DOI: 10.7860/JCDR/2025/73401.20516

Original Article

Internal Medicine Section

Clinical Outcomes in Diabetic Females Presenting with STEMI: A Cohort Study

ANJANA AJITH BEENA[1], PRIYA SHANMUKHAN[2], VEENA FELIX[3], ALUMMOOTTIL GEORGE KOSHY[4], KUNJUKRISHNAPILLA SIVAPRASAD[5]

ABSTRACT

Introduction: Although the incidence of Acute Coronary Syndrome (ACS) is lower in women, outcomes are worse, particularly in diabetic females. Despite advances in revascularisation and treatment, mortality rates among diabetic females remain higher, with poorer postpercutaneous coronary intervention outcomes. Studies have rarely addressed the differences in the course of myocardial infarction in diabetic females and this underrepresentation has influenced the formulation of guidelines.

Aim: To evaluate the in-hospital composite outcomes of death, non fatal myocardial infarction, emergency revascularisation, heart failure and cerebrovascular accident in diabetic women presenting with ST Elevation Myocardial Infarction (STEMI), as well as the individual in-hospital outcomes and outcomes at one and three months follow-up.

Materials and Methods: This was a prospective single-centre cohort study conducted between November 2017 and October 2018 on 204 patients with STEMI and followed-up for three months. Data were collected from patients using a semistructured questionnaire-based interview, clinical examination, laboratory investigations, echocardiography and angiography. In-hospital outcomes—death, non fatal MI, emergency revascularisation, heart failure and cerebrovascular accident—were studied. Telephonic follow-up was conducted at one and three months. The comparison of variables was carried out using the Independent Student's t-test or Chi-square test, and regression analysis was performed to identify predictors of mortality.

Results: The mean age was 64±11 years; 60.3% were hypertensive and 26% had dyslipidaemia. A total of 12.3% were newly diagnosed diabetics. The mean prehospital delay was 201.9±156.8 minutes. Primary angioplasty was performed in 77%, while thrombolysis was done in 16.7%. The composite outcome was observed in 26.3% of the patients, with heart failure occurring in 19%, cardiogenic shock in 27.9% and death in 16.2%. Cerebrovascular accidents were noted in 0.5% and renal dysfunction was present in 13.2%. At one and three months, heart failure occurred in 7.6% and 5.8%, respectively. Among those with in-hospital mortality, a higher proportion had Anterior Wall Myocardial Infarction (AWMI) (p=0.043), were in Killip class>II (p-value <0.0001), and had qRBBB (Right Bundle Branch Block) (p-value <0.0001). They presented later, with higher blood sugar (p-value <0.0001) and creatinine values (p-value=0.009) and had a lower Ejection Fraction (EF) (p-value=0.003). Killip class (OR=16.0), presence of Ventricular Septal Rupture (VSR) (OR=23.4), no-reflow phenomenon (OR=23.4) and development of renal dysfunction (OR=9.0) were identified as predictors of mortality.

Conclusion: Despite a high rate of revascularisation and fewer procedure-related complications, outcomes remain grim, with a higher incidence of heart failure, cardiogenic shock, renal dysfunction and mortality. A worse clinical profile, left ventricular dysfunction and renal dysfunction were significant predictors of mortality.

Keywords: Acute coronary syndrome, Heart failure, Mortality, Myocardial infarction, Primary angioplasty, Type 2 diabetes mellitus

INTRODUCTION

Even though the incidence of ACS is lower in women than in men across all ages, the difference in mortality appears to be narrowing [1-3]. The incidence of non obstructive disease, microvascular and endothelial dysfunction is higher in females, leading to greater adverse events such as recurrent angina, hospitalisation, heart failure and death [4,5]. Women presenting with STEMI tend to be older, have multiple risk factors and experience cardiogenic shock, pulmonary oedema, mechanical complications and major bleeding events more frequently, even after statistical adjustments [6-8]. Despite technological advances in revascularisation and treatment, mortality rates in female diabetic patients remain higher. Primary angioplasty is also associated with higher rates of vascular complications and worse outcomes [9-11].

Diabetic women are more prone to develop diffuse small-vessel disease and, consequently, diabetic cardiomyopathy. There are also fundamental biological differences in the composition of atherosclerotic plaques [12,13]. As a result, after an ACS, diabetic women tend to have a worse prognosis due to more severe underlying Coronary Artery Disease (CAD), reduced myocardial function, endothelial dysfunction and differences in neuroendocrine regulatory mechanisms [14,15].

Over the last decade, innovations in revascularisation and treatment strategies have considerably improved prognosis [16]. However, data from various studies remain conflicting. There are few studies focusing on the outcomes of female diabetic patients presenting with STEMI, especially in Indian population [17-21]. Most of these studies have included mixed cohorts of patients with both stable and unstable disease. Some studies have shown that the diabetes-related increase in cardiovascular risk is greater in women, leading to worse outcomes [22-26]. This excess risk seems to be largely driven by high in-hospital mortality. On the other hand some studies have questioned the reversal of female advantage in the diabetic population after adjusting for classic risk factors and have reported that the outcomes have improved with availability of enhanced revascularisation therapies [27-29]. Clinical studies have rarely addressed the differences in the course of myocardial infarction

in the female diabetic population, possibly due to the inadequate participation of females, with a maximum of 30% in the majority of significant trials. This underrepresentation has contributed to the failure to recognise female sex as a risk factor for poorer outcomes in the diabetic population. Given the ambiguity of evidence regarding the role of gender in clinical outcomes for the diabetic population presenting with STEMI, a study was warranted [30].

