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Research Article

Gender Differences in ST-Elevation Myocardial Infarction (STEMI) Time Delays: Experience of a Public Health Service in Salvador-Brazil

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Abstract

Background: Delays in attending to ST-elevation myocardial infarction (STEMI) are indicators or markers of quality of health services. Several records suggest gender disparity in cardiac care as a contributor to the increased mortality among women.

Objectives: To analyze the influence of the gender and baseline characteristics on the time goals of the STEMI care.

Methods: We prospectively enrolled all consecutive STEMI patients who were transferred to our hospital from January through December 2015. The following variables were analyzed: Symptom-to-Door Time (SDT); Time to First ECG (TECG); Transfer Time to Referring Center (TTRC); and Door-to-Cath lab time (DCT).

Results: Of the 133 patients, 85(63.9%) were male and 45 (36%) female. The mean age and body mass index (BMI) between the male and female sexes was 56.3 and 60.5 years for the first and 26 and 27.7 Kg/M2 for the second. Diabetes and low school education level were more prevalent in women than men, with statistical significance: 20 (48.8%) vs 18 (26.1%) with P = 0.01 and 26 (54.2%) vs 28 (32.9%) with P = 0.04, respectively. Regarding the times evaluated (SDT, TECG, TTRC and DCT), there was no statistically significant difference in relation to gender. STEMI Killip class I was more prevalent in males: 93 (86.1%) vs 12 (63.2%) cases with P = 0.01, and thrombolysis with a tendency towards to the same direction: 17 (20%) vs 4 (8.3%) and P = 0.07.

Conclusions: According to our results women with STEMI had a significantly higher prevalence of diabetes and a low school education level, as well as a higher proportion of complicated STEMI (Killip class ≥ II), and a higher probability of obtaining time goals for SDT and TECG.

Keywords: *ST-Elevation Myocardial Infarction; SDT; TECG; TTRC; DCT*

Introduction

ST-elevation myocardial infarction (STEMI) is characterized by acute thrombotic occlusion of a coronary artery subepicardial, resulting in ischemia of the cardiac muscle and transmural myocardial necrosis. Morbidity and mortality is directly dependent on the severity and duration of the deprivation of the flow. Therefore, it is fundamental that an early diagnosis be made and a reperfusion therapy be installed in a short period of time [1].

The majority of deaths due to STEMI occur in the out-of-hospital environment, 40-65% in the first hour of onset of symptoms and 80% in the initial 24 hours [2]. Delays in attending to STEMI are indicators or markers of quality of health services [3]. In this way, it is essential to have an integrated and organized network that involves prehospital care, emergency care units and referenced emergency services. An analysis of this network demonstrated all the complexity involved, and during the implementation and consolidation period, results were still far from those recommended by the world's recommendations [4].

In order to analyze the main factors responsible for the delay in the diagnosis and treatment of patients with STEMI in relation to gender in the public health system in the city of Salvador-Brazil, a prospective observational cohort was developed in 2015.

Methods

Study design and population

It is a prospective and observational cohort of pre and in-hospital follow-up. From January 2015 to December 2015, all patients admitted to Hospital Ana Nery (Salvador – Brazil) were included, if they were 18 years of age or older, and had STEMI (defined as ST segment elevation of at least 1 mm in two or more contiguous leads).

Data collection (sociodemographic information and relevant clinical characteristics) was performed within 24 hours after hospital admission. Complementary clinical data were obtained through information provided by patients, family members and direct medical records. The project was submitted and approved to the local ethics committee.

Study Definitions

The classification of chest pain was based on the use of a 4-level scale adapted to the emergency department: type A (definitely anginal), type B (probably anginal), type C (probably non-anginal) and type D (definitely non-anginal) [5,6]. A new simplified two levels pain scale was then applied: typical pain (patients classified as type A or B pain) and atypical pain (patients classified as type C or D pain).

The following variables were used to analyze the time involved in the care process for the patient with STEMI, based on previously published studies in the literature [7-11]: Symptom-to-Door Time (SDT); Time to First ECG (TECG); Transfer Time to Referring Center (TTRC); and Door-to-Cath lab Time (DCT). In relation to the goals for the times, the following cut points were recommended: SDT ≤ 120 min; TECG ≤ 10 min; TTRC ≤ 120 min; DCT ≤ 120 min, inspired by goals recommended by some global guidelines and results of some clinical records, besides the local experience [4,7,12,13].

The Salvador Care Unit Network System

Utilizing the experience assembled in a regionalized network of patient care with STEMI started in 20094 and completed in 2014, a new service model was initiated in 2015, which centralized the activation and selection of cases through a smartphone application (WhatsApp®) with professionals from emergency medical service (SAMU-Salvador-Brazil), emergency care units (UPA-SUS-Brazil), coordination of emergency services and PCI-capable receiving center (Hospital Ana Nery-Salvador-Brazil). The operation of this system was done after prehospital attendance by SAMU, or by health professionals at UPAs or general hospitals who posted the case summaries in a virtual group made in smartphone application. After this triage, an UTI mobile service was activated to remove the patient from the unit of origin to the primary PCI center. In the presence of overcrowding, thrombolysis was performed.

