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Original Article

Prognostic Determinants and Three-Month Survival in Myocardial Infarction: A Single-Center Retrospective Study at Shahid Beheshti Hospital, Kashan, Iran

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Abstract

Objectives: This study aimed to evaluate the three-month survival rate of myocardial infarction (MI) patients in Kashan, Iran, and identify key prognostic determinants. The hypothesis tested was that specific demographic and clinical factors are associated with increased mortality within three months of MI.

Design: Retrospective study.

Setting: Single-center study at Shahid Beheshti Hospital, a tertiary medical center in Kashan, Iran.

Participants: 120 MI patients admitted between 2017 and 2021 were identified from the hospital's archival system. MI diagnosis was confirmed based on established clinical criteria including electrocardiogram (ECG) findings, elevated cardiac enzyme levels, and expert confirmation by certified cardiologists. The study included patients with a confirmed diagnosis of MI, established through ECG changes, elevated cardiac enzymes, and specialist confirmation. Patients were excluded if their records were incomplete or if they were referred to other medical centers for continuing care.

Interventions: N/A (retrospective study).

Outcome Measures: The primary outcome measure was three-month all-cause mortality following MI. Measurements included demographic data, clinical history, and cardiovascular parameters, including left ventricular ejection fraction (LVEF).

Results: The study population was predominantly male (80.8%) with a mean age of 61.66 ± 11.94 years. The three-month mortality rate was 22.5%. Significant associations were found between mortality and patient gender ($P = 0.04$), type of MI ($P = 0.014$), history of prior MI ($P = 0.004$), age ($P < 0.001$), and cardiac output ($P < 0.001$).

Conclusions: Early diagnosis and management are crucial for high-risk MI patients, particularly the elderly and females. Interventions targeting improved cardiac output and hypertension control may enhance short-term survival. Future research should focus on comprehensive risk stratification and secondary prevention strategies.

Trials registration: Approval of the study protocol was given by the Institutional Ethics Committee of Kashan University of Medical Sciences, and the ethics code IR.KAUMS.MEDNT.REC.1402.106 was assigned.

Keywords: Myocardial Infarction, Three-Month Survival, Geriatric Population, Prognostic Determinants

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Introduction

Cardiovascular diseases (CVDs) continue to be the primary cause of death across the globe, with myocardial infarction (MI) significantly impacting global morbidity and mortality rates [1]. Recent estimates from the World Health Organization (WHO) reveal that CVDs are responsible for nearly 18 million deaths each year, highlighting the significant public health consequences of conditions such as MI and coronary artery diseases.[1] Approximately 138 000 mortalities per year (i.e., over 40% of all deaths) are caused by CADs, making them the main cause of mortality in Iran. Approximately half of these deaths are due to heart attacks.[2] The burden of MI is especially noticeable in the senior population, which not only has a higher incidence of MI but also has worse prognostic outcomes, despite the fact that there has been substantial improvement in acute management and secondary prevention.[3,4]

Elderly people are more susceptible to cardiac events due to a variety of physiological changes and comorbidities that come with aging, such as hypertension, diabetes mellitus, and renal dysfunction.[4,5] In addition, the early diagnosis and intervention of this population are impeded by the potential for atypical clinical presentations and diminished physiological reserves, resulting in an increase in mortality and morbidity following MI.[3,6] Mortality rate is high in the first year after MI, especially within the first three months, which remains a critical period for adverse outcomes despite advances in revascularization and pharmacotherapy.[7,8] This time frame is not only a window for acute therapeutic intervention but also an opportunity to implement intensive secondary prevention strategies.[7]

Although the CVD landscape in Iran reflects worldwide trends, some areas, like Kashan, may experience particular difficulties as a result of resource constraints and population changes.[9] Given the growing elderly population in the area, it is crucial to investigate the prognosis of MI patients to enhance healthcare delivery and improve survival rates.[9,10] It is imperative to evaluate the three-month survival rate after MI in Kashan to identify the factors that influence short-term outcomes, as healthcare providers are observing a disproportionate burden of MI among elderly individuals. These insights can help in customizing management strategies for high-risk elderly groups, leading to better clinical outcomes.

As a result, the objective of this study is to examine the three-month survival rate of patients diagnosed with MI at Shahid Beheshti Hospital in Kashan, Iran. By examining prognostic indicators during this critical period, we aim to enhance the evidence base shaping clinical practice guidelines for the prevention and management of MI in older adults.

