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ST-segment Elevation Myocardial Infarction in North African Women: Results From a Twenty-year Experience

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Abstract

Background: Coronary artery disease remains the most common cause of morbidity and mortality in the general population. Several studies in developed countries have reported a gender-related difference in ST-segment elevation myocardial infarction (STEMI) in terms of risk factors, clinical presentation, delays in management, therapeutic modalities, and in-hospital as well as one-year outcomes. Data from non-developed countries about women with STEMI remain rare. We therefore aimed through this study to investigate the baseline characteristics of STEMI in Tunisian women compared to men and to determine the impact of gender difference on STEMI complications, in-hospital mortality, and one-year follow-up outcomes.

Methods: All patients presenting to our center for STEMI between January 2001 and January 2021 were retrospectively enrolled in this analysis. Clinical features, therapeutic management, and in-hospital as well as one-year outcomes were compared between women and men. Predictive factors of in-hospital mortality in women were determined.

Results: Out of 1670 STEMI hospitalizations, 359 (21.4%) were female. Compared to male, female had higher rates of hypertension (51.5% vs. 24.4%, $p < 0.001$), diabetes (50.1% vs. 32.2%, $p < 0.001$), and obesity (63.8% vs. 55%, $p = 0.003$). The clinical presentation was characterized by less prevalent inaugural chest pain (58.8% vs. 68.6%, $p < 0.001$). Atypical symptoms were significantly higher in women compared to men (55.2% vs. 5%, $p < 0.001$). On admission, women had higher prevalence of anemia, renal failure, and hyperglycemia compared to men. Primary percutaneous coronary intervention (pPCI) was the reperfusion strategy of choice in 37.9% of women vs. 33.1% of men ($p = 0.02$). Women were significantly less likely to receive thrombolysis ($p = 0.004$), with a significantly less prevalent successful thrombolysis (55.6% vs. 67.2%, $p = 0.013$). In-hospital mortality was markedly higher in women compared to men (12.8% vs. 7.3%, $p = 0.001$). Compared to surviving women ($n = 313$), those who died ($n = 46$) frequently had more diabetes and hypertension (65.2% vs. 47.9%, $p = 0.02$ and 67.4% vs. 49.2%, $p = 0.02$, respectively). New-onset atrial fibrillation, acute left heart failure, cardiogenic shock, ventricular tachycardia, and atrioventricular block markedly occurred in women who died (52.2% vs. 23.3%, $p < 0.001$; 17.4% vs. 1.9%, $p < 0.001$; 19.6% vs. 8.3%, $p = 0.016$; 15.2% vs. 1.6%, $p < 0.001$ and 34.8% vs. 10.2%, $p < 0.001$, respectively).

Conclusion: Compared to men, Tunisian women presenting for STEMI had higher prevalence of risk factors and atypical symptoms. Women had more in-hospital complications and mortality.

Keywords: STEMI, Women, Prognosis, Mortality

1. Introduction

Coronary artery disease remains the most common cause of morbidity and mortality in the general population. About three million people

worldwide have myocardial infarction each year [1,2]. In Tunisia, the age standardized incidence of myocardial infarction was 163 per 100 000 people [3] while this incidence ranged from 43 to 144 per 100 000 per year in European countries [4]. Several

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studies have reported a high prevalence of in-hospital complications and death in women presenting with ST-elevation Myocardial Infarction (STEMI) despite the marked improvements in revascularization strategies and secondary prevention [5–7]. Data from developed countries have shown that women with STEMI tend to have worse in-hospital outcomes, such as acute heart failure and higher in-hospital mortality than men regardless of the revascularization strategies (fibrinolysis or primary percutaneous coronary intervention (pPCI)) [8–11]. On the other hand, women with STEMI receive reperfusion therapy less frequently compared to men [12–14]. The contributing factors to gender gap in terms of morbidity and mortality in patients with STEMI remain unclear. Studies from undeveloping countries focusing on the impact of gender difference on STEMI prognosis are rare [15]. This study aimed to compare the baseline characteristics of STEMI between Tunisian women and men and to investigate the impact of gender difference on STEMI complications, and in-hospital as well as one year-follow-up outcomes.