Statistical Analysis

Categorical variables were presented as proportions and continuous variables were presented as mean ± SD. Medians and interquartile ranges were used to summarize continuous variables with skewed distributions. The qualitative and categorical variables in univariate analysis were presented in percentages and their comparisons were made by chi-square test or fisher's exact test, when indicated. Finally, a binary logistic regression model was applied to evaluate some independent predictor of delay in attendance according to each

time mentioned. Effects or differences were considered statistically significant when P ≤ 0.05 values were found. SPSS 19.0 software (SPSS Inc., Chicago, IL, USA) was used to perform statistical analysis of the data collected.

Results

The comparison of clinical and sociodemographic characteristics in patients with STEMI in relation to gender is presented in Table 1. Of the 133 patients, 85 were male (63.9%) and 48 (36%) female; The mean age and BMI between the male and female sexes was 56.3 and 60.5 years for the first and 26 and 27.7 Kg /M^2 for the second. Diabetes and lower levels of education were more prevalent in women than men, with statistical significance: 20 (48.8%) vs 18 (26.1%) with P = 0.01 and 26 (54.2%) vs 28 (32.9%) with P = 0.04, respectively.

Variable	Male n = 85	Female n = 48	P value
Age			
Mean ± SD	56.3 ± 13	60.5 ± 13	0.08
Median (IIQ)	57 (49 – 65)	60 (52 – 70)	-
BMI, mean, Kg/M^2	26 ± 4	27.7 ± 5	0.12
Hypertension - no. (%)	78 (67.2)	16 (69.6)	0.89
Diabetes - no. (%)	18 (26.1)	20 (48.8)	0.01
Low school education level	28 (32.9)	26 (54.2)	0.04
Previous AMI - no. (%)	10 (15.2)	5 (12.2)	0.66
Renal Insufficiency- no. (%)	3 (4.4)	2 (4.9)	0.91
Dyslipidemia - no. (%)	11 (16.4)	9 (22.5)	0.43
Previous Stroke - no. (%)	5 (7.4)	1 (2.4)	0.27
Killip class I - no. (%)	93 (86.1)	12 (63.2)	0.01
Typical chest pain - no. (%)	74 (87)	39 (81.25)	0.36
Primary PCI * - no. (%)	51 (60)	27 (56.3)	0.67
Thrombolysis - no. (%)	17 (20)	4 (8.3)	0.07
Involved Artery: LAD - no. (%)	20 (23.5)	16 (33.3)	0.22

Table 1: *Comparison of clinical and sociodemographic characteristics in patients with STEMI in relation to gender (n = 133).*

Values are in numbers and percentages, unless otherwise reported; SD – Standard deviation; IIQ – Interquartile range; BMI – Body mass index; AMI – Acute myocardial infarction; LAD – Left anterior descending artery; PCI – Percutaneous coronary intervention; (*) Patients classified as primary PCI performed the procedure within 12 hours of the onset of symptoms.

The presence of uncomplicated STEMI (classified as Killip class I) was more prevalent and significant in males than in females, corresponding to 93 (86.1%) vs 12 (63.2%) cases with P = 0.01, and thrombolysis with a tendency towards the same direction: 17 (20%) vs 4 (8.3%) and P = 0.07. In addition, primary angioplasty, typical chest pain and history of infarction were numerically more prevalent in males than females, but without statistical significance: 51 (60%) vs 27 (56.3%), 74 (87%) vs 39 (81.3%) and 10 (15.2%) vs 5 (12.2%), respectively, with values of P = 0.67, P = 0.36 and P = 0.66, following the same order.

In relation to prehospital delays times (SDT, TECG and TTRC) and DCT, the mean/median time (in minutes), comparing the male and female sex, were 154/90 min vs 189/30 min, 168/30 vs. 174/15 min, 108/60 vs 91/32 min and 116/61 vs 94/45 min, without statistical significance for all cited, Table 2.

Regarding the time goals recommended in this study, we observed that SDT ≤ 120 min was achieved in 62.7% vs 84.2% (P = 0.01) and the TECG ≤ 10 min in 26.7% vs 47.2% (P = 0.03), both with significance statistic. On the other hand, the TTRC ≤ 120 min in 71.6%

vs 73.7% (P = 0.82) and the DCT ≤ 120 min in 76.7% vs 82.6% (P = 0.57) for the male and female, respectively, did not reach the level of statistical significance, Table 3.

