Is There a Sex Difference of Cardiovascular Risk Factors in Patients with Acute Myocardial Infarction?

LARISA ANGHEL1,2, CRISTINA PRISACARIU1,2*, CATALINA ARSENESCU GEORGESCUI,2
1Cardiovascular Diseases Institute Prof. Dr. George I. M. Georgescu, 50 Carol I Blvd, 700508, Iasi, Romania
2University of Medicine and Pharmacy, Grigore T. Popa, 16 Universitatii Str, 700115, Iasi, Romania

Conventional cardiovascular risk factors, such as hypertension, diabetes, smoking, and dyslipidemia, increase the risk of developing acute myocardial infarction. Primary prevention studies have shown that early detection and aggressive treatment of risk factors prevent cardiovascular events. In women, coronary artery disease appears up to 10 years later in life than in men. We analyzed the presence of conventional risk factors in patients with acute myocardial infarction and compared findings according to sex. We observed that more than 90% of patients included in the study had at least one of these risk factors, hypertension and diabetes predominated in women and smoking was more frequent in men. Because many of these risk factors are modifiable and amenable to treatment, an early detection and aggressive treatment can prevent cardiovascular events.

Keywords: risk factors, acute coronary syndrome, atherosclerosis, clinical study.

Cardiovascular disease is currently the most common cause of morbidity and mortality worldwide, with the highest rate in Eastern Europe (58%) compared to developed countries, where cardiovascular disease mortality decreased to 38% [1].

Relevant differences have been reported in the genesis, development, and pathophysiology of coronary atherosclerosis between women and men, which have not been fully unraveled [1,2]. In women, coronary artery disease (CAD) appears up to 10 years later in life than in men and prevalent angiographic obstructions are less severe at all ages [3,4]. It is speculated that this age difference is due protection against atherosclerotic plaque development by circulating estrogens, of whose concentration drops dramatically to menopause. Despite this explanation, hormone replacement therapy after menopause did not have the expected protective effect [3].

Numerous evidences suggest that cardiovascular disease worldwide is less detected in women. Compared to men, women require health care later on after the onset of symptoms, later coronary reperfusion therapy is applied, rarely take aspirin or beta blockers in the first 24 hours from the presentation and have a higher risk of bleeding complications associated with antithrombotic therapy. Although coronary artery disease is the most common cause of death worldwide, regardless of the gender of the patient, statistically can be observed that the percentage of men who die from coronary heart disease is higher than that of women, whereas in case of cerebrovascular disease, the ratio is reversed [4,5].

Among patients with coronary artery disease, 80%-90% present at least one conventional risk factor, such as hypertension, diabetes, smoking, and dyslipidemia, which increase the risk of developing coronary artery disease [6]. On the other hand, lipid profile modification after a cardiovascular event related to acute coronary syndrome (ACS) has been recognized. Primary prevention studies have shown that the early detection and aggressive treatment of risk factors prevent cardiovascular events [7].

Several hypotheses have been formulated in order to explain the higher in-hospital mortality in women with acute myocardial infarction with ST-segment elevation (STEMI) compared to men: the presence of more comorbidities, the higher ischemic time or the suboptimal use of reperfusion strategies [8]. It has not yet been established whether female sex through biological and sociocultural differences, is itself a risk factor for in-hospital mortality of patients with STEMI.

Experimental part
The aim of our study was to identify the risk factors for the in-hospital mortality of patients with STEMI and to compare these findings according to sex. We also recorded the prevalence of conventional risk factors such as smoking, hypertension, dyslipidemia, and diabetes and we compared the findings according to the sex of the patients. The presence or absence of a history of conventional risk factors (hypertension, diabetes, dyslipidemia, and pre– and/or current smoking) was recorded at the time of admission to the coronary care unit and was based on patient/family self-report or previous medical records. The serum levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG) were determined within the first 24 h of admission. We defined high serum levels as TC ≥ 200 mg/dL, LDL-C ≥130 mg/dL, and TG ≥ 150 mg/dL; a low serum level of HDL-C was defined as ≤ 40 mg/dL. The body mass index (BMI) was also recorded. Patients were classified as normal (BMI ≤ 24.9 kg/m²), overweight (BMI 25–29.9 kg/m²), or obese (BMI ≥ 30 kg/m²).

Coronary angiography was performed in the laboratory of hemodynamics in our institution and interpreted by interventionist cardiologists. We determined the stenosis percentage of the main epicardial coronary arteries, and the extent of CAD was categorized as one-vessel, two-vessel, or three-vessel disease, according to the number of affected vessels.

