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RESEARCH ARTICLE

THE INFLUENCE OF RISK FACTORS ON THE SEVERITY OF MYOCARDIAL INFARCTION COMPARATIVE ANALYSIS IN MEN AND WOMEN

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Abstract: The aim of the study was to evaluate the influence of the main cardiovascular risk factors on the severity of myocardial infarction and to compare their role in men and women. The urgency of the problem is due to persistent differences by gender in the structure of morbidity, clinical course and outcomes of myocardial infarction, which is confirmed by modern clinical and epidemiological data. A single-center prospective observational study was conducted that included 100 patients with acute myocardial infarction admitted to the cardiology department of a multidisciplinary hospital. The sample included 58 men and 42 women aged 38 to 84 years. Traditional risk factors (hypertension, tobacco smoking, type 2 diabetes mellitus, obesity, hypercholesterolemia), the time from the onset of pain to reperfusion intervention, as well as indicators of the severity of myocardial infarction were assessed: left ventricular ejection fraction according to echocardiography, Killip heart failure class, highly sensitive troponin I level, hospital complications. The data obtained indicate that the cumulative effect of modifiable risk factors significantly determines the severity of myocardial infarction and should be taken into account when planning prevention. The results emphasize the need for a gender-specific approach to assessing cardiovascular risk and stricter control of hypertension, diabetes mellitus, and body weight in women, as well as quitting smoking and seeking early medical attention in men.

Keywords: Myocardial infarction, risk factors, gender differences, arterial hypertension, diabetes mellitus, obesity, smoking, severity of the course.

INTRODUCTION

Myocardial infarction remains one of the leading causes of death and disability worldwide, despite significant progress in the field of reperfusion therapy, pharmacological treatment and secondary prevention.

In recent decades, differences between men and women in the level of cardiovascular risk, frequency and age of myocardial infarction, clinical picture, treatment tactics and long-term outcomes have been actively studied.

A number of studies demonstrate that men are more likely to suffer a myocardial infarction at a younger age, while women often become ill later, against the background of an already formed "cluster" of risk factors, including hypertension, diabetes mellitus, obesity and chronic heart failure [10].

It is also noted that women are more likely to seek medical help later, have atypical symptoms, and are less likely to receive full invasive treatment, which can contribute to a more severe course of a heart attack and worse outcomes.

The traditional risk factors associated with the development of myocardial infarction include hypertension, smoking, dyslipidemia, diabetes mellitus, obesity, sedentary lifestyle and hereditary burden. At the same time, it has been established that the relative contribution of the same risk factors to the formation of myocardial infarction may differ in men and women. In particular, women have a more pronounced increase in the relative risk of myocardial infarction in the presence of diabetes mellitus and tobacco smoking compared with men [9].

Despite the accumulation of data on epidemiological and clinical differences, the question of how the combined load of classical risk factors affects the severity of myocardial infarction in men and women in real clinical practice remains controversial. Most studies focus on mortality rates or the frequency of recurrent cardiovascular events, while comparatively less attention is paid to the immediate severity of an acute episode in patients of different genders.

In this regard, it is of particular interest to analyze the degree of association of the main modifiable risk factors with the clinical severity of myocardial infarction separately in men and women in the same sample of patients. This approach makes it possible to specify the role of individual factors in the formation of a severe course of a heart attack and to justify the need for differentiated preventive and therapeutic strategies [2].

The aim of the study was to assess the influence of the main cardiovascular risk factors on the severity of myocardial infarction and to compare these patterns in men and women in the group of inpatient patients.

MATERIAL AND METHODS

The study was performed in the format of a single-center prospective observational analysis conducted on the basis of the cardiology department of a multidisciplinary hospital.

The study consistently included 100 patients diagnosed with acute myocardial infarction with or without ST segment elevation who were hospitalized within the first 24 hours of the onset of symptoms. The diagnosis was based on a combination of the clinical picture, signs of ischemia or necrosis on the electrocardiogram, and dynamics of the level of highly sensitive troponin I.

The inclusion criteria were age over 18 years, confirmed acute myocardial infarction of the first or repeated event, and written informed consent to participate in the study. Exclusion criteria included severe concomitant end-stage diseases, acute infectious processes, severe cognitive impairments that prevent the collection of medical history, as well as the patient's refusal to participate.

