Original Article
http://mjiri.iums.ac.ir
Medical Journal of the Islamic Republic of Iran (MJIRI)

Med J Islam Repub Iran. 2026 (20 Jul);40.77. https://doi.org/10.47176/mjiri.40.77

Evaluation of Effective Factors in the Prognosis of Patients with Acute Myocardial Infarction Transferred by Emergency Medical Services and Self-Referred Patients in Tehran

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Received: 8 Sep 2025 Revised: 28 May 2026 Accepted: 28 Jun 2026 Published: 20 Jul 2026

Abstract

Background: Little is known about the current scenario of acute myocardial infarction (AMI) under primary angioplasty; Transferred by emergency medical services and self-referred patients in Iran.

Methods: The study population consisted of AMI patients with ST-segment elevation myocardial infarction (STEMI) who were consecutively admitted with Emergency Medical Services (EMS) or directly in the first six months of 2021 in 2 PCI-capable selected hospitals in Tehran. We analyzed the pattern of transfer by emergency medical services and compared in-hospital treatments and outcomes between transferred patients and self-referred patients in Tehran. Statistical comparisons were performed using chi-square, t-tests, or Mann–Whitney U tests, and multivariable logistic regression was used to assess factors associated with in-hospital mortality, with significance set at $P<0.05$.

Results: In-hospital mortality was higher in the self-referred than in patients transferred by EMS (9.8% versus 5.2%) ($P=0.014$). The average door-to-balloon (DTB) time in the self-referred patients was significantly higher (60.26±59.0 minutes vs 49.30±48.82 minutes) ($P=0.020$). Results show that the average DTB time of patients who died in the hospital was higher than that of patients who were alive in the self-referred patients. The average time from pain onset to Balloon (OTB) in the self-referred patients and those transferred by EMS was 348.74±316.07 minutes and 226.26±183.15 minutes, respectively ($P<0.001$). Multivariable logistic regression models the chance of in-hospital mortality in patients who self-referred is 2.17 times that of patients who were transferred by EMS, which is statistically significant ($P=0.008$).

Conclusion: Our results indicated that there are significant differences in treatment delay and use of early revascularization, such as time of first medical contact (FMC) to the device, time of pain onset to Balloon (OTB), and DTB time between transferred-by-EMS patients and self-referred patients.

Keywords: Acute myocardial infarction, Emergency services, Direct admission, Health outcomes

Cite this article as: Kolivand Z, Azari S, Hasani Sharamin P, Shajari Z, Rouzitalab M, Omidi N, Saberian P. Evaluation of Effective Factors in the Prognosis of Patients with Acute Myocardial Infarction Transferred by Emergency Medical Services and Self-Referred Patients in Tehran. *Med J Islam Repub Iran.* 2026 (20 Jul);40:77. https://doi.org/10.47176/mjiri.40.77

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Key Messages:

↑What is "already known" in this topic:
Timely reperfusion is a key determinant of outcomes in STEMI, with recommended targets of ≤90 minutes for DTB and medical-contact-to-device time. However, the current situation of EMS-transported versus self-referred STEMI patients in Iran has been poorly described.

→What this article adds:
This study shows that self-referred STEMI patients experience longer treatment delays and higher in-hospital mortality, with self-referral associated with a 2.17-fold increase in the odds of in-hospital death after adjustment for confounders.

Introduction

Cardiovascular diseases (CVDs), which include ischemic heart disease (IHD), stroke, heart failure (HF), peripheral arterial disease, and other cardiac and vascular conditions, are the leading cause of death worldwide and significantly impact the quality of life (QALY) (1). According to the Global Burden of Disease (GBD), in 2017, CVDs caused approximately 17. 8 million deaths and resulted in a loss of 330 million years of life (YLLs) (2).

Acute myocardial infarction (AMI) is the most severe clinical manifestation of IHD and is often classified as ST elevation (STEMI) or non-ST elevation myocardial infarction (NSTEMI); however, treatment is similar for STEMI and NSTEMI (3). Despite significant improvements in prognosis over the past decade, AMI remains a major cause of morbidity and mortality worldwide, especially in low- and middle-income countries (LMICs) (3, 4).