Patients were stratified by sex for analysis. Categorical variables were reported by frequency and percentage;
groups were compared using the chi-square or Fisher’s exact test. Continuous variables were reported as medians and percentiles according to their distribution and analyzed with a one-sample Kolmogorov-Smirnov test; comparisons were made with the Mann-Whitney U-test. The results were reported using two-tailed significance. Significance was set at \( P \leq 0.05 \). All analyses were performed with SPSS version 17.0 (SPSS, Inc., Chicago, IL, USA) statistical software.

Results and discussions

During the study period, from September 2011 to September 2012, at the Cardiology Clinic of the Institute of Cardiovascular Diseases Prof. Dr. George I. Georgescu Iasi were hospitalized 652 patients diagnosed with acute myocardial infarction who met the inclusion criteria and which were divided into two groups, according to the biological sex: 207 (31.7%) women and 445 (68.3%) men.

Patients enrolled in the study were aged between 29 and 90 years, with a mean age of 62.65 ± 11.8 years. The mean age of the female population was 68.20 ± 10.8 years (limits: 40-90 years) with a coefficient of variation of 14.9%. The men had a mean age of 60.67 ± 11.6 years (limits: 29-89 years).

Arterial hypertension

More than half of the patients included in the study were hypertensive (52.3%).

Hypertension (summing up both treated and untreated hypertension) was found in 68.6% of women and only in 44.6% of men, the difference being statistically significant: \( p < 0.01 \). There were no significant differences between personal history of pharmacologically untreated hypertension: 17.9% women, 15.1% men, \( p = 0.989 \). But a statistically significantly percentage of women were receiving antihypertensive treatment (50.7%) compared to only 29.5% of men, with a \( p \) value < 0.01. We then compared, within each batch, the proportion of patients receiving pharmacologic treatment with those who were hypertensive but not treated: women with antihypertensive treatment were significantly (\( p < 0.01 \)) more than those without medication. In the male group, there was a difference only at the limit of statistically significance (\( p = 0.045 \)) in favor of those with treatment (fig. 1).

Diabetes mellitus

Almost a quarter of the patients had diabetes mellitus (24%).

It was present in a number of 77 women, representing 37.2% of them, and only in 18% of the male population, with a statistically significant difference, \( p < 0.01 \). Most of the diabetic patients had type 2 diabetes mellitus with significant differences between the two groups: 36.7% of women were registered with this type of diabetes compared with only 17.3% of men: \( p < 0.01 \).

Dyslipidemia

Only 16.3% of patients were diagnosed with abnormal lipid profile.

The percentage was higher for men, 17.1% compared to 14.3% for women, but without a statistically significant difference: \( p = 0.97 \). In the male group, 6.1% of patients were under normolipemiant treatment, and 11% knew of their affection, but they had no treatment. In the female group, there were 6.8% of patients with normolipemiant treatment and 7.7% of women were diagnosed with lipid disorders but they had no treatment (fig. 2).

Most patients included in the study were overweight, with a BMI \( \geq 25 \) kg/m\(^2\), and men had a higher frequency than women (77.6% versus 77.2%, respectively, \( p = 0.84 \)). Obesity, irrespective of its grade, was found in 35.45% of patients included in the study, in 36.72% of women and 24.01% of men, without a statistically significant difference between the two groups, \( p = 0.164 \).

Smoking status

Smoking was the most frequently observed risk factor in both groups. More than half (54.1%) of the patients included in the study were or had been smokers. The number of male smokers and former smokers (301, representing 67.8%) was about three times the number of women with this status (51, representing 24.7%), with a significant difference: \( p < 0.01 \).

---

**Table 1**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Patients</th>
<th>All patients</th>
<th>Women</th>
<th>Men</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent %</td>
<td>Frequency</td>
<td>Percent %</td>
<td>Frequency</td>
</tr>
<tr>
<td>Typical chest pain</td>
<td>309</td>
<td>77.9%</td>
<td>134</td>
<td>65.2</td>
<td>175</td>
</tr>
<tr>
<td>Atypical chest pain</td>
<td>143</td>
<td>22.1%</td>
<td>70</td>
<td>33.8</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>852</td>
<td>100%</td>
<td>207</td>
<td>100%</td>
<td>645</td>
</tr>
</tbody>
</table>

---

Fig. 1. Hypertensive status in patients included in the study

Fig. 2. Presence of dyslipidemia in patients included in the study
Family history of early coronary artery disease
Approximately one fifth (18.5%) of patients had a family history of early coronary artery disease. More men (19.8%) had a family history of early coronary artery disease, and the difference with women with this risk factor (15.8%) was statistically significant (p <0.05).

