Original Paper

Obesity and Myocardial Infarction-The Place of Obesity Among Cardiovascular Risk Factors-Retrospective Study

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ABSTRACT: Since the 21st century, the leading cause of death is cardiovascular disease, with myocardial infarction being the most common. The incidence and prevalence of obesity has risen sharply in recent years, and it is commonly recognised as a cardiovascular risk factor among tobacco smoking, dyslipidemia (high LDL-C, high triglycerides, low HDL-C), hypertension, diabetes, age, gender, hereditary predisposition. Materials and methods. This study is a retrospective study conducted at the Craiova Emergency Clinical Hospital between October 2020 and January 2023. Enrolled patients are 60, 36 patients with ST-segment elevation myocardial infarction and 24 patients with non-ST-segment elevation acute myocardial infarction. The data was collected from the hospital's official database and then analyzed using Microsoft Excel and the Toolbar Data Analysis. Results. The mean age of the patients in the study was 62 years with a minimum of 34 years and a maximum of 84 years. 23(38.3%) of patients were smokers, 7(11.6%) were ex-smokers and 30(50%) were non-smokers. 49(81.6%) patients were hypertensive. 44(73%) had cholesterol greater than 200mg/dl. 54(90%) had LDL>100mg/dl, 18(30%) had HDL>45mg/gl, 24(40%) patients had serum TG>150mg/dl, 17(28%) were overweight and 13(22%) were obese, 30(50%) were normal weight. 18(30%) patients had type 2 diabetes. Conclusions. Among the cardiovascular risk factors in the patients studied, hypertension was the most common, followed by dyslipidemia, obesity, smoking, diabetes mellitus, and very rarely the use of drugs and anabolic substances.

KEYWORDS: *Obesity, myocardial infarction, dyslipidemia, smoking, diabetus mellitus.*

Introduction

Obesity is a significant health problem today than at any other time in history, representing a growing threat to people worldwide.

Being overweight in adults is defined as a body mass index (BMI) of 25 to 29.9kg/m2, and obesity is a BMI>30kg/m2 [1].

There are many consequences of obesity, and coronary heart disease is perhaps the most feared.

Myocardial infarction

Globally, coronary heart disease and its complications remain the leading cause of death [1].

When cardiac troponin (cTn) levels are higher than the 99th percentile upper reference limit, it indicates myocardial injury.

However, it's important to note that myocardial injury differs from myocardial infarction (MI), as defined in the 4th Universal Definition of Myocardial Infarction.

MI should only be used when there is clinical evidence of acute myocardial ischemia and a rise in cTn levels and one or more of the following characteristics must be present: (i) symptoms of myocardial ischemia; (ii) new ischemic electrocardiogram changes; (iii) development of pathological Q waves; (iv) imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischemic cause; and (v) identification of a coronary thrombus through angiography or autopsy [2,3].

Obesity, especially abdominal obesity, is a predictor of mortality.

Obese males have an increased risk of acute myocardial infarction; interestingly, overweight women have a lower risk of developing an acute myocardial infarction than normal-weight women [4].

Obesity increases beat volume and cardiac output, resulting in a more significant cardiac workload.

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The Frank-Starling curve shifts left in obese patients due to high filling pressures and volumes, further increasing cardiac workload [5].

Adipose tissue accumulation is associated with several morphological and performance changes in the heart: increased cardiac output, left ventricular hypertrophy, right and left ventricular diastolic dysfunction, and left ventricular systolic dysfunction [6].

Compared to elderly patients with myocardial infarction, younger patients tend to have a higher body mass index (31% vs. 29%) [7,8].

The proportion of hypertensive patients is higher in obese patients than normal-weight patients [5].

Age is another cardiovascular risk factor.

Coronary heart disease generally affects the elderly, as the landmark Framingham study indicates, showing an 8-fold higher incidence of myocardial infarction in elderly patients compared to patients under 55.

The proportion of younger patients with myocardial infarction has recently increased [2].

This demonstrates the need not only to know the risk factors but also to combat these risk factors.

It is well known there is a gender distribution, and women are affected by ischemic cardiovascular disease ten years later than men.

Still, it has been observed that women have a much higher mortality risk than men [4].

Female hormones are associated with a less atherogenic lipid profile and healthier fat distribution [5,6].

Men are more physically active, and women have healthier dietary habits [5].

The majority of young myocardial infarction patients are male.

Female patients tend to have more atypical symptoms: palpitations, dyspnea, and epigastric pain [9,10].

Smoking

Young patients with myocardial infarction are more likely to be active smokers than older patients [10].

