Patient Characteristics, Risk Factors, and Disease Outcomes in Young Adults With St-Elevation Myocardial Infarction: Insights From The Kermanshah Acute Coronary Syndrome Registry

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Abstract

Background: Myocardial infarction in younger adults is an understudied research area.

Objectives: This paper reports on characteristics, risk factors, and disease outcomes of young adults with St-elevation myocardial infarction (STEMI).

Methods: This is a sub-analysis of data from the Kermanshah Acute Coronary Syndrome Registry, including all patients aged ≤45 with STEMI (n=247) registered in the registry from June 2017 to June 2019.

Results: Patients aged ≤45 constituted 10.66% of all patients with STEM; the majority was male (91.8%), and the most common CVD risk factors included: smoking (56.7%), low high-density lipoprotein (55.5%), elevated triglyceride (44.4%), hypertension (38.2%), hypercholesterolemia (38.1%), elevated low-density lipoprotein (26.3%), and obesity (24.3%). Many patients (62.8%) received primary percutaneous coronary intervention (PCI), and in-hospital mortality was low at 0.8%.

Conclusions: Younger adults should be screened for CVD risk factors, and are educated and supported to participate in programs that aim to reduce risk through risk factor modification.

Background

Despite significant advances in diagnosis and therapeutic technology, cardiovascular disease (CVD) continues to be the leading cause of morbidity and mortality worldwide. It is estimated that approximately 80% of all CVD deaths occur in low-and middle-income countries [1]. Further, people in these countries develop CVD earlier; while the average age of patients with CVD is 65 or over in developed nations [2], people in low-and middle-income countries develop this disease an average 5-10 years earlier [3]. It is promising to see that mortality from CVD continues to decline in developed countries; in Australia, for example, for age group 35–54, the decline in coronary heart disease (CAD) deaths has slowed from an average of 7.2% (1980–1993) to 3.1% per year (1993–2015) [4] however, reduction in the mortality rate has slowed in younger age groups, particularly in women, in recent years. For example, in the United States (US), the proportion of MI admissions for younger women (35–54 years old) increased from 21% (1995-1999) to 31% (2010- 2014) [5]. These statistics indicate that younger adults *have benefited less from CVD preventive measures and/or treatment*.

Different age cutoffs are used for defining younger adults with CVD. In assessing CVD- related outcomes, researchers often use 65 years old as the cutoff age [3]. As a result, there is limited information about the risk factor profile, clinical presentation, and disease outcomes of a subgroup of patients who develop the disease at much younger ages. Like the general population, atherosclerotic-related processes are the most known etiology of acute myocardial infarction (AMI) in younger adults [6] yet, the contributing risk factors for atherosclerotic CVDs may be different in younger adults. For example, hypertension is less common in young adults than in the elderly [7, 8], or menopausal changes are not the subject for young

women who develop CVD. On the other hand, vasospastic angina, myocardial infarction with intact fibrous cap, drug abuse (e.g., cocaine) [9-11], and spontaneous coronary artery dissection are common in the younger population [8, 12]. Overall, atheromatous CAD, non-atheromatous CAD, hypercoagulable states, and substance misuse, with considerable overlap between them, are known as the underlying causes of AMI in younger adults [10].

The burden of CVD in younger adults has been overlooked due to its lower prevalence; however, AMI at a young age can carry significant physical and psychological morbidity and financial impact for the patient, family, and society. Similar to many other low-and middle-income countries, the prevalence of AMI is high and on the rise in Iran. Iranians develop CVD at relatively younger ages, with the mean age of the patients varying between 54.8 and 60.5 in men and 59.4 and 67.1 in women [13]. This paper reports on characteristics, risk factors, and disease outcomes of young adults ≤45years with ST-segment elevation MI (STEMI).

Methods

This is a sub-analysis of data from the Kermanshah Acute Coronary Syndrome Registry, based in a tertiary referral hospital in Western Iran. The majority of the population in this area has Kurdish background (nearly 80%). Since June 01, 2016, a total of 2341 patients with the diagnosis of STEMI were registered in the registry, of which 247 patients (10.55 %) were aged 45 years or younger and eligible for our analysis.