The primary objective of this study was to evaluate the in-hospital composite outcome of mortality, non fatal Myocardial Infarction (MI), emergency revascularisation, heart failure and Cerebrovascular Accident (CVA) in female diabetic patients presenting with STEMI.

The secondary objectives were: a) to evaluate the incidence of mortality, non fatal MI, emergency revascularisation, heart failure, and CVA during hospitalisation and at one and three months follow-up; b) to evaluate the incidence of in-hospital bleeding, arrhythmia and renal dysfunction; and c) to identify the predictors of mortality in female diabetic patients with STEMI.

MATERIALS AND METHODS

This was a single-centre prospective cohort study conducted in the Department of Cardiology at Government Medical College, Thiruvananthapuram, Kerala, India between November 2017 and October 2018, with a three-month follow-up. The study was approved by the Ethics Committee of the Government Medical College, Thiruvananthapuram (IEC No 11/02/2017/MCT). Informed written consent was obtained from all participants.

Inclusion criteria:

- Diabetic females or those diagnosed with Diabetes Mellitus (DM) during admission, diagnosed as: a) Fasting Blood Sugar (FBS) ≥126 mg/dL; or b) Postprandial Blood Sugar (PPBS) ≥200 mg/dL; or (c) HbA1c ≥6.5% [31].
- Female patients with STEMI within 24 hours of the onset of chest pain. STEMI was diagnosed by: a) chest pain lasting 30 minutes or more; b) ECG-ST-elevation of ≥0.1 mV from the J point in at least two contiguous leads (≥0.15 mV in V2, V3); (c) detection of a rise and/or fall of cardiac biomarkers with at least one value above the 99th percentile of the Upper Reference Limit (URL) [32].

Exclusion criteria: Patients whose expected lifespan was less than one year, patients with STEMI beyond 24 hours of chest pain were excluded from the study.

Among 1,208 patients who presented with STEMI, 913 males were excluded. Of the 295 females, 42 presented beyond 24 hours and 49 were non diabetics, hence excluded, while 204 were enrolled in the study.

Sample size: The sample size was calculated using the formula:

$$N = \frac{\left(Z_{1-\frac{\alpha}{2}}\right)^2 pq}{d2}$$

The proportion of composite index (p) was fixed at 32% based on similar studies as well as data from the past three years from our centre [22]. The minimum sample size was calculated to be 200.

Study Procedure

Female patients presenting with STEMI within 24 hours of the onset of chest pain were prospectively recruited into the study. Data were collected using a semistructured questionnaire-based interview and clinical examination. Baseline laboratory investigations, electrocardiograms and echocardiograms were performed. Patients were classified as having mild (EF 41-50%), moderate (EF 30-40%), and severe Left Ventricular (LV) dysfunction (EF <30%) [33]. The revascularisation strategy was determined based on standard protocol. The American Heart Association (AHA) classification (based on the morphology of the lesion to predict procedural success) was used to stratify the lesions [34]. Any complications from the procedures were noted. The outcomes—death, heart failure, non fatal MI, emergency revascularisation, CVA, bleeding, arrhythmia and renal dysfunction during the hospital stay—were assessed. Telephonic follow-up was conducted at one and three months.

STATISTICAL ANALYSIS

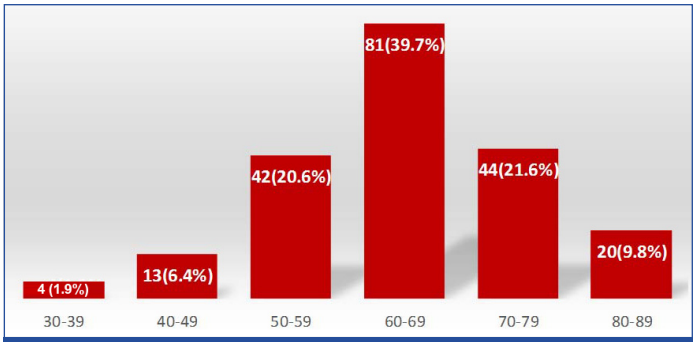
The data from the questionnaires were entered into a Microsoft Excel spreadsheet (2007). The comparison of variables between the groups (survival and death) was carried out using the Independent Student's t-test or Chi-square test. Regression analysis was performed to identify the risk factors associated with mortality. Statistical software Statistical Package for the Social Sciences (SPSS) version 20.0 was used for data analysis. The results were presented as Hazard Ratios (HR) with a 95% confidence interval. A p-value of <0.05 was considered significant.

RESULTS

The population was of an older age group (mean age 64±11 years, with 39.7% in the 60-69 year range). The prehospital delay was still far from ideal (mean - 201.9±156.8 minutes), which might have contributed to the grim outcomes [Table/Fig-1,2].