Methods

Study Design and Setting

This descriptive observational study was conducted at Shahid Beheshti Hospital in Kashan, Iran, over a five-year period from the year 2017 to 2021. The study was designed to retrospectively evaluate patients diagnosed with MI and assess short-term survival outcomes following the cardiac event.

Sample Size

The sample size calculation was based on a myocardial infarction prevalence rate of 3.8%, as documented in previous studies.[11] Utilizing G*Power statistical software with a defined type I error (α) of 5% and a statistical power of 80%, the initial sample size required was determined to be 110 individuals. To account for a potential drop-out or loss-to-follow-up rate of 10%, the final targeted sample size was increased to 122 participants.

Participant Selection

Patients with a confirmed diagnosis of MI were identified from the archives of Shahid Beheshti Hospital, Kashan. MI diagnosis was confirmed based on established clinical criteria, including electrocardiogram (ECG) findings, elevated cardiac enzyme levels, and expert confirmation by certified cardiologists.

The study included patients with a confirmed diagnosis of MI, established through ECG changes, elevated cardiac enzymes, and specialist confirmation. Patients were excluded if their records were incomplete or if they were referred to other medical centers for continuing care. Participants meeting the inclusion criteria were consecutively enrolled using a convenience sampling approach.

Data Collection

A standardized data collection checklist was developed prior to data extraction. Patient data were collected from the electronic archiving system of Shahid Beheshti Hospital in Kashan. The following variables were systematically recorded: demographic information (age, gender, etc.), history of heart diseases in the patient, including first-degree relatives with cardiovascular events before the age of 45, presence of underlying comorbid conditions, history of cardiac medication use, family history of heart attack, tobacco use status, cardiac output evaluation metrics available in patient records, and time interval from symptom onset to hospital admission.

Data regarding the survival status of patients, specifically during the three months following the heart attack, were collected via structured telephone interviews. Care was taken to standardize data collection procedures

to minimize interviewer bias and ensure accuracy.

Data Management and Statistical Analysis

The collected data were thoroughly reviewed for completeness and entered into SPSS version 26.0. Descriptive statistics were employed to summarize patient demographics, clinical characteristics, and other baseline variables. Continuous data were expressed as mean ± standard deviation, while categorical variables were reported as frequencies and percentages.

Survival analysis was performed using the Kaplan-Meier method to estimate the survival probabilities over the three-month follow-up period. A log-rank test was applied to evaluate differences in survival distributions among subgroups. Statistical significance was defined as a P value < 0.05.

Quality Assurance

To ensure data quality and reduce potential biases, a pre-prepared checklist was used consistently by all data collectors. The extracted data were cross-validated by independent reviewers, and cases with incomplete records were excluded from the analysis.

Results

Demographics

A total of 120 MI patient records from Shahid Beheshti Hospital in Kashan were retrospectively analyzed. The demographic and baseline characteristics of the study population are summarized in Table 1. The mean age of the patients was 61.66 ± 11.94 years. A marked gender difference was observed, with 97 males (80.8%) and 23 females (19.2%), resulting in a male-to-female ratio of more than 4:1. Urban residents predominated the sample (P = 0.491), comprising 98 patients (81.7%), and smoking was reported by 40 cases (33.3%). Tobacco or substance use was significantly more prevalent in males (P = 0.008), but no other difference was observed between genders. The mean body mass index (BMI) was 27.18 ± 3.89 kg/m^2. Underlying comorbidities were present in approximately two-thirds of the patients, with hypertension being highly prevalent (60 patients, 50%) as the sole underlying condition. Medication use was common; aspirin 80 mg was the most frequently prescribed drug (58 patients, 48%), followed by angiotensin II blockers (36 patients, 30%). A temporal pattern of care-seeking behavior was notable, with 78 patients (65%) presenting to the hospital