The registry is sponsored by Kermanshah University of Medical Sciences and is part of the European Observational Registry Program (EORP). Therefore, the data for the registry are collected according to the EROP protocol by two trained nurses. The inclusion criteria include: 1) being hospitalized with the diagnosis of STEMI; 2) being above 18 years and 3) being able to provide informed consent. Patients were excluded from the registry if they were not interested or experienced MI after being admitted to the hospital. Data were collected through patient interviews and a review of their medical records. All collected data were audited for quality and completeness by a trained physician, and defective and/or incomplete cases were corrected by revisiting patients' medical records or patient interviews. A detailed description of the registry’s objectives, inclusion and exclusion criteria, type of data, and ethical considerations has been published elsewhere [The citation was removed for blind review]. This study has received approval from the Research Ethics Committee of Kermanshah University of Medical Sciences (The approval number was removed for blind review).

Data analysis

We chose the age cutoff of 45 years for defining young adults with STEMI based on previous research [15, 16]. Data were entered in and analyzed using IBM SPSS Statistics for Windows, version 23.0. Descriptive statistics including, frequencies, percentages, ranges, means, and standard deviations, were used to summarize data. Differences in the mean scores between groups were examined using the independent t-tests.

Results

Two hundred forty-seven patients aged 45 years or younger were entered into the registry between June 04, 2016, and June 10, 2019. The demographic and clinical characteristics of the patients are presented in Table 1. The mean age of this patient cohort was 39.36±5.21, with a range of 19 to 45 years. Sixteen out of 2341 registered patients (0.68%) experienced STEMI at age 30 or younger. The majority of patients were male (91.8%), with no statistically significant difference between males and females in terms of age (p=0.250).

CVD risk factors

The most common CVD risk factors were smoking (56.7%), followed by low high-density lipoprotein (HDL) (55.5%), elevated triglyceride (44.4%), hypertension (38.2%), hypercholesterolemia (38.1%), elevated low-density lipoprotein (LDL) (26.3%), and obesity (24.3%). Only 8 (3.2%) patients did not have any of the main CVD risk factors, yet, the study did not query the early family history of CVD or physical activity.

Hospital arrival

Patients' first contacts with medical professional were as follows: most patients (79.8%) were directly transported to the ED by a private vehicle, 30(12.1%) visited a general practitioner first, and 20(8.1%) called the emergency services. Only 26 (10.5%) arrived at the hospital by ambulance, and 76(30.8%) patients were first admitted to a non-PCI center and later transferred to a PCI center (Table 1).

Table 1 Demographics, CVD risk factors and hospital arrival of young adults with STEMI (n=247)

n(%)	Variable		Variable
		N(%)	
	BMI		Age group
63(25.5)	<25	16(6.5)	*<=30*
184(74.5)	≥25	231(93.5)	*31-45*
140(56.7)	Current smoker	227(91.8)	Males
5(2.0)	Previous stroke /TIA		Previous MI
0(0)	History of hypothermia	20(8.1)	*Yes*
29(11.7)	Previous angina	223(90.3)	*No*
4(1.6)	History of heart failure	4(2.6)	*Unknown*
6(2.4)	Previous CABG		Hypercholesterolemia
9(3.6)	Previous PCI	47(19)	*Yes*
1(0.4)	History of Renal Failure	193(81)	*No*
1(0.4)	Current malignancy	0(0)	*Unknown*
	History of sleep apnea	36(14.6)	History of hypertension
5(2.0)	*Yes*	9(3.6)	Treated hypertension
38(15.4)	*No*		History of atrial fibrillation
204(82.6)	*Unknown*	0(0)	*Yes*
55(22.3)	Other life limiting disease	235 (96.1)	*No*
	Type of first medical contact	12(4.9)	*Unknown*
20(8.1)	*Paramedics*		Familial hypercholesterolemia
197(79.8)	*Emergency Room staff*	6(2.2)	*Yes*
30(12.1)	*General practitioner*	138(55.8)	*No*
	Type of patient transport to hospital	104(42)	*Unknown*
26(10.5)	*Ambulance*		Diabetes mellitus
221(89.5)	*Private vehicle*	27(10.9)	*Yes*
	First Admission site	215(98.1)	*No*
171(69.2)	*A PCI center*	5(2)	Unknown
76(30.8)	*A non-PCI center*		

MI: myocardial infarction; BMI: Body mass index; TIA: transient ischemic attack;