Chest pain characteristics
We also studied the symptoms at presentation and we discovered that the chest pain was the most frequent symptom at presentation. Analyzing the onset of the symptoms, we observed a maximum onset of the symptoms in the morning, between 6 and 12 o'clock, then between 12 and 24 o'clock, and the lowest frequency was registered between 24 and 06 o'clock. This order was the same in both groups, according to the sex of the patients.

More than half of the patients (three quarters) had typical chest pain at onset of the acute event. Difference from those who have described atypical or equivalent symptoms of chest pain, was statistically significant: p <0.001 (table 1).

Biological profile
The mean values of glycemia, platelets, fibrinogen and LDL cholesterol were significantly higher in women compared to men. In the same time, men had significantly higher values for cTnI, CKMB, triglycerides and CRP. There were no differences between the two subgroups on the mean values of total cholesterol and HDL-cholesterol. The lipid profile analysis demonstrated the presence of some type of dyslipidemia, with low HDL-C levels having the highest levels of LDL-C (21.3%), and high levels of total cholesterol (49.3%), high triglyceride levels (49.3%), high levels of LDL-C (21.3%), and high levels of total cholesterol (24.1%) (table 2).

In our study, we found that the prevalence of conventional risk factors in patients with acute myocardial infarction was very high, more than 90% of patients presented at least one of the four risk factors (smoking, hypertension, diabetes, and dyslipidemia). The lipid profile analysis demonstrated the presence of some type of dyslipidemia, with low HDL-C levels having the highest prevalence also in men and women.

There is little information on the prevalence of conventional risk factors in patients with acute coronary syndrome and significant coronary artery disease. One of the most relevant advances in the knowledge of coronary artery disease is the role played by the different risk factors in its development, in which smoking, arterial hypertension, diabe-tes, and dyslipidemia participate as independent factors [9,10].

Table 2
| Biological Profile at Hospital Admission. N - Number of Patients; X - Average Value; V% - Coefficient of Variability; S - Clinical Significant; NS - Clinical Insignificant |
|-----------------|--------|--------|-----|--------|--------|--------|------|--------|
| Patients        | Women  | N      | X    | V%    | Men    | N      | X    | V%    | P-value |
| Glicemia        | 205    | 192.8  | 47.3 |       | 436    | 158.7  | 44.2 |       | p<0.001; S |
| Platelets       | 204    | 279430 | 27.2 |       | 438    | 252985 | 31.4 |       | p<0.001; S |
| Fibrinogen      | 201    | 597.2  | 31.1 |       | 428    | 465.8  | 37.4 |       | p<0.001; S |
| Leukocytes      | 207    | 12747.9| 36.9 |       | 444    | 12257.6| 32.2 |       | p<0.001; S |
| cTnI            | 31     | 0.89   | 144.6|       | 55     | 1.88   | 140.6|       | p<0.05; S |
| CK MB           | 205    | 100.56 | 93.5 |       | 442    | 108.8  | 101.9|       | p<0.01; S |
| LDL-C           | 181    | 113.55 | 32.4 |       | 423    | 110.3  | 31.9 |       | p<0.05; S |
| Triglycerides   | 184    | 138.1  | 34.8 |       | 430    | 144.1  | 71.2 |       | p<0.03; S |
| Total cholesterol| 184    | 190.5  | 22.7 |       | 431    | 187.9  | 23.9 |       | p<0.05; NS |
| HDL-C           | 182    | 49.48  | 27.8 |       | 428    | 50.3   | 26.7 |       | p>0.05; NS |
significant alterations in lipids occur after an ACS. From the time of admission until the next morning, in patients with myocardial infarction, the TC and LDL-C levels can undergo a change of 7% and 10% [15]. Therefore, current guidelines recommend measurement of serum lipids after admission for patients with an acute coronary event. This is of importance because in-hospital lipid testing was strongly associated with the initiation of statin therapy at discharge in patients with an ACS cardio-vascular event [16–17].

Conclusions
The prevalence of conventional risk factors, such as smoking, hypertension, diabetes and dyslipidemia was very high in patients with acute myocardial infarction, more than 90% of patients included in the study had at least one of these risk factors. Hypertension and diabetes predominated in women and therefore caused higher comorbidity, which could have prognostic implications. Smoking was more frequent in men. Many of these risk factors are modifiable and amenable to treatment, an early detection and aggressive treatment can prevent cardiovascular events.

References