2. Methods

2.1. Study population and design

Data were obtained from the STEMI registry at the cardiology department. All patients presenting with STEMI and admitted to our department between January 2001 and January 2021 were retrospectively enrolled in this study. STEMI was defined as a new ST-segment elevation > 2 mm in two contiguous leads or a new left bundle branch block on electrocardiogram (ECG), concomitant to prolonged chest pain >20 min [16]. The study population was divided into two groups according to gender. Demographic data, cardiovascular risk factors, clinical presentation, delays, and electrocardiographic as well as biologic features were collected and compared between the two groups. The symptom-to-diagnosis delay was defined as the time from chest pain onset to STEMI diagnosis, either in the emergency department or at the time of the emergent medical service. Acute left heart failure on admission was defined as Killip class II or III. Cardiogenic shock was referred to as Killip class IV. Acute right heart failure on admission was defined as the association of hypotension and jugular venous distention or hepatojugular reflux. Renal failure on admission was defined as a creatinine clearance <60 mL/min using the Modification of Diet in Renal Disease (MDRD) formula in patients with no chronic kidney disease history.

Abbreviations

CABG	Coronary artery bypass grafting
ECG	Electrocardiogram
MDRD	Modification of Diet in Renal Disease
OR	Odds ratio
pPCI	Primary percutaneous coronary intervention
STEMI	ST-segment elevation myocardial infarction

Hyperglycemia on admission was defined as glycemia ≥ 11 mmol/L. Anemia was defined when the hemoglobin rate was <13 g/dL in men and <12 g/dL in women.

2.2. Therapeutic strategies and prognosis

Upon diagnosis, all patients received 250 mg of aspirin, 100 IU of intravenous unfractionated heparin, and 300 mg or 600 mg oral dose of clopidogrel according to the reperfusion strategy. The other antiplatelets were not available in our center. The choice of the reperfusion strategy, whether primary percutaneous coronary intervention (pPCI) or thrombolysis, was based on the availability of the catheterization laboratory and the operator and the possibility to transfer the patient to a PCI-capable center within 90 min [15,16].

If not contraindicated, thrombolysis was started immediately. Patients with contraindications to thrombolysis were referred for pPCI, even when the transfer time was delayed more than 120 min. The decision not to offer any reperfusion strategy was made based on individual criteria, such as advanced age, severe co-morbidities, late presentation, or contraindications to both reperfusion methods. Spontaneous reperfusion was defined as the disappearance of chest discomfort concomitant with complete ST-segment regression before the initiation of reperfusion therapy. Diagnosis to pPCI delay was defined as the time from STEMI diagnosis to successful wire crossing time during pPCI. Diagnosis-to-fibrinolysis delay was defined as the time from STEMI diagnosis to fibrinolysis administration. Thrombolysis success was defined by a regression >50% of ST segment in the ECG lead with maximal ST elevation, and/or disappearance of chest pain with no hemodynamic or electrical instability 60–90 min after the initiation of thrombolysis [17]. At discharge, all patients received aspirin and statins for life and clopidogrel for 1–12 months. Beta-blockers and angiotensin-converting enzyme inhibitors were prescribed according to the indication.

The primary outcome measure was in-hospital complications, including acute left and right heart

failure, cardiogenic shock, conduction and rhythm troubles, mechanical complications, acute pericarditis effusion, hemorrhage, and mortality. Secondary outcomes, including rehospitalization, acute coronary artery syndrome, and death were reported at the one year follow-up. Univariate analysis was performed to determine the appropriate factors associated with in-hospital death in women. Factors independently associated with in-hospital death in women were studied in multivariate analysis.

2.3. Statistical analysis

Categorical variables were presented as absolute value and proportions. The independent t-test and Chi-square test were used to compare means and proportions of continuous and categorical variables, respectively. Multivariate analysis was performed using binary logistic regression for variables that were significantly associated with in-hospital death in univariate analysis. Multivariable adjusted odds ratio (OR) with accompanying 95% confidence intervals were reported. A p value < 0.05 was set for statistical significance. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS), version 21 (IBM, Armonk, NY, USA).

3. Results

3.1. Patients' demographic characteristics, clinical presentation, and electrocardiographic as well as biologic findings on admission (Table 1)

Out of 1670 STEMI hospitalizations, 359 (21.4%) were women. The proportion of patients aged >65 years was 39.9% and that of young women (<40 years) was 2.5%. Diabetes mellitus, hypertension, current smoking, and obesity accounted for 35.9%, 30.1%, 66.8%, and 56.7%, respectively. Compared to men, women had higher rates of hypertension, diabetes, and obesity. Smoking was less prevalent in women compared to men. History of percutaneous coronary intervention (PCI) and chronic heart failure was more frequent in women. Nevertheless, no significant difference was noted between the two genders with regard to hyperlipidemia, coronary artery bypass grafting (CABG), and peripheral arterial disease of the lower extremities. The clinical presentation was characterized by a less prevalent inaugural chest pain. Atypical symptoms, including gastrointestinal complaints, fatigue, dyspnea, or atypical irradiation were significantly higher in women compared to men. Moreover, tachycardia >100 bpm was more frequent in women compared

Table 1. Baseline characteristics according to gender.