Patients who smoke >25 cigarettes daily have an eight times higher risk of acute myocardial infarction than non-smoking patients [1].

Smoking is linked to decreased HDL-cholesterol levels and increased total cholesterol levels.

Smoking also increases heart rate, inflammation, and endothelial dysfunction, stimulating thrombus formation [11].

Dyslipidemia

Serum cholesterol is normal at values <200mg/dl, but most authors recommend it to be below 175mg/dl, and in those with heart disease, if possible, <155mg/dl.

More important than determining serum cholesterol is the decision of its various subdivisions.

The most important is the determination of LDL-cholesterol.

In individuals without heart disease, average values of LDL-cholesterol are <130mg/dl, optimally less than <100mg/dl.

In those who already have heart disease, of course atherosclerotic, it is recommended that LDL-Col be <100mg/dl, optimally <70mg/dl.

Men should have HDL-cholesterol levels higher than 40mg/dl, and women taller than 45mg/dl.

Triglycerides do not directly cause atherosclerosis, but they contribute to its development.

Average values are <150mg/dL.

Cross-sectional studies have shown that younger MI patients have higher levels of triglycerides, LDL-C, and apolipoprotein B and lower HDL-C levels than older patients [7].

Other cardiovascular risk factors

Anabolics and stimulants

Substance abuse, such as cocaine and cannabis, is a rare cause of myocardial infarction, typically affecting young patients [2].

Cocaine abuse is reported in 10% of young patients with myocardial infarction.

The pathophysiological mechanisms behind cocaine abuse and myocardial infarction are coronary spasm, thrombus formation, stimulation of platelet aggregation, nonatherosclerotic intimal proliferation, and increased oxygen demand [12].

Anabolic substances, mainly anabolic androgenic steroids used by athletes and amateurs, have numerous adverse cardiovascular effects: they lower HDL-C and apolipoprotein A1 and increase LDL-C and apolipoprotein B [13].

Long-term use leads to the development of hypertension and increased C-reactive protein concentration, erythrocytosis, thrombocytosis, platelet hyperactivity, increased procoagulant factors (fibrinogen, factor VIII and X), increased homocysteine concentration, increased endothelial release of protein C and S and decreased fibrinolytic activity [13].

Homocysteine

Hyperhomocysteinemia increases proinflammatory cytokines: interleukin-1β and 6, tumor necrosis factor-α, monocyte chemoattractant protein 1, and intracellular adhesion molecule-1, increasing oxidative damage [2,14].

Numerous studies have shown that hyperhomocysteinemia is associated with an increased risk of myocardial infarction and could be used as a marker in preclinical stages [15].

Genetic factors

Genetic factors are recognized as risk factors for myocardial infarction.

Their importance increases the younger the age of the patient who has had a heart attack [2].

Many mutations have been shown to play a role in the etiopathogenesis of myocardial infarction [1].

Materials and Methods

This retrospective study was conducted at the Craiova Emergency Clinical County Hospital between October 2020 and January 2023.

There were 60 enrolled patients, out of which 36 had ST-segment elevation myocardial infarction, and 24 had non-ST-segment elevation acute myocardial infarction.

Among these patients, 51 were 45 or older, while nine were less than or equal to 45.

Cardiology professionals established the diagnosis of acute myocardial infarction, correlating clinical data, markers of myocardial necrosis, and EKG findings.

The study aimed to track cardiovascular risk factors in patients by analyzing socio-demographic data (age, sex), medical history, and a set of biological parameters.

The biological parameters followed were uric acid, alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine, urea, serum ionogram, blood glucose, HbA1C, cholesterol, HDL-C, LDL-C, total lipids, triglycerides, complete blood count, ESR, fibrinogen, CRP.

We collected the data from the hospital's official database and analyzed it using Microsoft Excel and Toolbar Data Analysis to create histograms and Anova: single factor.

We presented continuous variables as mean standard deviation.

Our study followed ethical, deontological, and legal norms.

We only included patients who signed the informed consent and voluntarily participated in the study.

Results

Obesity

In the study, of the 60 patients included, 30 were average weight, 17 were overweight, 6 were obese grade 1, 4 were obese grade 2, and 3 were obese grade 3 (Figure 1).