Table 1. Demographic and Baseline Characteristics of Patients

Variables		N (%)/mean ± Standard Deviation			*P* Value
		Male	Female	Total	
Residence	Urban	81 (83.5)	17 (74)	98 (81.7)	0.491
	Rural	16 (16.5)	6 (26)	22 (18.3)	
Type of MI	Anterior	28 (29)	6 (23)	24 (28.3)	0.154
	Posterior	2 (2)	0 (0)	2 (1.6)	
	Inferior	54 (55.6)	3 (13)	57 (47.5)	
	Subendocardial	13 (13.4)	14 (64)	27 (22.5)	
Tobacco/substance use	Yes	40 (41.3)	0 (0)	40 (34)	0.008
	No	57 (58.7)	23 (100)	80 (66)	
Underlying diseases	Hypertension	44 (45.3)	16 (69.5)	60 (50)	0.337
	Hyperlipidemia	13 (13.4)	8 (34.8)	21 (17.5)	
	Diabetes	13 (13.4)	7 (30)	20 (16.6)	
	Kidney Disease	4 (4.5)	1 (4.3)	5 (4.16)	
	None	36 (37.1)	4 (17.4)	40 (33)	
Medications used	ASA	49 (50)	9 (39.1)	58 (48)	0.295
	Angiotensin II receptor blockers	27 (27.9)	9 (39.1)	36 (30)	
	Statins	30 (31)	4 (17.4)	34 (28.3)	
	Beta-blockers	19 (19.5)	7 (30)	26 (21.6)	
	Plavix	16 (16.5)	8 (34.8)	24 (20)	
	TNG	14 (14.5)	4 (17.4)	18 (15)	
	Diuretics	11 (11.3)	1 (4.3)	12 (10)	
	None	26 (26.8)	4 (17.4)	30 (25)	
Delay	< 1 hour	30 (31)	12 (52)	42 (35)	0.096
	> 1 hour	67 (69)	11 (48)	78 (65)	
BMI (kg/m^2)		26.60 ± 8.57	29.71 ± 13.75	27.18 ± 3.89	0.314
Age (years)		61.12 ± 1.45	63.94 ± 11.76	61.66 ± 11.94	0.456

Table 2. History of Cardiovascular Events among Participants

Variable	N (%)/Mean ± Standard Deviation			*P* Value
	Male	Female	Total	
History of prior MI	50 (51.5)	7 (30)	57 (47.5)	0.297
Family history of MI (age < 45)	11 (11.34)	1 (4.3)	12 (10)	0.629
3-Month mortality	20 (20.6)	7 (30)	27 (22.5)	0.429
Mean LVEF	38.77 ± 12.32	38.23 ± 18.94	38.67 ± 13.19	0.340

LVEF, left ventricular ejection fraction.

Table 3. Association of Variables With 3-Month Survival

Variable		3-Month Survival		*P* Value
		Survived N (%)	Deceased N (%)	
Gender	Male	77 (79.4)	20 (20.6)	0.04
	Female	16 (69.5)	7 (30.5)	
Type of MI	Anterior	24 (70.6)	10 (29.4)	0.014
	Posterior	1 (50)	1 (50)	
	Inferior	50 (87.7)	7 (12.3)	
	Subendocardial	18 (66.7)	9 (33.3)	
Tobacco/substance use	Yes	30 (75)	10 (25)	0.155
	No	63 (78.75)	17 (21.25)	
History of prior MI	Yes	37 (64.9)	20 (35.1)	0.004
	No	56 (88.8)	7 (11.2)	
Delay	< 1 Hour	32 (76.2)	10 (23.8)	0.413
	> 1 Hour	61 (78.2)	17 (21.8)	
LVEF	< 35	30 (61.2)	19 (38.8)	0.000
	35-50	42 (84)	8 (16)	
	≥ 50	21 (100)	0 (0)	
Age	≤ 50	18 (94.8)	1 (5.2)	0.000
	> 50	75 (74.25)	26 (25.7)	

LVEF, left ventricular ejection fraction.

more than one hour after the onset of symptoms.

Cardiac Function

The study participants' cardiovascular event histories are summarized in Table 2, with a significant number of them (57 individuals, 47.5%) having documented histories of prior MI. Based on the results, 12 patients (10%) reported a family history of MI in first-degree relatives before the age of 45. The study population showed a generally compromised systolic performance, as evidenced by a mean left ventricular ejection fraction (LVEF) of 38.67 ± 13.19%.

Survival Analysis

The overall three-month survival rate was 77.5%, as 27 patients (22.5%) succumbed to complications associated with MI during the three-month follow-up period. The short-term vulnerability of MI patients is also emphasized by this finding.

The three-month survival rate was correlated with a variety of clinical variables, as documented in Table 3. Statistical analysis identified significant associations between survival and several key factors. Based on the results, gender ($P = 0.04$), type of MI ($P = 0.014$), history of prior MI ($P = 0.004$), patient age ($P < 0.001$), and cardiac output ($P < 0.001$) were significantly related to three-month survival outcomes. In contrast, no statistically significant association was detected between survival and either smoking status or the delay (time interval) between symptom onset and hospital admission.