Primary percutaneous coronary intervention (PCI), also known as coronary angioplasty or angioplasty, is a procedure used to treat coronary artery stenosis in the heart and angina in patients. Timely PCI for STEMI patients and high-risk NSTEMI patients is an important early treatment strategy recommended by relevant clinical guidelines. However, its effectiveness may be limited by delivery delays (5-7). The best time window for PCI is within 12 hours for STEMI (8, 9).

Unfortunately, many Iranian AMI patients initially arrive at hospitals that cannot provide acute care, especially early revascularization, or their admission to PCI-capable hospitals is delayed.

However, in the real world, many patients may not be transferred to a PCI-capable hospital within the time frame recommended by guidelines (10-12). Given the importance of early treatment in the ultimate prognosis of STEMI patients, full-time provision of revascularization services should be available 24 hours a day, 7 days a week (24/7), for this reason, the national 24/7 STEMI management program was implemented by the Ministry of Health and Education (MOHE) from 2015 in Iran (13).

Therefore, we investigated and compared the proportion of hospitalized patients with AMI referred to the emergency department and self-referred patients in selected hospitals in Tehran city. We also investigated the characteristics, treatment time, early revascularization, and outcomes of patients referred to the emergency services, compared with patients with STEMI who were self-referred and admitted directly to PCI-capable selected hospitals in Tehran.

Methods

Study design and population

This retrospective, cross-sectional comparative study was conducted to evaluate factors associated with the prognosis of patients with Acute Myocardial Infarction (AMI) who were transported by Emergency Medical Services (EMS) compared with patients who self-referred to hospital. AMI was defined according to the Fourth Universal Definition of Myocardial Infarction (14).

The study population consisted of patients with ST-segment elevation myocardial infarction (STEMI) who were consecutively admitted either through EMS transportation or by self-referral to two PCI-capable hospitals in Tehran. Two tertiary referral hospitals in Tehran were selected because they are PCI-capable centers with 24-hour cardiac catheterization services and receive both EMS-transported and self-referred patients with suspected acute coronary syndromes. Patients were enrolled during the first six months of 2022. Data collection began in January 2022 after obtaining permission to access hospital records. Participants were identified through hospital medical records and catheterization laboratory registries. All eligible patients who met the inclusion criteria during the study period were consecutively included in the analysis.

Inclusion criteria

- Patients diagnosed with STEMI who were admitted to the selected hospitals
- Patients transported by EMS or self-referred to the hospital
- Availability of medical records with required clinical and outcome data

Exclusion criteria

- Patients diagnosed with non–ST-segment elevation myocardial infarction (NSTEMI)
- Patients with incomplete medical records or missing key variables related to treatment timelines or clinical outcomes.
- Patients who declined participation in the study or whose informed consent was not obtained

Setting

The study was conducted in two tertiary referral hospitals in Tehran equipped with percutaneous coronary intervention (PCI) facilities and 24-hour cardiac catheterization services. These centers receive both EMS-transported patients and self-referred patients with suspected acute coronary syndromes. The study covered the period from January 2022 to June 2022, including the phases of patient admission, treatment, and in-hospital follow-up.

Variables, predictors, and outcomes

The primary exposure variable was the mode of hospital arrival, categorized as EMS transport or self-referral. The primary outcome of the study was in-hospital mortality. Secondary outcomes included treatment delay indicators such as door-to-balloon (DTB) time and first medical contact–to-device time.

Potential predictors and confounders included demographic characteristics (age and sex), cardiovascular risk factors such as diabetes mellitus, hypertension, hypercholesterolemia, smoking status, and other available clinical variables. Additional variables such as body mass index (BMI) and family history of cardiovascular disease were considered where available in the medical records.

[DOI: 10.47176/mjiri.40.77]

Definitions

Myocardial infarction (MI) is the term used to refer to a heart attack event caused by the formation of plaques on the inner walls of the arteries, leading to reduced blood flow to the heart and damage to the myocardium due to lack of oxygen supply. Some of the symptoms of MI patients include chest pain, shortness of breath, sweating, nausea, vomiting, abnormal heart rhythm, anxiety, and other factors (9, 14, 15).