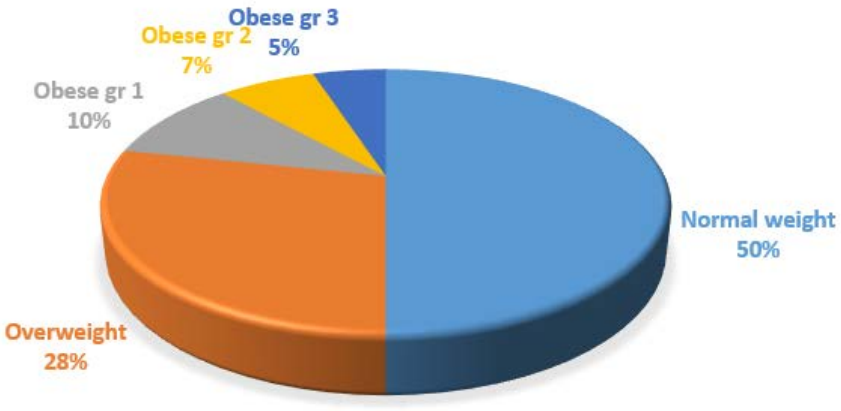

Figure 1. Obesity distribution among patients with MI.

We categorized the patients into three groups based on their weight: normal, overweight, and obese.

We aimed to investigate any potential correlation between these groups in terms of various factors such as number of hospital days, blood glucose levels, uric acid levels, transaminases, creatinine, LDL-c, HDL-c, triglycerides, and ejection fraction.

These findings are presented in Table 1.

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The only significant correlation, with a p-value of less than 0.05, was observed for LDL-C.

The higher the weight, the higher the LDL-C levels.

	GROUP 1- NORMAL WEIGHT	GROUP 2- OVERWEIGHT	GROUP 3- OBESE	ANOVA SINGLE FACTOR P-VALUE
COHORT SIZE	30	17	13	
WOMEN	9	6	7	
MEN	21	11	6	
STEMI	18	10	8	
NSTEMI	12	7	5	
AGE	64.4±12.09	62±11.96	57±11.2	
NUMBER OF DAYS OF HOSPITALIZATION (DAYS)	6.4±1.84	7.17±3.00	5.84±1.95	0.26
BLOOD GLUCOSE (MG/DL)	127±67.15	123±36.67	160.61±89.34	0.24
URIC ACID (MG/DL)	5.95±2.18	5.93±2.57	6.48±1.4	0.73
ALT (MG/DL)	55±94.19	78.05±145.02	44.69±39.77	0.65
AST (MG/DL)	110.46±158.10	116.29±116.33	144.23±151.55	0.77
CREATININE (MG/DL)	0.92±0.27	0.90±0.21	0.88±0.22	0.85
LDL-C (MG/DL)	120.43±41.25	124.47±46.67	169.53±40.41	0.003
HDL-C (MG/DL)	46.61±19.59	37.25±10.7	43.25±8.56	0.15
TG (MG/DL)	118.66±99.63	237.17±296.02	171.69±116.20	0.10
EJECTION FRACTION	42.5±10.64	45±10.3	46.53±6.88	0.42

Table 1. Correlations between obesity, overweight, and normal weight.

Age

The youngest patient with acute myocardial infarction included in the study was a 34-year-old patient with the following cardiovascular risk factors: HDL Col 1mg/dl, LDL Col 33mg/dl, Triglycerides 550mg/dl, smoking, and the particularity of the case was the occasional use of cocaine.

The oldest patient included in the study was an 84-year-old male with hypertension, dyslipidemia, and a former smoker.

The study included patients with a mean age of 62 years.

Distribution by age group reveals that patients between 60 and 70 are the most represented (Figure 2).

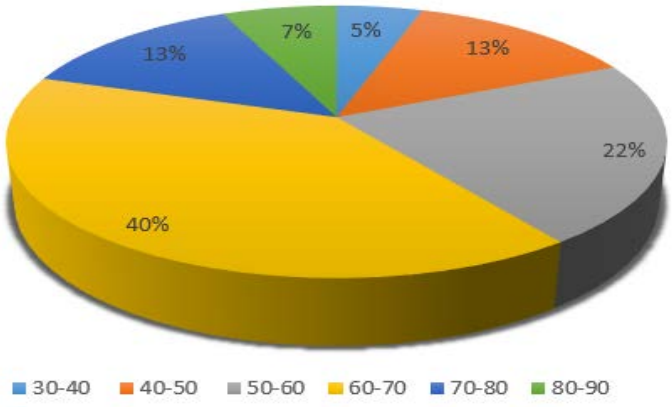

Figure 2. Distribution by age group shows that the most representative group is the group of patients between 60-70 years old.

Out of the 60 patients, we categorized those under 45 as young patients. 9 patients (15%) fell into this category, with seven male and two females.