	Population (n = 1670)	Female gender (n = 359)	Male gender (n = 1311)	p
Age ≥65 years	600 (40.1%)	191 (53.2%)	478 (36.5%)	<0.001
Age <40 years	104 (6.2%)	9 (2.5%)	95 (7.2%)	<0.001
Diabetes mellitus	602 (36%)	180 (50.1%)	422 (32.2%)	<0.001
Hypertension	505 (30.2%)	185 (51.5%)	320 (24.4%)	<0.001
Hyperlipidemia	197 (11.8%)	52 (14.5%)	145 (11.1%)	0.07
Current smoking	1119 (67%)	87 (24.2%)	1032 (78.7%)	<0.001
Obesity (BMI>30)	950 (56.9%)	229 (63.8%)	721 (55%)	0.003
Prior chronic coronary syndrome	114 (6.8%)	45 (12.5%)	69 (5.3%)	<0.001
Prior chronic heart failure	37 (2.2%)	13 (3.6%)	24 (1.8%)	0.04
Prior PCI	137 (8.2%)	75 (20.9%)	62 (4.7%)	<0.001
Prior CABG	6 (0.4%)	3 (0.8%)	3 (0.2%)	0.008
Peripheral artery disease of the lower extremities	58 (3.4%)	12 (3.3%)	46 (3.5%)	0.8
Clinical presentation on admission				
Inaugural chest pain	1110 (66.5%)	211 (58.8%)	899 (68.6%)	<0.001
Atypical presentation	263 (15.7%)	198 (55.2%)	65 (5%)	<0.001
Symptoms -to- diagnosis delay >1 h	1284 (76.9%)	313 (87.2%)	971 (74.1%)	<0.001
Tachycardia >100 bpm on admission	293 (17.5%)	76 (21.2%)	217 (16.6%)	0.04
SBP >140	292 (17.5%)	64 (17.8%)	228 (17.4%)	0.8
Electrocardiographic and biological results on admission				
Anterior location of STEMI	823 (49.3%)	174 (48.5%)	649 (49.5%)	0.2
ST segment elevation on AvR	111 (6.6%)	32 (8.9%)	79 (6%)	0.04
ST segment elevation on V3R and V4R	162 (9.7%)	25 (7%)	137 (10.5%)	0.06
Anemia on admission	386 (23.1%)	139 (38.7%)	247 (18.8%)	<0.001
Serum creatinine level on admission >120 μmol/L	315 (18.9%)	80 (22.3%)	235 (17.9%)	0.06
Hyperglycemia on admission	587 (35.1%)	164 (45.7%)	423 (32.3%)	<0.001

BMI: body mass index, CABG: Coronary artery bypass grafting, pPCI: Primary percutaneous coronary intervention, SBP, systolic blood pressure, STEMI: ST-segment elevation myocardial infarction.

to men on admission. Symptoms -to- diagnosis delay >1 hour was significantly more prevalent among women irrespective of whether they arrived by ambulance or they presented by themselves. No sex difference was noted in the prevalence of anterior ST-elevation location. Nevertheless, ST segment elevation in AvR was significantly higher in women. Biologic parameters on admission demonstrated higher prevalence of anemia, renal failure, and hyperglycemia in women compared to men.

3.2. Therapeutic strategies in the acute phase of STEMI (Table 2)

Percutaneous coronary intervention (pPCI) was the reperfusion strategy of choice in 37.9% of women vs. 33.1% of men ($p = 0.02$). Diagnosis to pPCI delay >2 h was numerically less prevalent in women. However, diagnosis to thrombolysis delay >2 h was significantly more prevalent in women. The latter were significantly less likely to receive thrombolysis ($p = 0.004$), with a significantly less prevalent thrombolysis success (55.6% vs. 67.2%; $p = 0.013$). Prevalence of conservative medical treatment and spontaneous fibrinolysis was similar between the two genders. Left coronary artery was the most culprit artery in both genders, with a significant higher prevalence in women ($p < 0.001$). Moreover, women more often multi-vessel stenosis ($p = 0.008$) and presented a markedly higher prevalence of spontaneous coronary dissection ($p < 0.001$). No significant difference was noted in

non-obstructive coronary arteries between the two genders.