Data collection

Data were extracted from hospital medical records using a structured data collection form developed for the study. The form consisted of two main sections:

- Demographic characteristics (e.g., age, sex, and cardiovascular risk factors)
- Clinical information and health outcomes, including mode of hospital arrival, treatment time intervals, procedures performed, and in-hospital outcomes.

Sample size

The sample size was determined based on the total number of eligible STEMI patients admitted to the participating hospitals during the study period. All consecutive patients who met the inclusion criteria during the six-month study period were included in the analysis.

Statistical analysis

Categorical variables were reported as frequencies and percentages, and continuous variables were summarized as mean ± standard deviation (SD). Comparisons between EMS and self-referred groups were performed using the chi-square test for categorical variables and independent-samples t-tests or Mann–Whitney U tests for continuous variables depending on the distribution of the data.

Multivariable logistic regression analysis was performed to evaluate factors associated with in-hospital mortality and to adjust for potential confounding variables. Variables with clinical relevance or statistical significance in univariate analysis were included in the regression model. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. A p-value less than 0.05 was considered statistically significant. Statistical analyses were performed using SPSS software.

Results

A total of 898 AMI patients undergoing primary angioplasty were included in this study. 224 (24.9%) self-

Table 1. Baseline characteristics of AMI patients undergoing primary angioplasty, compared by EMS-transported vs. self-referred groups.

Variable			Group		*P*-value	Total
			Non-EMS	EMS		
Gender	Male	Count	183	552	0.946	735
		% Within Group	81.7%	81.9%		81.8%
	Female	Count	41	122		163
		% Within Group	18.3%	18.1%		18.2%
Total		Count	224	674		898
		% Within Group	100.0%	100.0%		100.0%
			Group		p-value	Total
			Non-EMS	EMS		
History of DM	No	Count	167	468	0.145	635
		% Within Group	74.6%	69.4%		70.7%
	Yes	Count	57	206		263
		% Within Group	25.4%	30.6%		29.3%
Total		Count	224	674		898
		% Within Group	100.0%	100.0%		100.0%
			Group		p-value	Total
			Non-EMS	EMS		
History of HTN	No	Count	155	62.8%	0.145	578
		% Within Group	69.2%	251		64.4%
	Yes	Count	69	37.2%		320
		% Within Group	30.8%	62.8%		35.6%
Total		Count	224	674		898
		% Within Group	100.0%	100.0%		100.0%
			Group		p-value	Total
			Non-EMS	EMS		
History of smoking	No	Count	133	420	0.433	553
		% Within Group	59.4%	62.3%		61.6%
	Yes	Count	91	254		345
		% Within Group	40.6%	37.7%		38.4%
Total		Count	224	674		898
		% Within Group	100.0%	100.0%		100.0%
			Group		p-value	Total
			Non-EMS	EMS		
History of DLP	No	Count	172	474	0.062	646
		% Within Group	76.8%	70.3%		71.9%
	Yes	Count	52	200		252
		% Within Group	23.2%	29.7%		28.1%
Total		Count	224	674		898
		% Within Group	100.0%	100.0%		100.0%

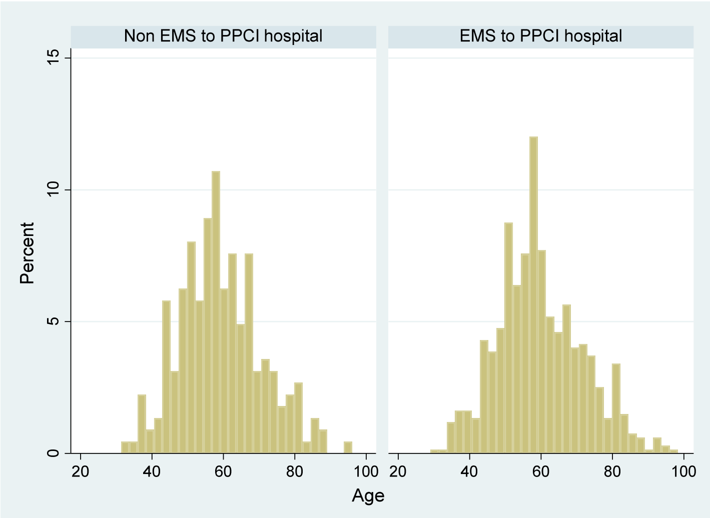

Figure 1. Age distribution (Year) of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and self-referred (non-EMS) patients. The X-axis represents the year and the Y-axis represents the percent of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and non-EMS patients.