CABG: coronary artery bypass graft; PCI: Percutaneous Coronary Intervention

Clinical presentations

Patients' clinical characteristics are summarized in Table 2. All patients presented with chest pain (100%), 46(18.6%) had a heart rate that was not within the normal range of 60-100 beats per minutes (bpm), 192(78%) had a systolic blood pressure either below or above the normal range of 90-119 mmHg, and 38.2% were hypertensive (SBP≥14). The mean earliest ejection fraction was 41.67±7.65, which dropped to 39.80±8.66 at later stages; 27.5% of patients experienced a decline in ejection fraction (<40%) in the early stage. The Killip classification in the majority of patients (96%) was I, indicating no sign of heart failure. Most patients (96.8%) had at least one coronary artery with more than 50% stenosis, and 22% had three coronary arteries with above 50% stenosis. The culprit artery was identifiable in 97.8% of patients who underwent angiography; the most common culprit artery was the left anterior descending artery (58.1%), followed by the right coronary artery (25.1%). Over 53% of MIs were anterior, including anterior, anteroseptal, extensive anterior, and anterolateral, while the remaining (46.6%) were inferior, lateral, lateral inferior, or posterior. Atrial fibrillation was present in the first ECG of 3 (1.2%) patients.

Table 2. Clinical characteristics of the study sample

Variables	Mean(SD)	n(%)
Heart rate in the first ECG, bpm	81.00 (19.64)	
60-100		201(81.4)
<60		18 (7.3)
>100		28(11.3)
SBP at presentation, mmHg	129.26 (23.48)	
<90		14(5.7)
90-119		54(22)
120-139		84(34.1)
≥140		94(38.2)
The earliest EF, %	41.67(7.65)	
<40		68(27.5)
41-49		95(38.5)
≥50		84(34.0)
The latest EF (measured before discharge), %	39.80(8.66)	
The Killip classification		
I		237(96)
II		1(0.4)
III or IV		9(3.6)
Number of coronary arteries with stenosis >50% (n=186)		
0		6(3.2)
1		85(45.7)
2		54(29.0)
3		41(22.0)
The culprit artery (n=186)		
LAD		104(58.1)
RCA		45(25.1)
CX		18(7.3)
OM		10 (15.6)
PLV		1(0.4)

PDA	1(0.4)
Others	2(0.8)
AF in the first ECG	3(1.2)

ECG: electrocardiogram; SBP: systolic blood pressure; EF: ejection fraction; PLV: the posterolateral artery; LAD: the left anterior descending artery; RCA: the right coronary artery; CX: the circumflex artery; OM: the obtuse marginal; PDA: the posterior descending artery; AF: atrial fibrillation.

Laboratory findings

The results of laboratory tests revealed that 46 out of 226 patients (20.3%) had abnormal hemoglobin level, 10 out of 246 patients (4.1%) abnormal platelet, 137 out of 241 patients (56.8%) increased white blood cells, 61 out of 232 patients (26.3%) elevated LDL, 102 out of 229 patients (55.5%) HDL level lower than 40mg/dl, 99 out of 223 patients (44.4%) had triglyceride above 150mg/dl, 90 out of 236 (38.1%) showed total cholesterol level above 200mg/dl, and 67 out of 238 patients (28.1%) had blood glucose level above 140mg/dl at the ED presentation. In addition, in 178 out of 208 patients (72.06%), creatine phosphokinase (CPK) was elevated, 53 out of 233 patients (22.7%) had increased CK-MB level, but only 8 out of 233 patients (3.4%) had elevated troponin at the ED presentation (Table 3).

Table 3. The laboratory test results of the study sample

Variables	Mean (SD)	n(%)
The earliest Hb (pre intervention), g/dL	15.41(1.76)	
Low (<13.5 ♂, <12.0 ♀)		38 (16.8)
Normal (13.5-17.5 ♂, 12.0-15.5 ♀)		180(79.6)
High (>17.5 ♂,> 15.5 ♀)		8(3.5)
The earliest platelet count, 10^9 cells/l	261.65(69.18)	
<150.000		8(3.3)
150.000-450.000		236(95.9)
>450.000		2(0.8)
The earliest WBC, 10^9 cells/l	11.99(3.51)	
<4500		0(0)
4500-11000		104(43.2)
>11000		137(56.8)
LDL, mg/dl	111.74(33.93)	
<129		171(73.7)
130-159		45(19.4)
>160		16(6.9)
HDL, mg/dl	40.56(9.86)	
<40		127(55.5)
≥40		102(44.5)
Triglyceride, mg/dl	172.64(116.22)	
<150		124(55.6)
150-199		40(17.9)
≥200		59(26.5)
Total cholesterol, mg/dl	187.76(45.38)	
<200		146(61.9)
200-239		64(27.1)
>240		26(11.0)
The earliest creatinine, mg/dl	1.13(0.71)	