3.3. In-hospital and one-year outcomes and mortality (Tables 3 and 4)

Compared to men, new-onset acute left and right heart failure was more prevalent in women ($p = 0.01$ and $p < 0.001$, respectively). A total of 344 patients with no preexisting heart failure experienced new onset of acute left heart failure without significant difference between the two sex ($p = 0.051$). Second or third degree atrioventricular blocks were significantly higher in women compared to men ($p = 0.008$) but with no effect of culprit artery or STEMI territories on this complication in women (right coronary artery 33.3%, inter ventricular artery 20.8% and other arteries 45.9%, $p = 0.2$). New-onset atrial fibrillation was more frequent in women ($p = 0.006$). Nevertheless, no differences in terms of sustained ventricular tachycardia, cardiogenic shock, mechanical complications, and hemorrhage were noted between the two genders. A higher rate of ventricular tachycardia, ventricular fibrillation, acute left heart failure and cardiogenic shock (3.9%, 5.1%, 30.6% and 3.3% respectively) was noted in anterior location of STEMI. In-hospital mortality rate was markedly higher in women than in men (12.8% vs. 7.3%, $p = 0.001$). The one-year follow-up revealed less rehospitalization and acute coronary artery diseases in women compared to men, with no significant difference in mortality.

Table 2. Therapeutic strategies and angiographic results according to gender.

	Population (n = 1670)	Female (n = 359)	Male (n = 1311)	p
pPCI	570 (34.1%)	136 (37.9%)	434 (33.1%)	0.02
Diagnosis to pPCI delay >2 h	434 (75.6%)	96 (70.1%)	338 (77.3%)	0.08
Thrombolysis	578 (34.6%)	101 (28.1%)	477 (36.4%)	0.004
Diagnosis to thrombolysis delay >2 h	413 (71.5%)	84 (83.2%)	329 (69%)	0.004
Thrombolysis success	514 (65.4%)	69 (55.6%)	445 (67.2%)	0.013
Spontaneous fibrinolysis	189 (11.3%)	35 (9.7%)	154 (11.7%)	0.3
Conservative treatment	497 (29.8%)	112 (31.2%)	385 (39.4%)	0.2
GPIIb/IIIa antagonist use	136 (8.2%)	27 (7.5%)	109 (8.3%)	0.6
Culprit coronary artery				<0.001
AIVA	600 (35.9%)	109 (30.4%)	491 (37.5%)	
CxA	291 (17.4%)	74 (20.6%)	217 (16.6%)	
RCA	520 (31.1%)	98 (27.3%)	422 (32.2%)	
MgA	143 (8.6%)	56 (15.6%)	87 (6.6%)	
DgA	72 (4.3%)	16 (4.5%)	56 (4.3%)	
non-obstructive coronary arteries	44 (2.6%)	6 (1.7%)	38 (2.9%)	0.2
Spontaneous coronary dissection	6 (0.4%)	5 (1.4%)	1 (0.1%)	<0.001
Multi-vessel stenoses	74 (4.4%)	25 (7%)	49 (3.7%)	0.008

AIVA: anterior inter ventricular artery, CxA: circumflex artery, DgA: diagonal artery, MgA: marginal artery, pPCI: Primary percutaneous coronary intervention, RCA: right coronary artery, STEMI: ST-segment elevation myocardial infarction.

Table 3. In-hospital prognosis according to gender.

	Population (n = 1670)	Female (n = 359)	Male (n = 1311)	p
New onset acute left heart failure	368 (22%)	97 (27%)	271 (20.7%)	0.01
New onset right heart failure	66 (4%)	19 (5.3%)	47 (3.6%)	<0.001
Cardiogenic shock	47 (2.8%)	14 (3.9%)	33 (2.5%)	0.16
New onset atrial fibrillation	110 (6.6%)	35 (9.7%)	75 (5.7%)	0.006
Ventricular tachycardia	60 (3.6%)	12 (3.3%)	48 (3.7%)	0.7
Ventricular fibrillation	65 (3.9%)	16 (4.5%)	49 (3.7%)	0.5
Second or third atrioventricular block	154 (9.2%)	48 (13.4%)	106 (8.1%)	0.008
Pericardial effusion	60 (3.6%)	16 (4.5%)	44 (3.4%)	0.35
Mechanical complications	8 (0.5%)	2 (0.6%)	6 (0.5%)	0.8
Hemorrhage	44 (2.6%)	8 (2.2%)	36 (2.7%)	0.5
In-hospital mortality	142 (8.5%)	46 (12.8%)	96 (7.3%)	0.001

Table 4. One-year follow-up according to gender.