referred AMI patients and 674 (75.1%) patients had been transferred by the Tehran Emergency Medical System (EMS) (Table 1). The average age of AMI patients who self-referred patients and patients transferred by EMS was 59.25 years (SD=11.51) and 59.75 years (SD=12.0), respectively, and there was no statistically significant difference between the two groups (*P*=0.587) (Figure 1). Out of all the patients, 81.8% were men, and no statistically significant difference was observed between the self-referred patients and those transferred by EMS (*P*=0.946) (Table 1).

Of all patients, 16.8% had a history of revascularization. The history of revascularization among patients transported by EMS was more than among non-EMS patients (17.5% vs 14.7%). Although this difference was not statistically significant (*P*=0.336). The results of the study show that the in-hospital mortality rate in self-referred patients with a history of revascularization was higher than that of patients without a history (15.2% versus 8.9%), this difference was not statistically significant (*P*=0.265). Of all patients, 8.5% had a history of PCI or Coronary artery bypass surgery (CABG). The history of coronary heart bypass in the group of patients transported by EMS was more than in self-referred patients (9.3% vs. 5.8%). This difference was not statistically significant (*P*=0.099). Also, no statistically significant difference was found between coronary heart bypass history and in-hospital mortality (*P*>0.05) (Table 1).

6.3% of all patients died in the hospital. In-hospital mortality was higher in the self-referred than in patients transferred by EMS (9.8% versus 5.2%), this difference was statistically significant (*P*=0.014). The results show that there was no significant difference in patients' risk factors such as diabetes, hypertension, hypercholesterolemia, and smoking between the two groups (Table 2).

The results of the present study show that the average door-to-balloon (DTB) time in the self-referred patients is significantly higher (60.26±59.0 minutes vs 49.30±48.82 minutes) (*P*=0.020) (Figure 2). The relationship between DTB time and in-hospital mortality in study groups showed that in both groups, the average DTB time of patients who died in the hospital was higher than that of patients who were alive, in the self-referred patients, the average DTB time of dead and alive patients is equal to 79.74 and 58.68 minutes, respectively, and in patients transported by EMS, equal to 65.91 and 48.34 minutes, respectively, this difference was statistically significant (*P*=0.045) (Table 3).

The average time of first medical contact (FMC) to the device in the self-referred patients was equal to 95.33±68.65 minutes and in the group transferred by EMS, it was equal to 81.11±41.68 minutes, and there was a statistically significant difference between the two groups (*P*=0.009) (Figure 3). in other words, the average

Table 2. In-hospital mortality rates of AMI patients undergoing primary angioplasty, compared by EMS-transported vs. self-referred groups.

Death in hospital		Group		*P*-value	Total
		Non-EMS	EMS		
No	Count	202	639	0.014	841
	% Within Group	90.2%	94.8%		93.7%
Yes	Count	22	35		57
	% Within Group	9.8%	5.2%		6.3%
Total	Count	224	674		898
	% Within Group	100.0%	100.0%		100.0%

[DOI: 10.47176/mjiri.40.77]