Baseline characteristics	Minimum	Maximum	Mean±SD
Age (years)	30.0	89.0	64.0±11
Prehospital delay (min)	15.0	750.0	201.9±156.8
Systolic blood pressure (mmHg)	60.0	190.0	128.3±29.4
Haemoglobin (g/dL)	7.0	17.0	12.0±1.6
Fasting blood sugar (mg/dL)	128.0	600.0	252.9±81.4
HbA1c (%)	6.6	7.4	6.9±0.2
Creatinine (mg/dL)	0.5	2.6	1.0±0.3
Total cholesterol (mg/dL)	107.0	354.0	221.7±49.6
Low density lipoprotein (mg/dL)	52.0	274.0	151.8±46.4
High density lipoprotein (mg/dL)	16.0	92.0	42.6±11.7
Echocardiogram- Ejection Fraction (EF) (%)	22.7	77.0	48.9±11.7

[Table/Fig-1]: Baseline characteristics- demographic features and investigations at presentation.



[Table/Fig-2]: Age distribution (years).
(values n (%))

They had more risk factors—hypertension in 60.3% and dyslipidaemia in 26%—and a worse clinical profile, with AWMI in 50.5% and LV dysfunction in 53%. A total of 16.2% of patients presented with a blood pressure <90/60 mm Hg, and 20% were in Killip class III/IV [Table/Fig-3,4]. Notably, mean fasting blood sugar levels were

Risk factors	n (%)
Hypertension	123 (60.3)
Dyslipidaemia	53 (26)
Chronic kidney disease	3 (0.01)
Cerebrovascular accident	1 (0.005)
History of coronary artery disease	6 (0.03)
-Chronic stable angina	2
-Non-ST elevation myocardial infarction	1

-ST Elevation Myocardial Infarction (STEMI)	3
Duration of diabetes mellitus	
Newly detected	25 (12.3)
<1 year	21 (10.3)
1-4 years	40 (19.6)
5-9 years	52 (25.5)
>10 years	66 (32.4)
Diabetics on treatment (n-179)	
-Yes	153 (85)
-No	26 (15)
ST Elevation Myocardial Infarction (STEMI)	
-Anterior Wall	103 (50.5)
-Inferior+Posterior wall	67 (32.8)
-Inferior wall+Right Ventricle	33 (16.2)
-Lateral wall	1 (0.5)
Blood pressure at presentation (mmHg)	
<90/60	33 (16.2)
>90/60	171 (83.8)
Killips class	
I	99 (48.5)
II	64 (31.4)
III	9 (4.4)
IV	32 (15.7)

[Table/Fig-3]: Risk factors, clinical profile (total number=204).

Variables	n (%)
Electrocardiogram features	
-First degree HB	8 (3.9)
-Second degree HB	6 (2.9)
-Complete heart block	16 (7.8)
-Left bundle branch block	2 (1.0)
-qRBBB	14 (6.8)
Echocardiogram- left ventricular dysfunction	
-Mild (41-50%)	63 (30.9)
-Moderate (30-40%)	41 (20.1)
-Severe (<30%)	5 (2.5)
Mitral regurgitation	4 (2.0)
Ventricular septal rupture	4 (2.0)
Primary angioplasty	157 (77)
Thrombolysis	34 (16.7)
Heparinisation	13 (6.3)

[Table/Fig-4]: Electrocardiogram and echocardiographic features and revascularisation strategy.
*HB: Heart block; #RBBB: Right bundle Branch Block

high, although 85% of the diabetics were on treatment, probably indicating poor glycaemic control. Uncontrolled blood sugars over a long period made the population more prone to CAD.

With improvements in the healthcare system, it can be observed that revascularisation rates have increased. Diabetes is usually associated with multivessel, complex and small vessel disease. In present study, multivessel disease was seen in 42.7%, with AHA class B2 (66.9%) and C (25.5%) lesions being more common, while small vessel disease (21.1%), diffuse lesions (17.2%), and chronic total occlusions (4.4%) were less frequent. The radial route was preferred for access. Stent implantation was performed in 87.8%. Culprit vessel Percutaneous Coronary Intervention (PCI) was the strategy used in most of the patients [Table/Fig-5-7].

Procedure-related complications were minimal, with intraprocedural hypotension occurring in 26.1% and slow flow in 19.1%, likely due

Variables	n (%)
Access (n=157)	
-Radial	126 (80.3)
-Femoral	31 (19.7)
Coronary angiogram	
-Single vessel disease	87 (55.4)
-Two vessel disease	37 (23.6)
-Three vessel disease	30 (19.1)
-Left main coronary artery disease	4 (2.6)
Small vessel disease	33 (21)
Chronic total occlusion	7 (4.4)
Diffuse lesions	27 (17.2)
AHA classification of lesions	
-A	0
-B1	4 (2.6)
-B2	105 (66.9)
-C	40 (25.5)
Pre procedure flow	
-TIMI 0	124 (79)
-TIMI 1	19 (12.1)
-TIMI 2	10 (6.3)
-TIMI 3	4 (2.6)
Infarct related artery	
-Left anterior descending	73 (46.5)
-Diagonal	4 (2.5)
-Right coronary	60 (38.2)
-Left circumflex	8 (5.1)
-Obtuse marginal	7 (4.5)
-Right posterolateral branch	2 (1.3)