Variable	Male N = 75	Female N = 38	Total N = 113	P value
SDT				
Mean ± SD	154 ± 192	189 ± 510	165 ± 332	0.60
Median (IIQ)	90 (30 – 240)	30 (17 – 120)	60 (30 – 180)	-
TECG				
Mean ± SD	168 ± 282	174 ± 348	170 ± 303	0.93
Median (IIQ)	30 (10 – 120)	15 (10 – 120)	30 (10 – 120)	-
TTRC				
Mean ± SD	108 ± 119	91 ± 115	102 ± 117	0.46
Median (IIQ)	60 (28 – 180)	32 (23 – 150)	50 (26 – 150)	-
DCT				
Mean ± SD	116 ± 166	94 ± 155	109 ± 162	0.60
Median (IIQ)	61 (20 – 120)	45 (24 – 90)	60 (23 – 120)	-

Table 2: *Prehospital time delays comparing the male and female sex (n = 113).*

SD – Standard deviation; IIQ – Interquartile range; SDT – Symptom-to-Door Time; TECG – Time to First ECG; TTRC – Transfer Time to Referring Center; DCT – Door-to-Cath lab time.

Variable	Male N = 75	Female N = 38	Total N =113	P value
SDT ≤ 120 min	47 (62.7)	32 (84.2)	79 (70)	0.01
TECG ≤ 10 min	20 (26.7)	17 (47.2)	37 (33.3)	0.03
TTRC ≤ 120 min	48 (71.6)	28 (73.7)	76 (72.4)	0.82
DCT ≤ 120 min	33 (76.7)	19 (82.6)	52 (78.8)	0.57

Table 3: *Comparison of the proportion of patients who reached the goals of pre-established times in relation to gender (n = 113).*

SDT – Symptom-to-Door Time; TECG – Time to First ECG; TTRC – Transfer Time to Referring Center; DCT – Door-to-Cath lab time.

In Table 4 we show the binary logistic regression analysis for the dependent variable TECG, noting that the gender variable was the only independent predictor: Wald 3.89 95% CI (0.11 - 0.99) with P = 0.04.

Variable	Wald	IC (95%)	P value
Age*	.010	0.96 – 1.05	0.91
Gender	3.89	0.11 – 0.99	0.04
BMI	1.43	0.85 – 1.04	0.23
Diabetes	0.07	0.29 – 2.56	0.79
Previous AMI	0.64	0.05 – 3.50	0.42
Arterial Hypertension	0.18	0.25 – 2.39	0.67
Killip class I	2.49	0.72 – 21.1	0.11

Table 4: *Binary logistic regression with a single categorical predictor: TECG.*

BMI – Body mass index; AMI – Acute myocardial infarction; (*) Age in years

Discussion

The use of prospective cohorts or clinical records can be an interesting and valid source of data because randomized clinical trials are strictly controlled studies, which due to the controlled environment, can distance itself from the real world [14].

As most STEMI patients present themselves in the prehospital environment, the treatment of this disease is exponentially time-dependent. A STEMI network that included active community participation in the recognition of symptoms, and a guided care of the prehospital teams will determine the success of this service chain and facilitate timely STEMI therapy [15,16].

In our study, when comparing the presentation of STEMI in relation to gender, we found that women had a significantly higher prevalence of diabetes and a lower level of schooling, in addition to a smaller proportion of STEMI Killip class I, suggesting a greater severity in the clinical presentation for this group. Benamer., *et al*. described a large French registry involving 16,760 patients with STEMI, with the objective of raising independent predictors of in-hospital mortality, noting that the female gender was older (69.7 ± 14.3 vs 59.3 ± 13 years), higher prevalence of diabetes (19% vs 15%) and cardiogenic shock (6.7% vs 4%) than the male sex [17], data confirmed by other publications [11,17-19], and questioned by some smallers [20,21]. Another author found in an Italian registry that being female and presenting low socioeconomic level were predictors of a lower chance of performing myocardial revascularization after STEMI [22]. This controversy leads some authors to question whether the gender factor actually influences the prognosis of STEMI physiopathologically or whether it is due to confounding factors [23].

We found in our study a higher proportion of female subjects that achieved SDT goals (84.2% vs 62.7% with P = 0.01) and TECG (47.2% vs 26.7% with P = 0.03), compared to the male, with statistical significance, contrary to some data in the literature that associated higher mortality among females in the course of STEMI due to the longer time for the evaluation of the symptoms by the health team and the diagnosis.19,24 On the other hand, we also showed a higher proportion of women that reached the TTRC goals (71.6% vs 73.7% with P = 0.82) and DCT (76.7% vs 82.6% with P = 0.57), however, without statistical significance.

Studies indicate a greater delay during the pre-hospital phase, particularly in the female, elderly, and those with low socioeconomic level [2,22], and others indicate that logistical challenges are generally encountered during TTRC measurement [9,25]. Despite all these mentioned factors, in our study, most of the identified delays times occurred according to recommendations used in clinical registries, and some national and international guidelines, mainly for SDT, TTRC and DCT [2,7,12,13].

Conclusion

In conclusion, in our single-center cohort study with STEMI patients, we found that women had a significantly higher prevalence of diabetes and a low level of schooling, as well as a higher proportion of complicated AMI (Killip class ≥ II), and a higher probability of achieving times goals for SDT and TECG.

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