The highest creatinine, mg/dl	1.17(0.75)	
BGL at presentation, mg/dl	144.76(101.19)	
<140		171(71.8)
140-199		36(15.1)
>200		31(13.0)
CPK at presentation, u/l	1788(1633.26)	
Normal (39-308 for men, 26-192 for women)		30(12.14)
Increased		178(72.06)
The highest CPK, u/l	2186(1839.17)	
The earliest CK-MB, ng/ml	35.21(52.92)	
5-25		180(77.3)
>25		53(22.7)
The highest CK-MB, ng/ml	141(118.79)	
The earliest troponin, ng/ml	0.24(1.84)	
≤ 0.4		225(96.6)
> 0.4		8(3.4)
The highest troponin, ng/ml	10.47(16.55)	
LDH at presentation, u/l	529(463.45)	
ESR at presentation, mm/h	9.23(9.23)	
Normal (0-15 ♂, 0-20 ♀)		150(85.22)
Increased		26(14.77)

♂men; ♀ women; Hb: hemoglobin; WBC: white blood cells; BGL: blood Glucose level; CPK: creatine phosphokinase; CK-MB: creatine kinase-MB

Primary percutaneous coronary intervention

Of 227 patients, 177(71.7%) were eligible to receive primary percutaneous coronary intervention and 54(21.9%) thrombolytic therapy (Table 4). Sixteen (6.5%) patients were not eligible for reperfusion therapy due to reasons such as late presentation, spontaneous reperfusion, and patient refusal. Primary PCI was conducted on 155(62.8%) patients, and 22 (12.42%) patients did not receive intended primary PCI for reasons such as technical issues, lack of facilities, no longer being eligible, patient refusal, and undergoing coronary artery bypass graft (CABG). Of patients who underwent primary PCI, 63 patients (35.4%) received thrombectomy and 161 (90.4%) stent placement, including Bare-metal stents (1.9%) and

drug-eluting stents (98.1%). A stenosis> 50% was presented in only three patients (1.6%) after performing primary PCI.

Table 4. The frequency of intended and performed interventions

Interventions	n/%
Intended reperfusion (n=227)	
No intended primary PCI	16(6.5)
Primary PCI	177(71.7)
Thrombolytic therapy	54(21.9)
Reasons for no intended primary PCI	
Late presentation	7(43.8)
Spontaneous reperfusion	1(6.3)
Patient refusal	2(12.5)
Not mentioned/missing	6(6.3)
Performed interventions (n=227)	
Primary PCI	155(62.8)
Thrombolytic therapy	55(22.3)
Medical therapy only	37(15.0)
Reasons for not performing intended primary PCI (n=22)	
Not applicable	6(27.2)
Thechnical problems/lack of facilties/patients refusal	5(22.7)
Diagnosis not STEMI	3(13.6)
Needed emergency CABG	8(36.3)
Type of artery access for PCI (n=173)	
Radial	86(46.2)
Femoral	100(53.8)

PCA: percutaneous coronary artery

Early complications after STEMI

None of the patients developed recurrent MI, stent thrombosis, or mechanical complications during the hospitalization period. However, one patient (0.4%) developed transient ischemic attack (TIA), 9(3.6%) patients required blood transfusion, 19 (7.7%) patients had severe bleeding, 30(12.1%) patients developed heart failure, and 14 (5.7) patients had the Killip class IV, and 6(2.4%) patients experienced atrial vibration. In addition, 2(0.8) patients experienced cardiac arrest, underwent mechanical ventilation, and died before discharge.