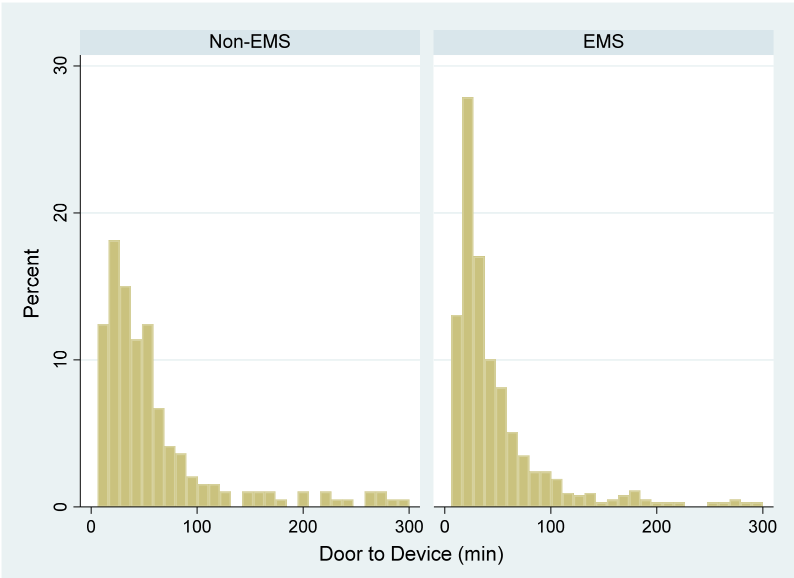

Figure 2. The results of average door-to-balloon (DTB) time (Minute) of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and self-referred (non-EMS) patients. The X-axis represents the time (Minute) and the Y-axis represents the percent of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and non-EMS patients.

Table 3. Door-to-balloon (DTB) time and its relationship with in-hospital mortality.

Study group	Door-to-device time	In-hospital death		*P*-value
		No	Yes	
In Non-EMS	N	174	19	0.259
	Mean± SD	58.68±57.26	74.79±73.35	
In EMS	N	595	33	0.045
	Mean± SD	48.38±48.21	65.91±56.98	

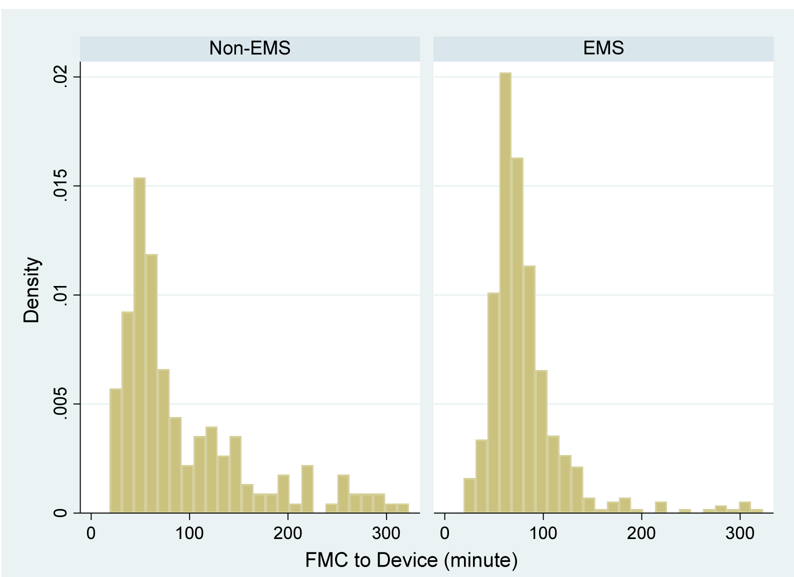

Figure 3. The results of average first medical contact (FMC) to the device time (Minute) of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and self-referred (non-EMS) patients. The X-axis represents the time (Minute) and the Y-axis represents the percent of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and non-EMS patients.

time of FMC to the device in the self-referred patients was significantly (about 14 minutes) more than the transfer group by EMS. The results of the study showed that there is no significant relationship between the average FMC-to-device time and in-hospital mortality of AMI patients in the two groups (P>0.05) (Table 4).

Table 4. Association between first medical contact (FMC)-to-device time and in-hospital mortality.