The final sample included 58 men and 42 women. All patients underwent a standard clinical and instrumental examination, which included anamnesis collection and objective examination, electrocardiogram registration, echocardiography, laboratory tests to determine the lipid profile, glycemia, glycated hemoglobin levels, and the level of highly sensitive troponin I in dynamics

The main risk factors assessed were the presence of previously diagnosed hypertension, tobacco smoking (active smoking or cessation less than 12 months before hospitalization), type 2 diabetes mellitus, obesity (body mass index ≥30 kg/m2), hypercholesterolemia (total cholesterol ≥5.0 mmol/l or taking lipid-lowering therapy), as well as a family history of early cardiovascular events. Additionally, the indicators of age, body mass index, systolic and diastolic blood pressure at admission, the nature of the infarction (anterior, lower, multi-focal), the presence and type of revascularization, and the time from the onset of pain to primary coronary intervention or thrombolytic therapy were recorded.

The severity of myocardial infarction was assessed comprehensively according to the following parameters: Killip heart failure class upon admission and in dynamics, left ventricular ejection fraction according to echocardiography in the acute period, the maximum recorded level of highly sensitive troponin I, the presence of severe hospital complications (cardiogenic shock, life-threatening arrhythmias, recurrent heart attack, stroke), as well as the total risk of the GRACE scale.

Based on these indicators, patients were divided into three severity subgroups: mild (Killip I, ejection fraction ≥50%, no severe complications, low or moderate risk on the GRACE scale), moderately severe (Killip II, ejection fraction 40-49%, absence of cardiogenic shock and stroke, intermediate risk on the GRACE scale) and severe course (Killip III–IV and/or ejection fraction <40%, presence of cardiogenic shock, stroke or recurrent heart attack, high risk on the GRACE scale).

The comparison of the average values between men and women was carried out using the Student's t-test; for categorical variables, Pearson's $\chi 2$-criterion was used.
To assess the relationship between the number of risk factors and the severity of myocardial infarction, logistic regression was used to calculate the odds ratio and a 95% confidence interval. The differences at $p<0.05$ were considered statistically significant.

RESULTS AND OBSERVATIONS:

The average age of the examined persons was 64.3±11.2 years. Men were on average younger than women (62.7±11.3 and 66.3±10.8 years, respectively, $p<0.05$).

The proportion of patients with anterior myocardial infarction was 53%, with lower myocardial infarction — 39%, with multi—focal or unspecified - 8%, while there were no significant differences in the location of the infarction between men and women.

Table 1 shows the main clinical and anamnestic characteristics of men and women with myocardial infarction.

Table 1 – Clinical characteristics of men and women with myocardial infarction (n=100)

Indicator	Men (n=58)	Women (n=42)	p
Age, years	62,7±11,3	66,3±10,8	<0,05
Arterial hypertension, n (%)	39 (67,2 %)	35 (83,3 %)	<0,05
Smoking, n (%)	37 (63,8 %)	13 (31,0 %)	<0,01
Type 2 diabetes mellitus, n (%)	14 (24,1 %)	16 (38,1 %)	<0,05
Obesity (BMI ≥30 kg/m2), n (%)	18 (31,0 %)	19 (45,2 %)	0,09
Hypercholesterolemia, n (%)	34 (58,6 %)	27 (64,3 %)	>0,05
BMI, kg/m2	28,9±4,2	30,4±4,7	0,07
Time from the onset of pain to reperfusion, h	4,1±2,3	5,7±2,8	<0,01
Family history of early CC events, n (%)	17 (29,3 %)	15 (35,7 %)	>0,05

The data obtained confirm the higher age of women and the greater prevalence of hypertension and diabetes mellitus in them, while men are characterized by a significantly higher frequency of tobacco smoking and a shorter delay before reperfusion intervention. These observations are consistent with the results of large foreign cohort studies demonstrating a more unfavorable risk factor profile in women with myocardial infarction, especially in relation to diabetes and hypertension, with a slightly lower prevalence of smoking.

When assessing the severity of myocardial infarction, significant differences in gender were revealed. The proportion of patients with mild course (Killip I, preserved systolic function of the left ventricle, low or moderate risk on the GRACE scale) was 46.6% among men (27 people), 26.2% among women (11 people). A moderately severe course was recorded in 36.2% of men (21 people) and 35.7% of women (15 people). Severe myocardial infarction, including cases with Killip III–IV, ejection fraction less than 40%, cardiogenic shock, stroke or recurrent heart attack, was observed in 17.2% of men (10 people) and 38.1% of women (16 people), $p<0.01$.