	Population (n = 1528)	Female (n = 313)	Male (n = 1215)	p
Rehospitalization	432 (25.9%)	72 (20.1%)	360 (27.5%)	0.001
Acute coronary syndrome	53 (3.2%)	6 (1.7%)	47 (3.6%)	0.001
Death	38 (2.5%)	4 (1.3%)	34 (2.8%)	0.1

Predictive factors of in-hospital mortality in women were studied in univariate analysis (Table 5). Diabetes and hypertension (65.2% vs. 47.9%, $p = 0.02$ and 67.4% vs. 49.2%, $p = 0.02$, respectively) were more frequent in women who died ($n = 46$) compared to those surviving ($n = 313$). Paradoxically, current smoking was significantly lower in those who died than in survivors. Anemia and renal failure

on admission were significantly more prevalent in women who died. New-onset atrial fibrillation, acute left heart failure, cardiogenic shock, ventricular tachycardia, and atrioventricular block were markedly noted in those who died (52.2% vs. 23.3%, $p < 0.001$, 17.4% vs. 1.9%, $p < 0.001$, 19.6% vs. 8.3%, $p = 0.016$, 15.2% vs. 1.6%, $p < 0.001$, and 34.8% vs. 10.2%, $p < 0.001$ respectively). Multivariate analysis

Table 5. Factors associated with in-hospital death in women in univariate analysis.

	Survivors (n = 313)	dead (n = 46)	P
Age ≥ 65 years	158 (50.5%)	33 (71.7%)	0.007
Diabetes mellitus	150 (47.9%)	30 (65.2%)	0.02
Hypertension	154 (49.2%)	31 (67.4%)	0.02
Current smoking	84 (26.8%)	3 (6.5%)	0.003
Obesity (BMI >30)	200 (63.9%)	29 (63%)	0.9
Prior heart failure	11 (3.5%)	2 (4.3%)	0.6
Prior PCI	72 (23%)	3 (6.5%)	0.03
Symptoms -to- diagnosis delay >1 h	276 (88.2%)	37 (80.4%)	0.1
Tachycardia >100 bpm on admission	60 (19.2%)	16 (34.8%)	0.016
Anemia on admission	104 (33.2%)	35 (76.1%)	<0.001
Serum creatinine level on admission >120 $\mu\text{mol/L}$	57 (18.2%)	23 (50%)	<0.001
Hyperglycemia on admission	139 (44.4%)	25 (54.3%)	0.2
pPCI	117 (37.4%)	19 (41.3%)	0.6
Diagnosis to pPCI delay >2 h	80 (67.8%)	16 (84.2%)	0.1
Thrombolysis	89 (28.4%)	12 (26.1%)	0.7
Diagnosis to thrombolysis delay >2 h	75 (84.4%)	9 (75%)	0.4
Spontaneous fibrinolysis	32 (10.2%)	3 (6.5%)	0.4
GPIIb/IIIa antagonist recourse	17 (5.4%)	10 (21.7%)	<0.001
Acute left heart failure on admission	73 (23.3%)	24 (52.2%)	<0.001
Cardiogenic shock	6 (1.9%)	8 (17.4%)	<0.001
New onset atrial fibrillation	26 (8.3%)	9 (19.6%)	0.016
Ventricular tachycardia	5 (1.6%)	7 (15.2%)	<0.001
Atrioventricular block	32 (10.2%)	16 (34.8%)	<0.001

BMI: body mass index, pPCI: primary percutaneous coronary intervention.

Table 6. Factors independently associated with in-hospital mortality in women presenting with ST-elevation myocardial infarction (STEMI) in multivariate analysis.

Variables	Odds ratio	95% CI	p
Tobacco	0.2	0.04–0.87	0.03
Tachycardia >100	2.025	0.83–4.92	0.12
New onset acute heart failure	2.008	0.89–4.52	0.09
Cardiogenic shock	17.32	7.57–39.61	<0.001
Atrial fibrillation	1.93	0.63–5.92	0.25

revealed that cardiogenic shock was independently associated with in-hospital mortality in women (OR = 17.32, 95% CI: 7.57–39.61, $p < 0.001$) (Table 6).

