# The association of changes in electrocardiography, echocardiography and cardiac enzymes with One-month mortality in AMI patients referring to Hajar Hospital of Shahrekord

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**Abstract: Background and aim:** Various laboratory tests with their own particular strengths and weaknesses exist for diagnosis of acute myocardial infarction (AMI). This study was conducted to determine the association of changes in electrocardiography, echocardiography and cardiac enzymes with One-month mortality in AMI patients referring to Hajar Hospital of Shahrekord in 2011. **Materials and method:** For this descriptive analytical study, 107 AMI patients were randomly enrolled. For gathering data a questionnaire was used. Demographic data and test results of cardiac enzymes, EKG, and echocardiography according to the medical profile were registered in the questionnaire. The follow-up continued for 40 days through phone calls and medical profile and the mortality and/or any recurrent myocardial complication was entered into the medical profile. Data analysis was performed by SPSS 11 using chi-square, Spearman correlation coefficient, and *t* test. **Results:** The mean age of patients was 60.62±12.58 years. Mortality showed a direct association with age and personal history of ischemic heart disease ($p<0.05$). In addition, one-month mortality was directly associated with troponin, ejection fraction, and the number of segments involved in echocardiography ($p<0.05$); troponin level in outliving people was less, the mortality among patients with less ejection fraction was higher, and the number of involved segments was higher in the dead compared to the outliving. **Conclusion:** The findings of this study emphasize the value of echocardiography in determining the prognosis of AMI. Moreover, troponin could have a high prognostic value in addition to its high value in diagnosis.

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## 1. Introduction

Acute myocardial infarction (AMI), commonly known as heart attack, is actually the perfusion abnormality in some part of the heart, causing heart cells to die (1). This disease is the most common diagnosis in industrialized countries, so that 650 thousand people annually in the United States are suffering from the new AMI and early mortality (in 30 days) due to this disease is about 30% (2). The laboratory tests for the diagnosis of myocardial infarction are divided into four groups: 1. liver enzymes 2. Changes in the electrocardiography 3. Echocardiographic imaging, and 4. Nonspecific marker of inflammation and tissue necrosis (3). In 2000, the highest value was for cardiac biomarkers in the WHO diagnostic criteria (4). These are proteins that are released from necrotic myocardium in a large amount into blood after infraction (5). Creatinine phosphokinase is one of these proteins or heart enzymes that enters blood, damaging myocardial cells, and begins to rise 4 to 8 hours after onset of stroke, then returns to normal after 2 to 3 days. This enzyme is at its peak for 24 hours. The larger the size of MI, the faster the enzyme will rise (6). But in 15% of cases of negative results, they are reported positive—false one (7). Another marker, Troponin, is not normally measurable in healthy subjects, but 3 hours after onset of chest, it begins to rise (8). The electrocardiography is also one of the first evaluations for patients, and if it is utilized during rib cage pain, it will diagnose correctly (9). Most patients with acute myocardial infarction undergo serial ECG changes, but some cases like extensive myocardial injury, infarct location, and presence of acute pericarditis and electrolyte changes limit the capability of ECG in MI diagnosis and localization (8). The two-dimensional echocardiography, wall motion (WM) abnormalities are always there, and although the echocardiography cannot differentiate acute myocardial infarction from old scars or ischemia, the simplicity and safety of this technique make it an interesting screening method; moreover, the assessment of left ventricular function by echocardiography may be important in determining the prognosis (2). In echocardiography, first the damaged myocardium is immobilized, but ventricular wall thickness is normal; after about 4 to 6 weeks, the

damaged area starts to thin, and increase echogenicity (10). Echocardiography may detect right ventricular infarction, ventricular aneurysm and pericardial effusion, too (5). Given that the acute myocardial infarction is one of the most common diagnoses in hospitalized patients, and is one of the most common causes of death in most communities, including our country, and includes life-threatening complications such as heart attack again, heart failure, ventricular septal defect, mitral valve failure as well as variety of arrhythmias—as mentioned above, various laboratory tests used for diagnosis of myocardial infarction, each with its own specific advantages and disadvantages; moreover, there is no study to investigate the performance of all tests simultaneously--this study, conducted in 1389, is an attempt to determine the association of changes in electrocardiography, echocardiography and cardiac enzyme with one-month mortality in AMI patients going to Hajar hospital of Shahr-e-Kurd.