The average left ventricular ejection fraction in the acute period in men was 47.1±9.3%, in women — 42.0±8.6%, $p<0.01$. The average GRACE score was also significantly higher in women (149±27 versus 137±24 in men, $p<0.05$). Thus, even with a comparable structure of heart attack localization, women have more pronounced manifestations of acute heart failure and a higher integral risk of an unfavorable outcome.

Table 2 shows the severity of myocardial infarction in men and women.

Table 2 – Indicators of the severity of myocardial infarction in men and women

Indicator	Men (n=58)	Women (n=42)	p
Mild course, n (%)	27 (46,6 %)	11 (26,2 %)	<0,05
Moderately severe course, n (%)	21 (36,2 %)	15 (35,7 %)	>0,05
Severe course, n (%)	10 (17,2 %)	16 (38,1 %)	<0,01
LV ejection fraction, %	47,1±9,3	42,0±8,6	<0,01
High risk on the GRACE scale, n (%)	21 (36,2 %)	23 (54,8 %)	<0,05
Cardiogenic shock, n (%)	3 (5,2 %)	5 (11,9 %)	0,19
Life-threatening arrhythmias, n (%)	7 (12,1 %)	8 (19,0 %)	0,32

These tables demonstrate a higher proportion of severe forms of myocardial infarction in women. Although differences in the frequency of individual complications, such as cardiogenic shock and life-threatening arrhythmias, have not reached statistical significance, the cumulative severity index, including a decrease in ejection fraction, Killip class, and GRACE risk, indicates a more unfavorable course of heart attack in patients.

To assess the effect of the number of risk factors on the severity of myocardial infarction, patients were divided into two groups: with the number of risk factors from zero to two and three or more risk factors. In the group with zero or two risk factors, severe heart attack was observed in 12.5% of men and 18.8% of women. In the group with three or more risk factors, the proportion of severe course was 31.8% for men and 52.6% for women.

The analysis showed that the presence of three or more risk factors is associated with a significant increase in the chances of severe myocardial infarction in both men and women, but the relative increase in risk in women was more pronounced. In the age—adjusted logistic regression model, the number of risk factors >3 increased the likelihood of severe heart attack in men by about 3 times, while in women it increased by almost 4 times.

The role of diabetes mellitus and arterial hypertension deserves special attention. In the subgroup of patients with severe heart attack, the proportion of people with diabetes among women was 62.5%, among men — 40.0%, and arterial hypertension was registered in 93.8 and 80.0%, respectively. These observations are consistent with the data that diabetes mellitus and hypertension carry a higher relative risk of myocardial

infarction in women compared to men, and indicate the high importance of controlling these risk factors in patients.

An important indicator that indirectly affects the severity of a heart attack is the time from the onset of symptoms to reperfusion therapy [6]. In the present study, women had a significantly longer delay compared to men, which may partially explain the more severe course of the heart attack. This fact correlates with the literature data that women often seek medical help later, have more atypical symptoms, and are less likely to interpret them as a manifestation of acute coronary syndrome.

The combination of older age, high prevalence of hypertension, diabetes mellitus and obesity in women with myocardial infarction leads to the formation of a more severe clinical profile in the acute period. Given that diabetes mellitus and hypertension are described as factors that have a more pronounced negative impact on the risk and outcomes of cardiovascular events in women, the differences found seem pathogenetically justified.

In men, despite the younger age indicators, tobacco smoking plays a leading role, determining a high atherothrombotic risk and an earlier manifestation of coronary heart disease. At the same time, a shorter delay before reperfusion intervention may contribute to a relatively lower severity of myocardial necrosis and better indicators of systolic function of the left ventricle.

It should be noted that differences in the frequency of severe complications, such as cardiogenic shock and life-threatening arrhythmias, have not reached statistical significance due to the limited sample size, however, the trend towards a higher frequency of such outcomes in women can be traced and is consistent with the data from large registries.