Study group	FMC to device time	In-hospital death		*P*-value
		No	Yes	
In Non-EMS	N	171	16	0.916
	Mean± SD	95.17±68.56	97.06±71.85	
In EMS	N	446	18	0.369
	Mean± SD	80.59±40.70	94.06±61.42	

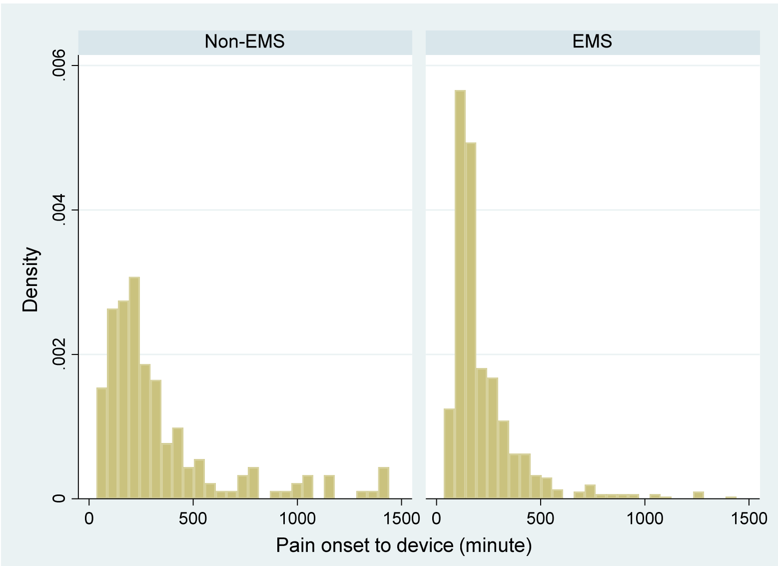

Figure 4. The results of average Pain onset to device time (Minute) of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and self-referred (non-EMS) patients. The X-axis represents the time (Minute) and the Y-axis represents the percent of AMI Patients Undergoing Primary Angioplasty Transferred by EMS and non-EMS patients.

The mean time of pain onset to Balloon (OTB) in the self-referred patients and the group transferred by EMS was 348.74±316.07 minutes and 226.26±183.15 minutes, respectively, which is a statistically significant difference between two groups (*P*<0.001) (Figure 4), in other words, the average pain onset to device time in the group of self-referred patients was significantly longer than the group transferred by EMS (about 122 minutes). Examining the relationship between pain onset time to the device and in-hospital mortality in the study population showed that in self-referred patients, the average time of pain onset to the device in patients who died in-hospital was almost twice as much compared to the patients who did not die (604.29 vs. 326.52 minutes), and this difference was statistically significant (*P*=0.039) (Table 5).

Of all patients, 11.7% had a history of Major adverse cardiovascular events (MACE). The history of MACE in the group of patients transferred by EMS was significantly less than that of the self-referred patients (10.2% vs 16.1%) (*P*=0.019). Examining the relationship between the history of MACE and in-hospital mortality by study groups showed that in both groups, the rate of in-hospital mortality in AMI patients with a history of MACE is higher. Results show that in the self-referred patients, among patients with and without a history of MACE, the percentage of in-hospital death was equal to 61.1% and 0, respectively, and in patients transported by EMS, it was equal to 50.7% and 0, respectively. that, these differences were statistically significant (*P*<0.05) (Table 6).

Finally, based on the multivariable logistic regression models and after removing the confounding effects of demographic variables and history of diabetes and hypertension, the chance of in-hospital mortality in patients who self-referred is 2.17 times that of patients who were transferred by EMS, which is statistically significant (*P*=0.008) (Table 7).

Discussion

Through this real-world study, we provided a comprehensive comparison between primary coronary angioplasty STEMI patients referred via EMS and self-referred patients at selected hospitals in Tehran. The main initiative to improve the prognosis of AMI is to minimize the time from symptom onset to reperfusion. Cardiomyocyte death begins as early as 20 minutes after coronary artery occlusion, and the time from symptom onset to the balloon is a significant determinant of myocardial damage and risk of mortality (5, 7, 16).

The results showed that about 25% of STEMI patients in Iran were self-referred patients to PCI-capable hospitals; this amount in Iran is comparable to developed countries. Studies in Western countries have reported that 20–40% of STEMI patients are initially admitted to a referral

[DOI: 10.47176/mjiri.40.77]

Table 5. Association between pain onset-to-device time and in-hospital mortality.