Discussion

In our study, young adults (≤45) composed 10.66% of all patients with STEMI who were registered in the registry. This ratio is higher than the reported proportion of 4.4% based on the Norwegian Myocardial Infarction Register [17] and 6.8% according to the PRIMVAC registry in Spain [18] but similar to the rates of 10% reported by Dougthy et al. in Michigan, the US [19], a rate that the authors believed was unexpectedly high. Other similar studies in Iran report AMI admission rates at 8.6% and 6.8% for adults ≤45 [13]. These results suggest that AMI in younger adults occurs at a high rate in Iran. Internationally, evidence also suggests a steady increase in AMI admissions among young adults, particularly in young women over the recent decade [20-22]. These trends may suggest that cardiovascular risk-reducing programs have not been able to reach young adults effectively. Factors such as low socioeconomic status, limited access to quality health care, substance abuse [23], and underestimation of CVD risk [24] can contribute to this growing burden of CVD among this population group.

In our study, nearly 92% of the patients who developed STEMI at 45 or younger were male. This proportion is much higher than the reported three times higher incidence of MI in males vs. females, including all age groups [25]. In other similar studies, men constituted 91% (15) and 90% (16) of younger adult patients with AMI [18, 26]. In a study that included very young patients (aged ≤30), men constituted 95% of the patients [27]. These results suggest that the gender gap in MI incidence is more remarkable in younger ages, i.e., women are particularly protected against cardiovascular disease at younger ages.

The most common CVD risk factors were smoking, low HDL, elevated triglyceride, hypertension, hypercholesterolemia, elevated LDL, and obesity. This finding is most consistent with the results of previous research from other countries (16, 24, 26, 27). In addition, lower HDL was a common risk factor in our study (55.5%), which is similar to the study by Chua et al., who found that low HDL was common among younger patients with STEMI (26). This finding indicates that the role of lower HDL in developing STEMI in younger adults needs focused investigation.

However, some patients in our study were unaware of their CVD risk factors; more specifically, 23.6% were not aware that they were hypertensive, 19.1% did not know that they had high blood cholesterol levels, and 2.1% were not aware of their diabetes. Only 8 (3.2%) patients did not have any of the main CVD risk factors. The actual number of the risk factors is likely to be even higher, as the study did not assess the family history of CVD or physical activity level. Further, there were some missing data. To our knowledge, no previous study has investigated CVD risk factors among younger adults with STEMI in Iran; however, a

systematic review of the prevalence of AMI revealed that smoking, hypertension, diabetes mellitus, and hypercholesterolemia are the common AMI risk factors in this country irrespective of age and type of MI [13].

Overall, these findings indicate that many MI cases in young adults could have been prevented if their risk factors had been identified earlier and modified through behavior change, such as smoking cessation, following up healthy diet control, physical activity, or medication therapy [28]. Screening CVD risk factors in young adults and effective management of the risk factors can result in significant health gains in the population by detecting subclinical disease, reducing the risk of the onset of the disease, and slowing disease progression and development of complications [29]. Unfortunately, a lack of knowledge and awareness of CVD risk factors and underestimating personal CVD risk hinder the timely management of CVD risk, particularly among younger adults [30].

The proportion of patients who arrived at the hospital by ambulance was only 10.5%. This rate is alarmingly low and consistent with previous studies in Iran; Seyed Mohammadzad et al. (2010) reported that only 15% of patients with MI admissions in the city of Urmia, Iran arrived at the hospital by ambulance. This rate is even lower than 17% reported by a study conducted in the Middle East [31], while in the United Kingdom (UK) about two-third of all AMI patients [32], in Australia 58.4% [33], and in New Zealand 73% are transferred to hospital by ambulance. A lack of knowledge about the ambulance services and symptoms of heart attack was identified as significant barriers to using ambulance services in Iran (Seyed Mohammadzadeh et al., 2010). Evidence suggests that arriving by ambulance results in timely treatment, shorter decision-to-balloon time, and symptom onset-to-balloon time [34], factors that can have a significant impact on MI outcomes [35].

In our study, the left anterior descending artery was identified as the most common culprit artery (58.1%), followed by the right coronary artery (25.1%). This finding is consistent with previous research findings [27, 36, 37]. Primary PCI was conducted on 62.8% of the patients, while the remaining eligible missed the opportunity to receive the gold standard treatment for STEMI due to technical issues, lack of facilities, patient refusal, or the need for CABG. The rate of PCI in our study is slightly lower than the international statistics. Previous studies from Italy [26] and [27] and India reported that primary PCI was performed on 75% and 71.6% of patients≤ 45 with STEMI, respectively. This proportion was 74.8% in the US, including patients under 60 years old [38].