The results obtained confirm the need for a targeted, gender-differentiated approach to preventing myocardial infarction and reducing the severity of its course. Since women have a more pronounced accumulation of hypertension, diabetes, and obesity, the focus in the female population should be on early detection and active treatment of these disorders. It is not only about choosing the optimal drug therapy, but also about forming a stable committed behavior: regular monitoring of blood pressure and glycemia, compliance with dietary recommendations, increasing physical activity levels, taking into account age and concomitant pathology. In women of perimenopausal and postmenopausal age, a particularly low threshold is required for the appointment of antihypertensive and lipid-lowering therapy, since the combination of hormonal changes and classical risk factors forms an unfavorable cardiovascular profile and contributes to a more severe course of heart attack.

Smoking remains the leading target of prevention for men. Reducing the proportion of men who smoke, especially under the age of 60, potentially reduces both the frequency and severity of myocardial infarction. In the context of real clinical practice, it is advisable to systematically include smoking cessation programs based on a combination of behavioral counseling and pharmacological support in the work of cardiological hospitals and polyclinics. Early detection of the initial manifestations of coronary heart disease in men — stable angina pectoris, pain-free ischemia, and subclinical atherosclerosis according to instrumental methods is essential. This allows timely optimization of therapy, lifestyle adjustments, and prevention of the development of large-focal infarction with severe consequences [4].

A common direction for both sexes is the comprehensive correction of body weight and metabolic disorders. Optimization of nutrition with restriction of saturated fats, easily digestible carbohydrates and excess calories in combination with dosed aerobic exercise helps to reduce body mass index, normalize lipid profile and improve carbohydrate metabolism. It is important that the recommendations on physical activity are individualized: for patients of older age groups and patients with concomitant pathology, a gradual increase in exercise is required, coordinated with the attending physician. At the same time, patients should develop an understanding of the relationship between the accumulation of risk factors and the severity of a possible myocardial infarction, which increases motivation to change behavior [1].

A special place is occupied by measures to reduce the time from the onset of symptoms to the start of reperfusion therapy, since the women in the study were characterized by a later request for medical help and, as a result, a more severe heart attack. It is necessary to strengthen awareness-raising efforts, emphasizing that an atypical clinical picture is possible for women: shortness of breath, pronounced weakness, discomfort in the back or neck, and not just classic chest pain. The aim of recognizing such symptoms should be both for the patients themselves, as well as for primary care physicians and emergency medical teams. Expanding the use of standard "infarction corridor" routes with direct transportation to the center performing primary coronary intervention reduces the ischemic interval and reduces the risk of severe complications [8].

Secondary prevention after a myocardial infarction should be based on gender differences in the risk profile

. For men, smoking cessation, adequate physical activity and control of lipid metabolism become key accents, whereas for women, in addition to standard

antiplatelet and lipid-lowering therapy, strict control of blood pressure and glycemia, correction of obesity, and discussion of the role of hormonal factors are more important. Rehabilitation programs should take into account psychosocial characteristics: women are more likely to have anxiety-depressive reactions to a past event, which may reduce adherence to therapy and limit participation in physical rehabilitation. The involvement of a psychologist and training in self-control skills can increase the effectiveness of secondary prevention [5].

From the point of view of the healthcare organization, it is rational to implement routing, which implies a mandatory assessment of the number of risk factors for each patient with suspected coronary heart disease. In the outpatient chart, it is advisable to record not only the presence of specific risk factors, but also their total number, which makes it possible to quickly identify groups with a high risk of severe possible myocardial infarction. Such patients require more intensive monitoring, lower target levels of blood pressure, lipids, and glycemia, as well as priority referral for in-depth examination [7].

Finally, the interdisciplinary nature of preventive measures is important. Effective reduction of total cardiovascular risk is possible only with the participation of cardiologists, internists, endocrinologists, general practitioners, specialists in medical rehabilitation and psychotherapists. At the same time, all team members should take into account the gender characteristics of patients and understand that the same number of risk factors for men and women may have different effects on the severity of future myocardial infarction [3].

Below is a summary table of recommendations reflecting the key areas of prevention, taking into account gender and the profile of risk factors.

The presented recommendations and their systematization in the table can be used in the development of a section of practical proposals in a scientific article, as well as in the formation of local clinical protocols and educational programs for patients and doctors.

The practical significance of the results lies in the fact that the primary and secondary prevention of cardiovascular diseases requires an emphasis on aggressive control of hypertension, diabetes mellitus and body weight in women, especially in the perimenopausal and postmenopausal periods. For men, tobacco control and early diagnosis of coronary heart disease are of particular importance. An equally important task remains to reduce the time from the onset of symptoms to reperfusion intervention in women, which requires both increasing the alertness of the patients themselves and improving routing in the healthcare system.