Further analysis revealed that mortality within the three-month period was significantly higher in female patients compared to their male counterparts. Additionally, patients with anterior wall MI exhibited the highest three-month mortality, followed by those with subendocardial MI. A history of previous MI emerged as a significant risk factor for increased three-month mortality, emphasizing the cumulative risk associated with recurrent ischemic events. Moreover, both lower cardiac output and higher age at the time of MI were strongly linked to adverse outcomes during the follow-up period.

Discussion

This study evaluated the three-month survival rate among MI patients at Shahid Beheshti Hospital in Kashan, highlighting critical factors influencing short-term outcomes. According to our data, the 3-month survival rate in MI patients was 77.5%. Our results show that the following important prognostic factors are present in a cohort with a mean age of 61.66 years: patient age, cardiac output, gender, type of MI, and history of previous MI. These findings highlight the intricate interactions between clinical factors in post-MI survival and offer crucial insights into the susceptibility of high-risk subpopulations, especially among female and elderly patients.

As mentioned earlier, based on the findings of the study, the anticipated three-month survival rate in MI patients was 77.5%. Likewise, in a research conducted by Mosa Farkhani et al, the survival rates were almost 85% at one month, 84% at six months, 80% at one year, and 64% at five years.[7] Furthermore, the one-month death rates in previous studies conducted by Khosravi et al (15%), Dabiran et al (16%), and Ghaffarian Shirazi et al (18%) are somewhat lower than ours.[12-14] Myocardial necrosis and diminished cardiac function, patients' and their companions' ignorance of MI symptoms, self-treatment practices, delay in seeking medical attention, increased obesity rates, and medication noncompliance could all be factors contributing to the higher observed mortality rates in our study.

A male-to-female ratio of 4: 2 was observed in this study, with 80.8% of the patients being male and 19.2% being female. This male-to-female ratio is in line with earlier epidemiological evidence showing that MI tends to affect men more often.[4,8]Other studies have similarly documented a higher incidence of MI in men than in women.[15,16] Being a man is regarded as a risk factor for cardiovascular events in the medical literature.[17] This may be because men are more likely to be employed and play societal roles, which increases their exposure to environmental stressors, physiological differences, and the protective effects of estrogen on CVDs.[18-20]

In contrast to the higher prevalence of MI in men, our research demonstrated a higher three-month mortality rate in women. Compared to men, women were 1.5 times more likely to die from acute MI within three months of the event in the current study. This result aligns with prior research.[18] For instance, in a study conducted by Herman et al, the risk of mortality was significantly higher among women than among men, resulting in women having worse prognoses.[21] Similarly, in a research by Gottlieb et al, the 30-day survival rate following MI was 90.4% in males and 82.4% in women.[19] Other studies have also observed lower survival rates or higher death rates among women compared to men.[22,23] This paradox highlights the notion that despite the fact that males may have higher incidence rates, females frequently exhibit atypical symptoms, which can result in a delay in diagnosis and intervention, ultimately resulting in worse survival outcomes.[15] Furthermore, this may be partially explained by the fact that women have a greater number of adverse prognostic factors than men. Despite adjustments for these variables in certain studies, male survival rates continued to surpass female survival rates.[24] Though not statistically supported, the lower survival rates among women in the current research may be related to their higher average age, higher BMI, and higher incidence of risk factors. Some studies indicate that the frequency of thrombolytic therapy administered to women is reduced as a result of older age and the presence of comorbidities.[25]

In this study, older age was strongly correlated with elevated mortality, which corresponds with the established age-related deterioration in cardiovascular function and increased vulnerability to complications, as indicated by Benjamin et al.[4] Other studies have also documented an elevated mortality risk among MI patients as their age increases.[26,27] For instance, Stevenson et al conducted a study that identified age as a predictor factor for survival in patients with MI.[28] Decreased organ function, reduced repair and reperfusion capacity, and increased mortality rates following cardiovascular events are all associated with increasing age.

In the present study, the anatomical site of the MI substantially influenced survival, with anterior wall infarction being associated with the highest three-month mortality rate. In contrast, the three-month mortality rate was lowest in inferior and posterior infarctions. This finding aligns with prior research. One study, for example, demonstrated that inferior wall infarctions have a more favorable prognosis than anterior wall infarctions.[29] This finding is supported by other research, which shows that acute inferior wall MI is linked to the lowest relative risk.[30,31] Therefore, the anatomical location of the MI was a very significant predictor of survival in this study. Given that anterior wall infarctions are known to involve bigger myocardial regions, which can result in a more widespread impairment of left ventricular function and a worse prognosis, this could be the cause of the higher death rate in patients with anterior Mis.[8] Furthermore, the concept of cumulative myocardial injury and diminished cardiac reserve was corroborated by the significant association between a history of prior MI and increased three-month mortality.[8] These results underscore the importance of employing rigorous secondary prevention strategies in patients who experience recurrent ischemic events.