[Table/Fig-5]: Angiographic characteristics.
*AHA: American Heart Association; #TIMI: Thrombolysis in myocardial infarction

Procedure related characteristics	n (%)
Stent implantation	138 (87.8)
Balloon angioplasty	11 (7.0)
Coronary artery bypass grafting	1 (0.6)
Post procedure flow	
-TIMI 0	0
-TIMI 1	3 (2)
-TIMI 2	32 (20.3)
-TIMI 3	116 (73.9)
Slow flow	30 (19.1)
No reflow	5 (3.2)
Local haematoma	5 (3.2)
Pulmonary oedema	8 (5.0)
Arrhythmia	5 (3.2)
Hypotension	41 (26.1)
Asystole	22 (14.0)
Contrast induced nephropathy	2 (1.2)

[Table/Fig-6]: Procedure related characteristics.
*TIMI: Thrombolysis in myocardial infarction

to the increased total ischaemic period. However, final Thrombolysis in Myocardial Infarction (TIMI) 3 flow could be attained in 73.9%, and 64% had ST resolution >50% [Table/Fig-8]. Although procedure-related complications were minimal, they did not translate into better outcomes, as the occurrences of cardiogenic shock, heart failure and renal dysfunction were higher [Table/Fig-9].

Very few events occurred during follow-up (n=171; 33 were lost to follow-up), with heart failure (7.6%) being the most common. When

Angioplasty related characteristics (n=157)	Minimum	Maximum	Mean±SD
Fluoro time (min)	3.2	58.1	14.9±9.2
Contrast volume (mL)	50.0	440.0	150.6±59.2
Number of vessels stented	1	2	1.02±0.15
Mean stent length (mm)	13	68	25.7±11.6
Mean stent diameter (mm)	2.25	4	3±0.5
Total ischaemic period	120	1590	466.18±184.5
-Thrombolysis (n=34)	210	720	460.2±142.8
-Primary angioplasty(n=157)	120	1590	467.5±192.9
ST resolution	0	100	54.1±21.7
-Thrombolysis	0	100	50.16±21.5
-Primary angioplasty	0	100	55.70±22.0

[Table/Fig-7]: Angioplasty related characteristics and time delays related to revascularisation, ST resolution.

Outcomes	n (%)
In hospital outcome	
Composite outcome	54 (26.3)
Death	33 (16.2)
Non fatal myocardial infarction	0
Emergency revascularisation	0
Heart failure	39 (19)
Cerebrovascular accident	1 (0.5)
Major bleeding	2 (1)
Arrhythmia	5 (2.5)
Renal dysfunction	27 (13.2)
Mechanical complication	6 (3)
Cardiogenic shock	57 (27.9)
ST resolution <50%	79 (36)
ST resolution >50%	122 (64)
At 1 month	
-Death	0
-Non fatal myocardial infarction	0
-Emergency revascularisation	0
-Heart failure	13 (7.6)
-Cerebrovascular accident	0
At 3 month	
-Death	0
-Non fatal myocardial infarction	0
-Emergency revascularisation	0
-Heart failure	10 (5.8)
-Cerebrovascular accident	0

[Table/Fig-8]: In hospital outcome and outcome at 1, 3 month.

comparing individuals who died and those who survived, it was observed that a significantly higher number of patients presented in Killip class III/IV, had a QrBBB on ECG, lower ejection fraction, higher serum creatinine and fasting blood sugar levels, required femoral access, had prolonged total ischaemic periods, and poor ST resolution [Table/Fig-10].

Blood pressure, Killip class, LV dysfunction, and poor ST resolution appeared to predict mortality [Table/Fig-10]. The strongest predictors of mortality were cardiogenic shock requiring inotropic support, no-reflow, and the presence of ventricular septal rupture [Table/Fig-11].

DISCUSSION

This hospital-based study illustrated the grim outcomes in female diabetic patients presenting with STEMI, even in this era of technological advances. The results show that although revascularisation rates have increased, outcomes have not improved

	Survival (n=171)	Death (n=33)	p-value
Age (years)	63.62±10.98	66.03±10.95	0.25
Hypertension	103 (60.2%)	20 (60.6%)	0.97
Dyslipidaemia	47 (27.5%)	6 (18.2%)	0.27
Killips Class III & IV	19 (11%)	22 (66.7%)	<0.0001
Myocardial infarction			
-Anterior wall	81 (47.4%)	22 (66.7%)	0.043
-Inferior wall+right ventricle	25 (14.7%)	8 (24.2%)	0.17
-Inferior wall+posterior wall	65 (37.9%)	3 (9%)	0.001
Serum creatinine (mg/dL)	0.92±0.34	1.09±0.34	0.009
Fasting blood sugar (mg/dL)	240.22±79.62	318.70±81.43	<0.0001
Electrocardiogram			
-qRBBB	6 (3.5%)	8 (24.2%)	<0.0001
Ejection Fraction (EF) (%)	49.93±11.38	43.36±11.73	0.003
Coronary angiogram			
-Multivessel disease	58 (34%)	9 (27.3%)	0.45
-Type C lesion	36 (21.05%)	4 (12%)	0.21
Femoral access	20 (11.1%)	11 (33.3%)	0.002
Primary angioplasty	133 (77.7%)	24 (73%)	0.74
Total ischaemic period	456.61±193.04	725±192.89	<0.0001
ST resolution	57.43±21.50	30.95±21.06	<0.0001