CONCLUSION

Myocardial infarction in women in the study sample was characterized by a more severe course compared to men, which was manifested by a higher proportion of patients with Killip III–IV, a more pronounced decrease in the left ventricular ejection fraction and a higher overall risk on the GRACE scale.

Women with myocardial infarction were significantly older than men and were more likely to have hypertension, type 2 diabetes mellitus and obesity, while men were characterized by a significantly higher prevalence of smoking and a shorter time from the onset of symptoms to reperfusion.

The presence of three or more modifiable risk factors in both sexes was associated with a multiple increase in the likelihood of severe myocardial infarction, and the relative increase in risk was more pronounced in women than in men.

The totality of the data obtained indicates the need for gender-specific stratification of cardiovascular risk and an individualized approach to primary and secondary prevention of myocardial infarction, with special emphasis on strict control of hypertension, diabetes mellitus and body weight in women and smoking cessation in men, as well as reducing the time to reperfusion intervention, especially in women populations.

Table 3 – Recommendations for the prevention of severe myocardial infarction, based on gender

The direction of the intervention	The content of the recommendation	Features for men	Features for women
Control of arterial hypertension	Regular blood pressure measurement, selection of combined antihypertensive therapy, achievement of target values, self-control training	Pay attention to the initiation of therapy at borderline values, take into account the high prevalence of concomitant smoking and stress	Start treatment with a less pronounced increase in blood pressure, active screening in perimenopause and postmenopause, monitoring adherence
Management of diabetes mellitus	Optimization of hypoglycemic therapy, control of glycated hemoglobin, diet therapy and self-control training of glycemia	Special attention is paid to men with abdominal obesity and early impaired glucose tolerance	Strict glycemic control, more frequent visits to the endocrinologist, discussion of the effect of hormonal status, lower threshold for intensification of therapy
Correction of body weight and nutrition	Reducing the caloric content of the diet, limiting animal fats and salt, increasing the proportion of vegetables and whole grains, and an individual nutrition plan	Emphasis on reducing visceral fat, combining a diet with strength and aerobic exercise, and working with motivation	Correction of overweight and obesity, especially after menopause, consideration of concomitant osteoporosis and exercise restrictions
Smoking cessation	Individual and group counseling, pharmacological support, use of behavioral techniques, relapse control	The main target group, priority inclusion in smoking cessation programs, assessment of smoking experience and the degree of nicotine dependence	Targeted counseling for women who smoke, taking into account the effect of smoking on hormonal status and risk of thrombosis, dealing with myths about the "protective" role of small doses
Increased physical activity	The appointment of metered aerobic loads, a gradual increase in intensity, the inclusion of physical therapy and rehabilitation, safe exercise training	Formation of a regular training regime, taking into account professional and household loads, prevention of overexertion	Selection of gentle activity regimens, taking into account excess weight and concomitant diseases, the use of group programs aimed at women
Reducing the time to reperfusion	Informing about the symptoms of ACS, developing routes for the "infarction corridor", training staff and patients in the algorithm of actions for chest pain	Emphasis on immediate treatment in case of typical chest pain, work with barriers to calling an ambulance	Emphasizing the importance of atypical symptoms, conducting targeted information campaigns for women, increasing the alertness of primary care physicians
Secondary prevention after a heart attack	Prescribing standard drug therapy, organization of cardiac rehabilitation, regular follow-up visits, patient education	Main accents: smoking cessation, lipid control, physical activity, early return to metered work	Main focuses: blood pressure and glycemic control, body weight correction, work with anxiety and depression, more frequent monitoring by a cardiologist and an endocrinologist
Psychosocial support	Assessment of stress, anxiety and depression levels, if necessary, consultation with a psychologist or psychotherapist, family support	Dealing with occupational stress, alcohol abuse, and forming a realistic behavior model after a heart attack	Correction of anxiety-depressive disorders related to a heart attack, support in family care and return to social activity
Organization of supervision and interdisciplinary approach	Creation of high-risk surveillance routes, interaction of cardiologist, therapist, endocrinologist, rehabilitologists, maintenance of a unified register of risk factors	Providing regular follow-up, focusing on early detection of coronary heart disease and lifestyle modification	Priority inclusion of older women in medical examination programs, control of the cumulative burden of risk factors and adaptation of treatment regimens

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