Study group	Pain onset to device time	In-hospital death		*P*-value
		No	Yes	
In Non-EMS	N	161	14	0.039
	Mean± SD	326.52±293.52	604.29±447.64	
In EMS	N	564	20	0.205
	Mean± SD	223.66±179.77	299.60±256.63	

Table 6. Prevalence and history of Major Adverse Cardiovascular Events (MACE) among the study groups.

			Group		*P*-value	Total
			Non-EMS	EMS		
History of PCI	No	Count	188	605	0.019	793
		% Within Group	83.9%	89.8%		88.3%
	Yes	Count	36	69		105
		% Within Group	16.1%	10.2%		11.7%
Total		Count	224	674		898
		% Within Group	100.0%	100.0%		100.0%

Table 7. Multivariable logistic regression analysis of factors associated with in-hospital mortality.

	OR	95% CI for OR		*P*-value
		Lower	Upper	
Group (Non-EMS vs EMS)	2.170	1.220	3.860	.008
Age (year)	1.063	1.038	1.088	.000
Gender (Male vs. Female)	.708	.376	1.335	.286
Hx. DM (yes vs. No)	1.396	.740	2.636	.303
Hx. HTN (Yes vs. No)	.683	.358	1.300	.245

facility and then transferred to PCI-compatible facilities for primary PCI (17-21).

Reperfusion time refers to the duration between a STEMI patient's arrival at the emergency department and the passage of the catheter guidewire through the culprit lesion in the cath lab. This is commonly known as the door-to-balloon time (22). The concept of medical contact-to-balloon time has evolved into medical contact-to-device time, highlighting the significance of early assessment, care, and transportation for STEMI patients. The generally accepted target for medical contact-to-device time is 90 minutes or less (23).

The results showed the mean DTB time in both groups is ≤90 minutes. DTB times of ≤90 minutes for at least 85% of STEMI patients is a well-established cardiovascular goal for patients with STEMI undergoing primary PCI (24). In several observational studies, shorter DTB duration has been associated with lower in-hospital mortality (16, 25, 26). We also found a relationship between DTB time and in-hospital mortality in both groups; the average DTB time of patients who died in the hospital was higher than that of patients who survived. In the self-referred patients, this result is consistent with the results of previous studies. A study from Korea found that a 1-hour delay in DTB time was associated with a %55 increase in 1-year mortality, and reducing DTB time to within 45 minutes decreased mortality risk overall relative to a DTB time of more than 90 minutes, and a reduction in DTB time by 30 minutes showed a consistent reduction in 1-year mortality (27). It is not at all surprising that DTB time would be shortened in transfer by emergency services patients following arrival to the PCI-capable hospital because before the transfer of the patient to a capable hospital, arrangements have been made and the catheter team is ready to perform the intervention rather than needing to come in from home.

We found that self-referred patients were associated with a 2.0-hour additional time from symptom onset to PPCI. Similar results in the Hu et al. al study indicated that self-transferred patients had 2.0 h additional time for PPCI (7). The American College of Cardiology Foundation/American Heart Association (ACC/AHA) guidelines recommend that primary PCI is reasonable if there are clinical and/or electrocardiographic results of continuous ischemia 12-24 h after symptom onset in patients (24).

Several studies have shown that increasing duration from symptom onset to PPCI was associated with an increased risk of an adverse health outcome in AMI patients, especially when the delay exceeded 12 hours (12).

The median time from symptom onset to the device in the self-referred STEMI patients was significantly longer than in the EMS-transferred group. We also found a positive relationship between the time from symptom onset to reperfusion and in-hospital mortality, and the time from symptom onset to balloon is a significant determinant of myocardial damage and risk of mortality. Our results are in line with Nallamothu et.al and Terkelsen et. al. (5, 16).