A strong predictor of early mortality was cardiac output, as determined indirectly by LVEF ($P<0.001$). The average LVEF of 38.67% in our cohort indicates that the population had a significant degree of systolic dysfunction, which is a recognized independent risk factor for adverse cardiovascular outcomes.[1] In addition

to indicating extensive myocardial injury, patients with reduced cardiac output are also at an increased risk of developing progressive heart failure. As a result, to increase survival, particularly in the critical early post-MI phase, these patients need close monitoring and treatment measures.

High systolic blood pressure is a well-established risk factor for MI and has been demonstrated to significantly contribute to the burden of CVDs.[32] The notion that regional disparities in blood pressure control have a pronounced impact on MI outcomes is further confirmed by the recent study on the burden of diseases due to high systolic blood pressure in the Middle East and North Africa region.[5] In our cohort, hypertension was present in 50% of the patients, indicating a substantial underlying risk factor that exacerbates the post-infarction prognosis and contributes to myocardial ischemia. By integrating these discoveries into clinical practice, the significance of blood pressure management as a primary and secondary preventive measure is emphasized.

Our results showed no significant correlation between smoking and the three-month survival rates of MI patients. As evidenced by numerous studies,[33,34] smoking is a well-established risk factor for CVDs. While the majority of research concentrates on the role of smoking in the development of CVDs, there is a lack of studies examining its influence on post-MI survival. This underscores the necessity of additional research in this field. Moreover, despite the paramount significance of early intervention in MI therapy, our study could not find a statistically significant correlation between the time interval from symptom onset to hospital admission and three-month survival. There may be a number of reasons why there was no significant correlation, even though 65% of patients arrived more than an hour after the onset of symptoms. There is a possibility that the quality and efficacy of in-hospital care, which includes pharmacological management and reperfusion therapies, may serve as significant mitigating factors once patients arrive at the hospital. Subsequent studies should investigate prehospital delays with greater specificity, including the underlying causes of these delays, to comprehensively assess their potential effects on outcomes.

Our findings include significant clinical implications. First, the robust correlation between decreased cardiac output and an increased risk of mortality underscores the necessity of early therapeutic interventions and close hemodynamic monitoring in patients with low LVEF. Second, the higher death rate among female patients necessitates enhanced clinical awareness and customized diagnostic approaches to quickly detect and treat MI in women. Third, the necessity of secondary prevention programs and personalized treatment regimens that mitigate the cumulative burden of ischemic injury is underscored by the interaction between the type of MI and prior MI in determining outcomes. In addition, the high prevalence of modifiable risk factors highlights the urgent need for population-based treatments that focus on these factors. Future research should focus on integrating new biomarkers with conventional risk indicators to enhance predictive models and provide more tailored therapy.

Notwithstanding the insightful information this study provides, a few limitations are worth mentioning. The retrospective design unavoidably restricts our ability to account for any potential confounding variables. The results may not be generalizable to other regional or international contexts due to the single-center design of the study. Multicenter investigations are necessary to validate these findings. Furthermore, some patients with acute MI may have passed away before arriving at the hospital; therefore, this study cannot be categorized as population-based research. Moreover, this issue may cause potential selection bias, restricting the generalizability of our results. Finally, the lack of comprehensive data on post-discharge follow-up adherence and in-hospital therapies may have affected three-month outcomes.

Conclusions

Our research emphasizes that short-term survival in MI patients, particularly among the high-risk geriatric population and women, is intricately linked to demographic factors, MI subtype, prior cardiac events, and cardiac function. By incorporating regional epidemiological risks, our understanding of MI prognosis is further refined. These insights facilitate the development of more enhanced and personalized management strategies to reduce mortality rate after MI, thereby enhancing patient outcomes in high-risk settings.

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Author contributions

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethical approval

The study protocol was approved by the Institutional Ethics Committee of Kashan University of Medical Sciences (IR.KAUMS.MEDNT.REC.1402.106). All procedures followed the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Because of the retrospective nature of the study, patient consent was obtained via telephone contact for survival follow-up, and data confidentiality was strictly maintained throughout the study.

Consent for publication

Not applicable.

Conflict of interests

The authors declare that they have no conflict of interests in this study.

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