In-hospital mortality in our study was 0.8%, which is lower than reported death rates in other studies. For example, the in-hospital death rate in patients aged ≤ 30 years with STEMI was 2.8% in a study in India [27]; 5% in patients aged ≤ 35 years with STEMI in Spain [39], and 3.75% in patients aged <60 years with STEMI in the US.

Limitations

The main limitation of this study is that the value of some variables relied on patients' memories. In addition, patients were predominantly Kurdish, which is a minority group in Iran. Also, some data were to

be collected from patients' medical record, which was not available after their discharge, resulting in missing data.

Conclusion

This study suggests that STEMI occurs at a higher rate in younger adults (≤45) in western Iran. Gender gap in the incidence of STEMI is larger in younger ages. Smoking, low HDL, elevated triglyceride, hypertension, hypercholesterolemia, elevated LDL, and obesity were common CVD risk factors in younger adults with STEMI. To reduce the risk of STEMI, younger adults should be screened for these risk factors, and they are educated and supported to participate in programs that aim to reduce CVD risk through risk factor medication. The role of lower HDL in developing STEMI in younger adults needs focused investigation. In this study, a small percentage of patients arrived at the hospital by ambulance; public knowledge about MI symptoms needs to be improved, and the ambulance services in medical emergencies encouraged. This research also suggests that clinical management of younger patients with STEMI was good in western Iran, with nearly 63% of patients receiving primary PCI and in-hospital mortality rates at a lower level.

Declarations

Ethics approval and consent to participate:

This study has received approval from the Research Ethics Committee of Kermanshah University of Medical Sciences (The approval number was removed for blind review). All participants consented to the research.

Consent for Publication: All authors consented for publication.

Availability of data and material: Data will be made available if requested.

Competing interests: There is no conflict of interest in relation to this research.

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Authors' contributions

SS designed the study and drafted the manuscript. LG acted as the critical reviewer and participate in writing the manuscript. HS performed data analysis and participated in writing the manuscript. NS assisted with collecting data and writing the manuscript.

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Tables

Table 1 Demographics, CVD risk factors and hospital arrival of young adults with STEMI (n=247)

n(%)	Variable	N(%)	Variable
	BMI		Age group
63(25.5)	<25	16(6.5)	*<=30*
184(74.5)	≥25	231(93.5)	*31-45*
140(56.7)	Current smoker	227(91.8)	Males
5(2.0)	Previous stroke /TIA		Previous MI
0(0)	History of hypothermia	20(8.1)	*Yes*
29(11.7)	Previous angina	223(90.3)	*No*
4(1.6)	History of heart failure	4(2.6)	*Unknown*
6(2.4)	Previous CABG		Hypercholesterolemia
9(3.6)	Previous PCI	47(19)	*Yes*
1(0.4)	History of Renal Failure	193(81)	*No*
1(0.4)	Current malignancy	0(0)	*Unknown*
	History of sleep apnea	36(14.6)	History of hypertension
5(2.0)	*Yes*	9(3.6)	Treated hypertension
38(15.4)	*No*		History of atrial fibrillation
204(82.6)	*Unknown*	0(0)	*Yes*
55(22.3)	Other life limiting disease	235 (96.1)	*No*
	Type of first medical contact	12(4.9)	*Unknown*
20(8.1)	*Paramedics*		Familial hypercholesterolemia
197(79.8)	*Emergency Room staff*	6(2.2)	*Yes*
30(12.1)	*General practitioner*	138(55.8)	*No*
	Type of patient transport to hospital	104(42)	*Unknown*
26(10.5)	*Ambulance*		Diabetes mellitus
221(89.5)	*Private vehicle*	27(10.9)	*Yes*
	First Admission site	215(98.1)	*No*
171(69.2)	*A PCI center*	5(2)	Unknown

76(30.8)	*A non-PCI center*

MI: myocardial infarction; BMI: Body mass index; TIA: transient ischemic attack; CABG: coronary artery bypass graft; PCI: Percutaneous Coronary Intervention