[Table/Fig-9]: Comparison between patients who survived and died.
RBBB: Right bundle branch block

		Mortality		Total n (%)	χ^2	df	p
		Yes (n=33)	No (n=171)				
Age (years)	>60	25 (75.8)	120 (70.2)	145 (71.1)	0.419	1	0.517
	<60	8 (24.2)	51 (29.8)	59 (28.9)			
Duration of diabetes (years)	>5	18 (54.5)	100 (58.5)	118 (57.8)	0.176	1	0.675
	<5	15 (45.5)	71 (41.5)	86 (42.2)			
Blood Pressure (mm Hg)	<90/60	18 (54.5)	15 (8.8)	33 (16.2)	42.742	1	<0.001
	>90/60	15 (45.5)	156 (91.2)	171 (83.8)			
Creatinine (mg/dL)	>1.2	8 (24.2)	24 (14)	32 (15.7)	2.179	1	0.140
	<1.2	25 (75.8)	147 (86)	172 (84.3)			
Killip class	III / IV	22 (66.7)	19 (11.1)	41 (20.1)	53.165	1	<0.001
	I / II	11 (33.3)	152 (88.9)	163 (79.9)			
Ejection Fraction (EF)	<40	12 (36.4)	34 (19.9)	46 (22.5)	4.302	1	0.038
	>40	21 (63.6)	137 (80.1)	158 (77.5)			
ST Resolution	<50%	21 (63.6)	43 (25.1)	64 (31.4)	19.034	1	<0.001
	>50%	12 (36.4)	128 (74.9)	140 (68.6)			

[Table/Fig-10]: Factors influencing mortality.

proportionately, likely emphasising the inherent risks associated with the female gender.

The population had a mean age of 64±11 years. In the study by Ghaffari S et al., the mean age was 66±12.1 years, and in the study by Radomska E et al., it was 71.6±10 years [20,22]. Approximately 60.3% of patients were hypertensive and 26% had dyslipidaemia. Lopez-de-Andres A et al., reported a similar prevalence of hypertension (60.42%), while dyslipidaemia was reported at a higher rate (56.5%) [35]. Asleh R et al., noted that women were 10 years older and had more hypertension (79.9%) [36].

The mean prehospital delay was 201.9±156.8 minutes, indicating that there was a significant need to reduce this critical time in myocardial salvage. A total of 20% of patients presented in Killip class III/IV, and 22% had an EF <40%. Radomska E et al., reported that 31.9% presented with a prehospital delay of >12 hours, 18.6% were in Killip class III or IV, and 9.3% had severe LV dysfunction [20]. In the study by Blöndal M et al., the prehospital delay was >4 hours

	Mortality		Total n (%)	p	OR	95% CI for OR	
	Yes (n=33)	No (n= 171)				Lower	Upper
Blood pressure <90/60	18 (54.5)	15 (8.8)	33 (16.2)	<0.001	12.5	5.2	29.7
Killip Class -III/IV	22 (66.7)	19 (11.1)	41 (20.1)	<0.001	16.0	6.7	38.1
Ejection Fraction (EF) <40%	12 (36.4)	34 (19.9)	46 (22.5)	0.038	2.3	1.0	5.1
Ventricular septal rupture	4 (12.1)	1 (0.6)	5 (2.5)	<0.001	23.4	2.5	217.3
No reflow	4 (12.1)	1 (0.6)	5 (2.5)	<0.001	23.4	2.5	217.3
Pulmonary oedema	5 (15.2)	3 (1.8)	8 (3.9)	<0.001	10.0	2.3	44.2
Requirement of inotropic support	32 (97)	31 (18.1)	63 (30.9)	<0.001	144.5	19.0	1098.2
Mechanical ventilation	22 (66.7)	17 (9.9)	39 (19.1)	<0.001	18.1	7.5	43.7
Heart failure	18 (54.5)	21 (12.3)	39 (19.1)	<0.001	8.6	3.8	19.5
Renal dysfunction	14 (42.4)	13 (7.6)	27 (13.2)	<0.001	9.0	3.7	21.9

[Table/Fig-11]: Predictors of mortality.

in 57%, 14.1% had Killip class III or IV, and EF was <40% in 15.5% [19]. Even with significant advancements in the healthcare system, the prehospital delay continues to be considerably high and female diabetics present with larger MIs, worse clinical profiles with low EF, pulmonary oedema and cardiogenic shock.