## 2. Methodology

In this analytic descriptive study, conducted in 2010, given that the sample size have the reliability of 90 percent, the precision of 7 percent and one-month survival of 65%, we randomly selected 107 acute myocardial infarction patients going to Hajar hospital of Shahr-e-Kurd (diagnosed according to WHO criteria, including enzymatic changes, clinical findings and ECG changes). Since the intended experiments were exactly the same tests routinely performed on these patients for diagnosing MI, there was no ethical prohibition. The data collection instrument was a questionnaire and demographic data, test results of cardiac enzymes, ECG on admission and re-tests based on patient files were recorded in the questionnaire. The echocardiography findings of patients regarding the number of involved segments, aortic valve, and the EF, were recorded in the questionnaire based on the patient files. The patients were followed up for 40 days with phone calls, and their meical records were reviewed. The results such as heart failure resulting in death, or readmission to the hospital was mentioned in the questionnaire. After 40 days for all patients, the complete data was entered into SPSS v. 11.5. In order to compare the gender of subjects in the two groups, i.e. survived and died, as well as to compare the means of age, weight and the other quantitative variables between two groups, we used t-test. To determine the relationship between the personal and family history of ischemic heart disease and one-month mortality, the Spearman correlation coefficient was employed.

## 3. Results

This 107-subject population includes 82 male (76.6%), and 25 females (23.4%). The subjects had the age range of 32-85 years, and the mean of 60.62± 12.58 years. More than half of the patients (n=58, 54.2%) had complications during 40-day follow-up period; 49 patients (45.8%) did not. seventeen patients out of total sample (15.9%) died in the first 30 days, so the one-month survival rate was 84.1 percent. Death in the first month after a myocardial infarction was not associated with gender; the gender differences in the two groups was not significant (Table 1). The mean age of the patients who died were higher than that of those surviving; there was a significant relationship between age and one-month mortality ($p<0.001$). Among other demographic variables, the Spearman test showed a significant direct association between personal history of ischemic heart disease and one-month death ($p=0.24$, $r=0.01$). There is no significant relationship between family history of ischemic heart disease and one-month death ($p=0.52$, $r=0.06$). Other demographic variables (weight, the elapsed time period to go to the first medical center) were not significantly associated with mortality. In Table 2, the mean score of the studied variables in patients who survived is compared with that of patients who died. Laboratory, and diagnostic test results showed that the troponin enzyme, ejection fraction (EF) rate and the number of involved segment in echocardiography had a significant relationship with a one-month mortality ($P <0.05$), in a way that those who survived had lower troponin levels; moreover, lower EF rate in patients resulted in death. The number of involved segments in patients who died was higher than those of patients who survived. However, the mean of first creatinine phosphokinase, the highest creatinine phosphokinase, the highest STE in the electrocardiography, the sum of STE in the electrocardiography, and the number of involved leads in the two groups was not significantly different (Table 2).

## 4. Discussion

The present study was actually a descriptive analytical one. The subjects in this study were 107 AMI patients who were randomly selected. The results indicate that among demographic variables, age and personal history of ischemic heart disease was directly related to mortality, and other demographic variables (gender, weight, the elapsed time period to go to the first medical center, and history myocardial infarction in near relatives) were not significantly associated with mortality.

This study consisted of 76.6% male and 23.4% female. In a study conducted by Amani et al., entitled “An assessment of survival rate in patients

with acute myocardial infarction", the results were similar to those of the present study where a higher percentage of patients (72.8 percent) were male, and the rest (27.2 percent) female (11).

According to the results shown in Table 1, in this study, the mortality rate within thirty days after acute myocardial infarction was 15.9%. The results of the study conducted by Cambou et al. in France on the one-year survival of AMI patients showed that the mortality rate in the first 28 days was 13.2 percent (12). In another study conducted by Ghafarian the mortality in AMI patients in the first month has been reported in 18% (13). Higher mortality rate in the first month was related to the lack of familiarity with the symptoms of the disease, self-medication, late check-up, obesity and non-compliance with the physician orders (14). As the results showed, in older patients the risk of mortality had been significantly increased. In order to confirm the above results, a study conducted by Kubota showed mortality in AMI patients significantly increases with age (15). Another study done by Ghafarian showed that with increasing age, the mortality in patients rose up (13).