A longer interval between symptom onset and ballooning time has been associated with poorer outcomes in some cases (28-30). In the present study, door-to-balloon time was significantly longer among self-referred patients compared with those transported by EMS. Although this difference reached statistical significance, its clinical relevance should also be considered. Even relatively small delays in reperfusion may influence myocardial salvage in patients with STEMI, as timely restoration of coronary blood flow is a critical determinant of patient outcomes. Therefore, the observed delay among self-referred patients may still have meaningful clinical implications, particular-

[DOI: 10.47176/mjiri.40.77]

ly at the population level. These findings further support the importance of promoting early EMS activation and improving public awareness regarding the benefits of emergency medical services in the management of acute myocardial infarction.

We found that in-hospital mortality was significantly higher in self-referred patients to PCI-capable hospitals, and there was no significant difference in patients' risk factors between the two groups. The bottom line is that a key initiative to improve the prognosis of AMI is to minimize the delay between symptom onset and reperfusion. Our results show that symptom onset-to-door (OTD) time or DTB time in self-referred STEMI patients is statistically significantly higher than in EMS-transferred patients. The results are consistent with previous studies; for example, Park et.al study results that a 1-hour delay of DTB time was associated with a 55% increased 1-year mortality, whereas a 1-hour delay of OTD time was associated with a 4% increased 1-year mortality (27). Probably higher in-hospital mortality is due to the higher average OTD time or DTB time in the self-referred patients compared to STEMI patients under primary angioplasty transferred by emergency services. Also, our results show a positive relationship between door-to-device time and in-hospital mortality in the study groups; the average door-to-device time of patients who died was higher than that of patients who were alive.

Also, our multivariable logistic regression model shows that after removing the confounding effect of demographic variables and risk factors, the chance of in-hospital mortality in patients who self-referred is more than twice that of patients who were transferred by EMS, which is statistically significant. This result is in line with other results, such as higher average time of FMC to the device, higher average DTB time, and higher time of pain onset to Balloon (OTB) self-referred than patients transferred by emergency services.

Our study had several limitations. First, it included only STEMI patients who were admitted to selected hospitals. Second, we only accessed the in-hospital mortality and MACE; as a result, long-term outcomes after discharge of patients were not possible to evaluate, and long-term studies are recommended to evaluate long-term outcomes. Third, the study was conducted in selected hospitals in Tehran; Therefore, the results may vary across cities with different socioeconomic statuses.

Conclusion

Our results indicate that a large proportion of AMI patients hospitalized in Iran are transferred by EMS. There are significant differences in treatment time and use of early revascularization, such as time from FMC to the device, time of OTB, and DTB time, between transferred-by-EMS patients and self-referred patients. Guidelines recommend that the major initiative to improve the prognosis of AMI is to minimize the time from symptom onset to reperfusion, and National strategies are needed to promote the recommended revascularization strategies and minimize the inequality in the management of AMI.

Acknowledgment

We would like to thank all who helped us through writing the article. The authors received no specific grant for this work.

Conflict of Interests

The authors declare that they have no competing interests.

Authors' Contributions

Conceptualization: Peyman Saberian
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Investigation: Peyman Saberian, Parisa Hasani Sharamin
Methodology: Samad Azari, Peyman Saberian
Software: Samad Azari, Negar Omidi
Supervision: Peyman Saberian,
Validation: Samad Azari, Peyman Saberian
Visualization: Samad Azari, Zahra Kolivand, Peyman Saberian
Writing – original draft: Negar Omidi, Samad Azari, Peyman Saberian, Zahra Kolivand
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Ethical Considerations

The manuscript states that the study had ethics approval from Tehran University of Medical Sciences, code IR.TUMS.IKHC.REC.1400.300, and that written informed consent was obtained from eligible participants who agreed to participate. Since the study relied on existing hospital records, patient confidentiality should be protected by anonymizing or de-identifying the dataset before analysis. If this was done, it is worth stating explicitly in the Methods or Ethics section to reassure readers that no personal identifiers were used in the final analysis.

Funding Support

The authors received no specific funding for this work.

Data Availability

The datasets used and/or analysed during the current study are available upon reasonable request.

AI Use Statement

AI tools were used only for language editing, grammar correction, and improving the clarity of the manuscript

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