Traditionally, studies have shown that females are less likely to receive revascularisation. Ghaffari et al., reported reperfusion in 63.2%, while Blöndal M et al., reported it in 60.2% [19,22]. Lopez-de-Andres A et al., found that among diabetic females, a significantly lower number underwent revascularisation (46.57%, p-value=0.03) [35]. However, present study differs in this aspect, with 93.7% of the patients undergoing revascularisation (77% primary angioplasty and 16.7% thrombolysis). According to the Kerala ACS registry, only 37% of STEMI patients receive revascularisation [37]. However, this high number could be an overestimation, as the study included only those patients taken to cardiology.

Multivessel disease in present study was observed in 42.7%. Radomska E et al., reported it in 62.7%, and Blöndal M et al., reported it in 64.1%, which aligns more closely with the multivessel disease seen in non diabetic females in the above studies—48.5% and 45.3%, respectively [19,20].

The composite outcome was observed in 26.3%. Heart failure was the major event occurring in 19%, and death was reported in 16.2%. Cardiogenic shock was present in 27.9%, while renal dysfunction was noted in 13.2%. The mortality reported by Radomska E et al., was 21.6%, 27.5% by Blöndal M et al., and 15.6% by Lopez-de-Andres A et al., [19,20,35]. The mortality among non diabetic females in the aforementioned studies was 16.6%, 18.2%, and 13.5%, respectively. In a mean follow-up of 6.5 years by Asleh R et al., women had a 29% increased risk of recurrent MI, while the risk of heart failure and mortality was similar [36]. The mortality seen in present study was lower compared to the previous trials, but it is double the in-hospital mortality for STEMI reported in the Kerala ACS Registry, indicating that female diabetics still fare poorly compared to men in our state. The prevalence of heart failure was only 2.7% in the registry, compared to 19% in present study [37]. However, during follow-up, the number of events was limited; 7.6% had heart failure at one month and 5.8% at three months.

Many studies have reported that after adjusting for age and other co-morbidities, no significant difference could be observed in mortality among female diabetic patients [17,22,23,38]. However, in present study, there was no significant difference between the groups in terms of age or associated risk factors. The clinical profile was worse in the group that succumbed to death, as they presented more commonly with AWMI (p-value=0.043), with qRBBB (p-value <0.0001), in Killip Class III and IV (p-value <0.0001), and with lower EF (p-value=0.003). The patients who died had higher baseline creatinine levels (p-value=0.009) and fasting blood sugar levels (p-value <0.0001). They also had a significantly longer total ischaemic period (p-value <0.0001), required femoral access, and exhibited poor ST resolution (p-value <0.0001). Ding Q et al., in a meta-analysis that examined sex-specific short-term, mid-term, and long-term all-cause mortality associated with diabetes among AMI survivors, reported that women with diabetes had a 1.5-fold increase in the risk of all-cause mortality at short-, mid-, and long-term follow-up, and the relative risk of all-cause mortality associated with diabetes appeared to be greater for women than for men at short- (in-hospital or within 90 days of discharge) and long-term (>5 years) follow-up [39].

Of the presenting parameters, Killip class at presentation was a predictor of mortality (OR=16.0, p-value <0.001). EF <40 (OR=2.3, p-value=0.038) and mechanical complications such as ventricular septal rupture (OR=23.4, p-value <0.0001) also correlated with mortality. Among the intraprocedural complications, no-reflow was strongly associated with poor outcomes (OR=23.4, p-value <0.0001).

Radomska E et al., reported that age, cardiogenic shock, and pulmonary oedema at presentation (with Killip Class III/IV being the strongest predictor), as well as AWMI, were associated with in-hospital mortality [20].

Limitation(s)

This was an observational study with a short follow-up period. The study included only patients who were referred to cardiology, which could represent a selection bias and may explain the higher revascularisation rate. Nevertheless, if all patients were included, including a larger number who did not receive revascularisation, the outcomes might actually be worse.

CONCLUSION(S)

Diabetic females present with STEMI at an older age, have more risk factors and exhibit a worse clinical profile. There is a higher usage of revascularisation strategies and fewer procedure-related complications, yet mortality and heart failure rates remain high. A worse clinical profile, lower EF and renal dysfunction appear to predict mortality. This study indicates that diabetic women with Acute Myocardial Infarction (AMI) are a high-risk group that warrants special attention and calls for more dedicated and intensive management strategies to improve outcomes in this population.

Declaration: The abstract of this study was selected for poster presentation at the National CSI Conference 2018.

REFERENCES

[1] Wenger NK. Prevention of cardiovascular disease in women: Highlights for the clinician of the 2011 American Heart Association Guidelines. Adv Chronic Kidney Dis. 2013;20(5):e419-e422.
[2] Towfighi A, Zheng L, Ovbiagele B. Sex-specific trends in midlife coronary heart disease risk and prevalence. Arch Intern Med. 2009;169(19):1762-e1766.
[3] Otten AM, Maas AH, Ottervanger JP, Kloosterman A, van 't Hof AW, Dambrink JH, et al. Is the difference in outcome between men and women treated by primary percutaneous coronary intervention age dependent? Gender difference in STEMI stratified on age. Eur Heart J Acute Cardiovasc Care. 2013;2(4):334-41.
[4] Della Rocca DG, Pepine CJ. What causes myocardial infarction in women without obstructive coronary artery disease? Circulation. 2011;124:1404-06.
[5] Shaw LJ, Min JK, Narula J, Lin F, Bairey-Merz CN, Callister TQ, et al. Sex differences in mortality associated with computed tomographic angiographic measurements of obstructive and nonobstructive coronary artery disease: An exploratory analysis. Circ Cardiovasc Imaging. 2010;3:473-81.

