing admission heart rate, which was associated with higher in-hospital mortality. This association wasn't statistically significant. Diabetic patients tend to have higher heart rate than non-diabetics do and the autonomic neuropathy associated with diabetes mellitus may be the cause as others noticed similar results^(28, 33, 34, 35). Yudkin also found that the outcome in diabetic patients is poor despite smaller infarcts as assessed by enzyme measurements, ECG methods, and postmortem finding⁽³⁶⁾.

Hypertension and mortality:

Hypertension didn't affect in-hospital mortality in this study. Fresco C found those patients with a history of hypertension had a significantly higher mortality⁽³⁷⁾. In contrast, T. Heer found that a very high initial blood pressure in patients with AMI not associated with increase, but decrease, in in-hospital mortality. In the other hand, lower but still normal systolic blood pressure values (100-130 mmHg) are associated with higher mortality⁽³⁸⁾.

Angina pectoris and mortality:

The presence of previous angina pectoris, prior to hospital admission showed no effect on the in-hospital mortality in this study. The mortality rate between patients with angina was higher than found by others^(39, 40, 41). Similar results found by Pierard⁽³⁹⁾, while Behar noticed that angina pectoris preceding acute myocardial infarction emerged as an independent predictor of increased hospital mortality rates⁽⁴⁰⁾. On the other hand,

Anzai T and Yoshikawa T suggested that the presence of angina before acute myocardial infarction may be associated with a protective effect on left ventricular function during anterior wall acute myocardial infarction. Although the precise mechanisms underlying the beneficial effects are unknown, they may be related to the development of collateral channels or ischemic preconditioning^(41, 42).

Bundle branch block and mortality:

There was no significant association between the presence of bundle branch block (BBB) and the in-hospital mortality rate in this study. No similar results were obtained. Dubois found that (BBB) emerged as an independent factor for worse in-hospital outcome; he found that hospital mortality was much higher among patients with complete BBB⁽⁴³⁾. In addition, Alpman A. found that the number of patients who had a left ventricular aneurysm was more among patients with (BBB) than those without, and the main cause of poor prognosis during the hospital period in patients with AMI and BBB was not arrhythmia or conduction disturbance but severe pump failure due to extensive myocardial necrosis⁽⁴⁴⁾.

Site of infarction and mortality:

No significant relation between the site of the infarction, and the in-hospital mortality rate in this study. This finding may be due to small size study. However, Taylor had obtained similar results⁽³⁰⁾, and Mauri found that the extent of myocardial injury seems to be more relevant than the site in determining in-hospital mortality⁽⁴⁵⁾. While Thanavaro found that patients with inferior myocardial infarction had significantly lower in-hospital mortality⁽⁴⁶⁾.

Smoking and mortality:

No significant association was found between smoking and mortality. No similar results were obtained. Ryan found that smoking doubles mortality after acute MI as it triggers coronary spasm, reduces the anti-ischemic effects of beta - adrenoceptor blockers, thus smoking cessation is essential in patients with acute MI⁽⁴⁷⁾. While Shmuel Gottlieb found that smokers have an early survival advantage over nonsmokers, and the seemingly better early prognosis could be attributed to the younger age, lower risk profile and less eventful hospital course of smokers. Smokers present with acute myocardial infarction about a decade earlier than past or nonsmokers⁽⁴⁸⁾.

Admission heart rate and mortality:

There was clear relationship between admission

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heart rate and in-hospital mortality, although it was not significant. This may be due to small number of patients in each group of heart rate. Admission heart rate was significantly higher in diabetic patients, and it was also associated with hypertension as that 85% of hypertensive patients had heart rate of between 60-110 beats/min., Wilbert found both in-hospital and post discharge mortality increased with increasing admission HR (12).

CONCLUSION:

- i. Higher in-hospital mortality rate had been noted compared to other similar studies, and probably it had been affected by the shortage of modern reperfusion therapy.
- ii. Certain groups of patients tend to have higher mortality. Those older than 65 years, whether or not they had heart failure, had higher mortality than younger age group. Females had higher mortality, and the increasing female mortality appears to be due to higher incidence of clinical heart failure and diabetes mellitus. Diabetic patients. Patients with clinical heart failure have increasing mortality.
- iii. The following factors didn't affect survival, the location of the AMI according to certain ECG criteria, the presence of BBB, hypertension, the presence of angina pectoris prior to AMI, smoking, and the high heart rate on admission.

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