Table 2. Clinical characteristics of the study sample

Variables	Mean	Standard deviation	n(%)
Heart rate in the first ECG, bpm	81.00	19.64	
60-100			201(81.4)
<60			18 (7.3)
>100			28(11.3)
SBP at presentation, mmHg	129.26	23.48	
<90			14(5.7)
90-119			54(22)
120-139			84(34.1)
≥140			94(38.2)
The earliest EF, %	41.67	7.65	
<40			68(27.5)
41-49			95(38.5)
≥50			84(34.0)
The latest EF (measured before discharge), %	39.80	8.66	
The Killip classification			
I			237(96)
II			1(0.4)
III or IV			9(3.6)
Number of coronary arteries with stenosis >50% (n=186)			
0			6(3.2)
1			85(45.7)
2			54(29.0)
3			41(22.0)
The culprit artery (n=186)			
LAD			104(58.1)
RCA			45(25.1)
CX			18(7.3)
OM			10 (15.6)

PLV	1(0.4)
PDA	1(0.4)
Others	2(0.8)
AF in the first ECG	3(1.2)

ECG: electrocardiogram; SBP: systolic blood pressure; EF: ejection fraction; PLV: the posterolateral artery; LAD: the left anterior descending artery; RCA: the right coronary artery; CX: the circumflex artery; OM: the obtuse marginal; PDA: the posterior descending artery; AF: atrial fibrillation.

Table 3. The laboratory test results of the study sample

Variables	Mean (SD)	n(%)
The earliest Hb (pre intervention), g/dL	15.41(1.76)	
Low (<13.5 ♂, <12.0 ♀)		38 (16.8)
Normal (13.5-17.5 ♂, 12.0-15.5 ♀)		180(79.6)
High (>17.5 ♂,> 15.5 ♀)		8(3.5)
The earliest platelet count, 10^9 cells/l	261.65(69.18)	
<150.000		8(3.3)
150.000-450.000		236(95.9)
>450.000		2(0.8)
The earliest WBC, 10^9 cells/l	11.99(3.51)	
<4500		0(0)
4500-11000		104(43.2)
>11000		137(56.8)
LDL, mg/dl	111.74(33.93)	
<129		171(73.7)
130-159		45(19.4)
>160		16(6.9)
HDL, mg/dl	40.56(9.86)	
<40		127(55.5)
≥40		102(44.5)
Triglyceride, mg/dl	172.64(116.22)	
<150		124(55.6)
150-199		40(17.9)
≥200		59(26.5)
Total cholesterol, mg/dl	187.76(45.38)	
<200		146(61.9)
200-239		64(27.1)
>240		26(11.0)
The earliest creatinine, mg/dl	1.13(0.71)	

The highest creatinine, mg/dl	1.17(0.75)	
BGL at presentation, mg/dl	144.76(101.19)	
<140		171(71.8)
140-199		36(15.1)
>200		31(13.0)
CPK at presentation, u/l	1788(1633.26)	
Normal (39-308 for men, 26-192 for women)		30(12.14)
Increased		178(72.06)
The highest CPK, u/l	2186(1839.17)	
The earliest CK-MB, ng/ml	35.21(52.92)	
5-25		180(77.3)
>25		53(22.7)
The highest CK-MB, ng/ml	141(118.79)	
The earliest troponin, ng/ml	0.24(1.84)	
≤ 0.4		225(96.6)
> 0.4		8(3.4)
The highest troponin, ng/ml	10.47(16.55)	
LDH at presentation, u/l	529(463.45)	
ESR at presentation, mm/h	9.23(9.23)	
Normal (0-15 □, 0-20 □)		150(85.22)
Increased		26(14.77)

Table 4. The frequency of intended and performed interventions

Interventions	n/%
Intended reperfusion (n=227)	
No intended primary PCI	16(6.5)
Primary PCI	177(71.7)
Thrombolytic therapy	54(21.9)
Reasons for no intended primary PCI	
Late presentation	7(43.8)
Spontaneous reperfusion	1(6.3)
Patient refusal	2(12.5)
Not mentioned/missing	6(6.3)
Performed interventions (n=227)	
Primary PCI	155(62.8)
Thrombolytic therapy	55(22.3)
Medical therapy only	37(15.0)
Reasons for not performing intended primary PCI (n=22)	
Not applicable	6(27.2)
Thechnical problems/lack of facilties/patients refusal	5(22.7)
Diagnosis not STEMI	3(13.6)
Needed emergency CABG	8(36.3)
Type of artery access for PCI (n=173)	
Radial	86(46.2)
Femoral	100(53.8)

PCA: percutaneous coronary artery