[6] Kaul P, Armstrong PW, Sookram S, Leung BK, Brass N, Welsh RC. Temporal trends in patient and treatment delay among men and women presenting with ST-elevation myocardial infarction. Am Heart J. 2011;161(1):91-97.
[7] Toyota T, Furukawa Y, Ehara N, Funakoshi S, Morimoto T, Kaji S, et al. Sex-based differences in clinical practice and outcomes for Japanese patients with acute myocardial infarction undergoing primary percutaneous coronary intervention. Circ J. 2013;77(6):1508-17.
[8] Khan NA, Daskalopoulou SS, Karp I, Eisenberg MJ, Pelletier R, Tsadok MA, et al. Sex differences in acute coronary syndrome symptom presentation in young patients. JAMA Intern Med. 2013;173(20):1863-71.
[9] Pendyala LK, Torguson R, Loh JP, Kitabata H, Minha S, Badr S, et al. Comparison of adverse outcomes after contemporary percutaneous coronary intervention in women versus men with acute coronary syndrome. Am J Cardiol. 2013;111(8):1092-98.
[10] Wijnbergen I, Tijssen J, van 't Veer M, Michels R, Pijls NH. Gender differences in long term outcome after primary percutaneous intervention for ST-segment elevation myocardial infarction. Catheter Cardiovasc. Interv. 2013;82(3):379-84.
[11] Perdoncin E, Duvernoy C. Treatment of coronary artery disease in women. Methodist Debakey Cardiovasc J. 2017;13(4):201-08.
[12] Reynolds HR, Srichai MB, Iqbal SN, Slater JN, Mancini GB, Feit F, et al. Mechanisms of myocardial infarction in women without angiographically obstructive coronary artery disease. Circulation. 2011;124(13):1414-25.
[13] Vaccarino V, Badimon L, Corti R, de Wit C, Dorobantu M, Hall A, et al. Working Group on Coronary Pathophysiology and Microcirculation: Ischaemic heart disease women: Are there sex differences in pathophysiology and risk factors? Position paper from the working group on coronary pathophysiology and microcirculation of the European Society of Cardiology. Cardiovasc Res. 2011;90:09-17
[14] Graham MM, Ghali WA Faris PD, Galbraith PD, Norris CM, Knudtson ML, APPROACH Investigators, et al. Sex differences in the prognostic importance of diabetes in patients with ischemic heart disease undergoing coronary angiography. Diabetes Care. 2003;26:3142-47.
[15] Jacobs AK. Coronary intervention in 2009: Are women no different than men? Circ Cardiovasc Interv. 2009;2:69-78.
[16] Steinberg HO, Paradisi G, Cronin J, Crowde K, Hempfling A, Hook G, et al. Type II diabetes abrogates sex differences in endothelial function in premenopausal women. Circulation. 2000;101:2040-46.
[17] Kanaya AM, Grady D, Barrett-Connor E. Explaining the sex difference in coronary heart disease mortality among patients with type 2 diabetes mellitus: A metaanalysis. Arch Intern Med. 2002;162:1737-45.
[18] Dotevall A, Hasdai D, Wallentin L, Battler A, Rosengren A. Data from the Euro Heart Survey ACS. Diabetes mellitus: Clinical presentation and outcome in men and women with acute coronary syndromes. Diabet Med. 2005;22:1542-50.
[19] Blöndal M, Ainla T, Marandi T, Baburin A, Eha J. Sex-specific outcomes of diabetic patients with acute myocardial infarction who have undergone percutaneous coronary intervention: A register linkage study: Cardiovascular Diabetology. 2012;11:96.
[20] Radomska E, Sadowski M, Kurzawski J, Gierlotka M, Poloński L. ST-segment elevation myocardial infarction in women withtype 2 diabetes. Diabetes Care. 2013;36(11):3469-75.
[21] Franklin K, Goldberg R, Spencer F, Klein W, Budaj A, Brieger D, et al. Implications of Diabetes in patients with acute coronary syndromes: The Global Registry of Acute Coronary Events. Arch Intern Med. 2004;164:1457-63.
[22] Ghaffari S, Pourafkari L, Tajlil A, Bahmani-Oskoui R, Nader ND. Is female gender associated with worse outcome after ST elevation Myocardial Infarction? Indian Heart J. 2017;69(Suppl 1):S28-S33.
[23] Corrada E, Ferrante G, Mazzali C, Barbieri P, Merlino L, Merlini P, Presbitero P, et al. Eleven-year trends in gender differences of treatments and mortality in ST-elevation acute myocardial infarction in Northern Italy, 2000–2010. Am J Cardiol. 2014;114:336-41.
[24] Kyto V, Sipila J, Rautava P. Gender, age and risk of ST segment elevation myocardial infarction. Eur J Clin Invest. 2014;44:902-09.
[25] Leurent G, Garlantezec R, Auffret V, Hacot JP, Coudert I, Filippi E, et al. Gender differences in presentation, management and in hospital outcome in patients with ST-segment elevation myocardial infarction: Data from 5000 patients included in the ORBI prospective French regional registry. Arch Cardiovasc Dis. 2014;107:291-98.