The results of this study indicated that mortality rate was higher in patients with a personal history of ischemic heart disease. In this regard, a study was carried out in Ireland by McMahon, which represented that 60 percent of those whose premature death was caused by myocardial infarction had a history of heart failure, and 17 percent did not; therefore, this result indicated the relationship between the history of MI and premature death (16). In a study conducted by Hoseini (2003), it is observed that there is also a significant correlation between myocardial infarction and mortality within the first 28 days after the attack (17). Similar results were also observed in the study by Nakanishi et al. where both short-term (one-month) and long term (one-year) survival in patients with a history of ischemic heart disease is low (18).

According to the results in Table 2, there was not an association between the first and highest creatinine phosphokinase levels with one-month mortality. In a study conducted by Hoseini (2002), the results showed that changes in cardiac enzymes was not significant related to the mortality caused by heart attacks (17).

In a study carried out by Fioretti et al., the results indicate that the highest creatinine phosphokinase levels associated with mortality within thirty days but not with mortality beyond thirty days (19). The amount of troponin in AMI patients was significantly associated with the one-month mortality, where troponin levels for patients who survived was lower. Therefore, it can be inferred that not only does troponin have high diagnostic value for acute myocardial infarction, but also has prognostic one. In a study on 260 patients conducted by Christianson et al. in the USA, such a result was achieved (20). Also, Ohman et al. represented the association between troponin levels and one-month mortality (21). There was no significant relationship between the patient's ECG data (the highest STE, total STE, the presence or absence of the Q wave) and the number of involved leads with mortality in patients, while in a study by Christianson et al. (2010), there was a significant relationship between total STE and survival of the patients (20). This difference in results may be due to differences in the number of sample sizes selected in the two studies, or differences in the research population, or in the instrument accuracy of ECG.

The last part of the clinical cases was to investigate the relationship between echocardiographic data and the patient's death, where it was observed that the rate of EF and the number of involved segments in echocardiography has been associated with mortality, so that the lower the EF rate, the higher the mortality in patients. There was also observed that the number of involved segments in deceased people was more than that of those who survived. The abovementioned findings show the value of echocardiography in determining the prognosis of AMI patients. Investigating the relationship between complications of acute myocardial infarction with mortality, we observed that in patients with complications of acute myocardial infarction in the given term, the chance of survival was smaller than that of those with no complication.

**Table 1:** Frequency and the comparison of gender in the two groups

| Variables | Died (percent) | Survived (percent) | Sum (percent) | Significance of K 2 |
|---|---|---|---|---|
| Female | 6 (5.6) | 19 (17.8) | 25 (23.4) | P=0.16 |
| Male | 82 (76.6) | 71 (66.3) | 82 (76.6) | P=0.16 |
| Sum | 17 (18.9) | 90 (84.1) | 107 (100) | P=0.16 |

**Table 2:** The comparison of mean scores of variables in the two groups

| Variables | Died M±SD | Survived M±SD | Significance of t-test |
|---|---|---|---|
| Age (year) | 68.7±8.55 | 59.1±12.67 | P=0.000 |
| Weight (KG) | 65.47±10.05 | 67.86±65.47 | P=0.31 |
| Time elapsed from appearing symptoms until taken to hospital | 17.52±26.56 | 901±13.64 | P=0.21 |
| Troponin (microgram/liter) | 10.81±5.98 | 6.97±5.40 | P=0.01 |
| First creatinine phosphokinase | 716.82±739.01 | 547.51±792.65 | P=0.41 |
| Highest creatinine phosphokinase | 2640.88±2709.25 | 2333.43±1616.91 | P=0.55 |
| Highest STE in ECG | 5.23±2.72 | 5.47±2.5 | P=0.72 |
| Highest STE in ECG | 15.61±7.22 | 14.88±6.88 | P=0.70 |
| Number of involved lead in ECG | 3.70±1.15 | 3.77±1.21 | P=0.82 |
| Patients' EF in echocardiography | 28.23±10.14 | 39.97±10.36 | P=0.000 |
| Number of involved segments in echocardiography | 3.88±1.45 | 2.62±1.05 | P=0.000 |

## 5. Conclusion:

The results of the present study represent the value of echocardiography in determining the prognosis of AMI patients. Moreover, it can be inferred that not only does troponin have high diagnostic value for acute myocardial infarction, but also has prognostic one.

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