4. Discussion

Coronary artery disease is the most common cause of mortality in both men and women worldwide [16]. Despite its decreasing incidence, STEMI remains more common in men than in women [18]. During STEMI, gender difference in terms of cardiovascular profile, clinical presentation, therapeutic modalities, and prognosis has been widely studied. Several studies in developed countries have highlighted the poor outcome in women with STEMI [19–21]. However, data about this issue are limited in undeveloped countries. To the best of the authors' knowledge, this is the first and the largest Tunisian study investigating gender difference during STEMI. As reported in previous studies, a difference in cardiovascular risk profile was noted between women and men, making women more susceptible to STEMI [22–24]. Among the cardiovascular risk factors, old age, diabetes, and hypertension are the leading factors for STEMI in women [25]. These results are consistent with those found in the present study, revealing higher prevalence of diabetes and hypertension, and lower prevalence of smoking in women with STEMI [26,27]. Delay in seeking care is one of the principal factors for a bad prognosis in women with STEMI [28–30]. Women tend to seek medical care later than men because of many factors, such as the lack of health awareness, psychosocial factors, lack of recognition of alarming symptoms, and the difficulty to access to health care services [31,32]. Such behavior could delay STEMI diagnosis and appropriate therapeutic strategy, thus leading to a bad prognosis. However, in the present study, symptoms-to-diagnosis delay did not affect hospital mortality rate in women. As reported in other studies [33,34], our results revealed that chest pain was the most common symptom for both women and men. However, women are more likely to have a greater variety of symptoms, including back or epigastric pain, which they most often

misinterpret compared to men. Atypical symptom recognition affects not only the delay in seeking care but also the prognosis [35]. Regarding the therapeutic strategies, the guidelines recommend that both men and women receive the same STEMI management [36]. Despite the higher bleeding complications and mortality in women as reported in the ISIS-3 study (36080 STEMI patients treated by fibrinolysis), women should benefit from thrombolytic therapy when pPCI is not available [37]. Nevertheless, several studies have reported worse outcomes and higher mortality in women compared to men after pPCI in STEMI [38,39]. These results could be attributed to older age, higher cardiovascular and comorbidities prevalence, and longer symptom-to-balloon time [40,41]. In accordance with our results, a multicentric Australian study reported lower prevalence of pPCI in women compared to men [42]. However, the results of the aforementioned study are not in accordance with those found in the present study, revealing no impact of both thrombolysis and pPCI on in-hospital mortality. In our study, the low rate of pPCI could be explained by the non availability of the cath laboratory during the first three years of the study. So thrombolysis was the reperfusion strategy of choice at that period. The time door to balloon is often long leading to the use of fibrinolysis as well as many patients received thrombolysis at the ambulance even before the arrival at the hospital. In-hospital prognosis in women with STEMI remains poor with a higher mortality rate. Previous studies have revealed that women with STEMI have higher in-hospital mortality compared to men [43–45]. However, one-year and long-term mortality is controversial. Pascual reported that gender difference is not a risk factor for one-year mortality in STEMI patients [46], which was supported by the present study results. However, other reports have revealed higher one-year mortality in women compared to men, which is explained by the worse clinical profile and the reduced rate of reperfusion therapy [47–49].

4.1. Study limitations

The present study presents several limitations, including the retrospective observational study type. Our registry included only patients admitted to one Tunisian tertiary care center. So, data could not be adapted to all the Tunisian population. The reduced number of women could explain the weak statistical relationship between some factors (reperfusion therapies, in-hospital prognosis). In addition, the study did not take into consideration

the thrombolytic type, and the stenting procedure and complications. Moreover, the follow-up time was limited to one year. Information on chronic medical treatment during the follow-up and the echocardiographic evaluation were not assessed.

5. Conclusion

Gender-difference in terms of in-hospital prognosis between women and men with STEMI is due to the difference in the patients' characteristics (age and cardiovascular risk factors). Sex-related pathophysiological differences may contribute to the higher in-hospital mortality and complications in women compared to men. At one-year follow-up, the prognosis is reversed to poor outcomes (rehospitalization and acute coronary artery events) in men with STEMI with no difference in mortality between the two genders.

Ethics approval and consent to participate

The study does not entail other ethical issues. In the case of the present study, the local ethics committee ruled that no formal ethics approval was required.

Authors' contributions

IC, RS, NA were actively involved in data collection and processing. IC, WJ and WA were involved in manuscript preparation. KBH and FM were involved in manuscript reviewing. All authors have read and approved the manuscript.

Conflict of interest

Nothing to declare.

Acknowledgment

The authors have no financial or nonfinancial conflict of interest to declare.

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