[26] Chandrasekhar J, Mehran R. Sex-based differences in acute coronary syndrome; insights from invasive and non-invasive coronary technologies. J Am Coll Cardiol. 2016;9(4):451-64.
[27] Larsson CA, Gullberg B, Merlo J, Rastam L, Lindblad U. Female advantage in AMI mortality is reversed in patients with type 2 diabetes in the Skaraborg Project. Diabetes Care. 2005;28:2246-48.
[28] Hochman JS, Tamis JE, Thompson TD, Weaver WD, White HD, Van de Werf F, et al. Sex, clinical presentation, and outcome in patients with acute coronary syndromes. Global use of strategies to open occluded coronary arteries in acute coronary syndromes IIb Investigators. N Engl J Med. 1999;341:226-32.
[29] Regueiro A, Fernandez-Rodriguez D, Brugaletta S, Martín-Yuste V, Masotti M, Freixa X, et al. Sex-related impact on clinical outcome of everolimus-eluting versus bare-metal stents in ST-segment myocardial infarction. Insights from the EXAMINATION Trial. Rev Esp Cardiol (Engl Ed). 2015;68:382-89.
[30] Smith Jr SC, Collins A, Ferrari R, Holmes DR, Logstrup S, McGhie DV, et al. Our time: A call to save preventable death from cardiovascular disease (heart disease and stroke). J Am Coll Cardiol. 2012;60(22):2343-48.
[31] American Diabetes Association Position Statement: Standards of Medical Care in Diabetes-2017. Diabetes Care. 2017;40(Suppl.1):S1-S135.
[32] Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD; Joint ESC/ACCF/AHA/WHF Task Force for Universal Definition of Myocardial Infarction; Authors/Task Force Members Chairpersons, et al. Third Universal Definition of Myocardial Infarction. J Am Coll Cardiol. 2012;60(16):1581-98.
[33] Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L, et al. Recommendations for cardiac chamber quantificationby echocardiography in adults: An update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr. 2015;28(1):1-39.e14.
[34] Ryan TJ, Faxon DP, Gunnar RM, Kennedy JW, King SB 3rd, Loop FD, et al. Guidelines for percutaneous transluminal Angioplasty. A report of the American College of Cardiology/American Heart Association task force on assessment of diagnostic and therapeutic cardiovascular procedures (subcommittee on percutaneous transluminal coronary angioplasty). Circulation. 1988;78:486-502.
[35] Lopez-de-Andres A, Jimnes Garcia R, Hernandez-Barrera V, de Miguel-Yanes JM, Albaladejo-Vicente R, Villanueva-Orbaiz R, et al. Are there sex differences in the effect of type 2 diabetes in the incidence and outcomes of myocardial infarction? A matched-pair analysis using hospital discharge data. Cardiovasc Diabetol. 2021;20:81.
[36] Asleh R, Manemann S, Weston SA, Bielinski SJ, Chamberlain AM, Jiang R, et al. Sex differences in outcomes after myocardial infarction in the community. J Med. 2021;134(1):114-21.
[37] Guha S, Sethi R, Ray S, Bahl VK, Shanmugasundaram S, Kerkar P, et al. Cardiological Society of India: Position statement for the management of ST elevation myocardial infarction in India. Indian Heart Journal. 2017;69:S63-S97.
[38] Pancholy SB, Shantha GP, Patel T, Cheskin LJ. Sex differences in short term and long-term all cause mortality among patients with ST segment elevation myocardial infarction treated by primary percutaneous intervention: A meta-analysis. JAMA Intern Med. 2014;174:1822-30.
[39] Ding Q, Funk M, Spatz E, Lin H, Batten J, Wu E, et al. Sex-specific impact of diabetes on all-cause mortality among adults with acute myocardial infarction: An updated systematic review and meta-analysis, 1988-2021. Front Endocrinol. 2022;13:Doi: 10.3389/fendo.2022.918095.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Cardiology, Government Medical College, Trivandrum, Kerala, India.
2. Assistant Professor, Department of Cardiology, Government Medical College, Trivandrum, Kerala, India.
3. Associate Professor, Department of Cardiology, Government Medical College, Trivandrum, Kerala, India.
4. Professor, Department of Cardiology, Government Medical College, Trivandrum, Kerala, India.
5. Professor, Department of Cardiology, Government Medical College, Trivandrum, Kerala, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Veena Felix,
GRA-A2, Gandhipuram Road, Chavadimukku,
Sreekaryam P.O., Trivandrum-695017, Kerala, India.
E-mail: dr.veenafelix@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 25, 2024
- Manual Googling: Oct 17, 2024
- iThenticate Software: Oct 19, 2024 (6%)

ETYMOLOGY: Author Origin

EMENDATIONS: 8

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Jun 20, 2024**
Date of Peer Review: **Aug 30, 2024**
Date of Acceptance: **Oct 22, 2024**
Date of Publishing: **Jan 01, 2025**