Upon evaluation, it was discovered that of these young patients, 7 had uni coronary lesions, 1 had permeable epicardial coronary arteries, and 1 had coronary lesions.

In contrast, patients over 45 had more complex coronary lesions involving multiple coronary vessels.

Gender distribution

Out of the 60 patients admitted for MI in the study, 38 were male, and 22 were female.

The average age for men was 60.2 years, and for women, it was 65.5 years, as shown in Figure 3.

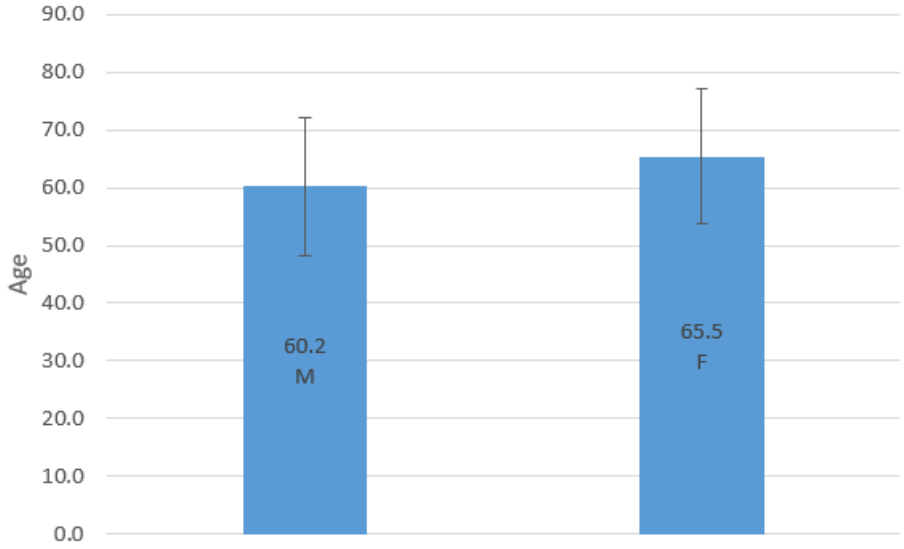

Figure 3. Gender distribution and age, the average age of women is higher than men.

Smoking

Of the patients studied, 23 (38.3%) were smokers and 7 (11.6%) were ex-smokers.

Among the nine young patients, 8 (88%) were active smokers, while only one was a non-smoker.

Among the 51 elderly patients, 15 (29.41%) were active smokers, 29 (56.86%) were non-smokers, and 7 (13.7%) were former smokers.

Women currently smoke just as much as men, and the same is true for the gender distribution of smokers (Figure 4).

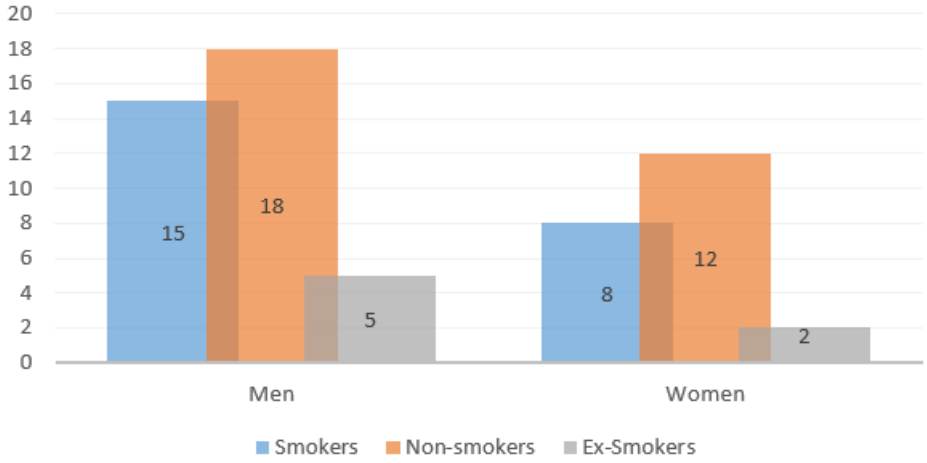

Figure 4. Gender distribution of smokers.

Hypertension

Of the 60 patients included in the study, 40 were diagnosed with arterial hypertension grade three, 6 with arterial hypertension grade two, 3 with arterial hypertension grade one, and 11 with no history of arterial hypertension.

Dyslipidemia

Of the 60 subjects, 44 (73%) had total cholesterol levels above 200mg/dl.

The mean value was 210mg/dl with a minimum of 98mg/dl and a maximum of 352mg/dl (Figure 5).

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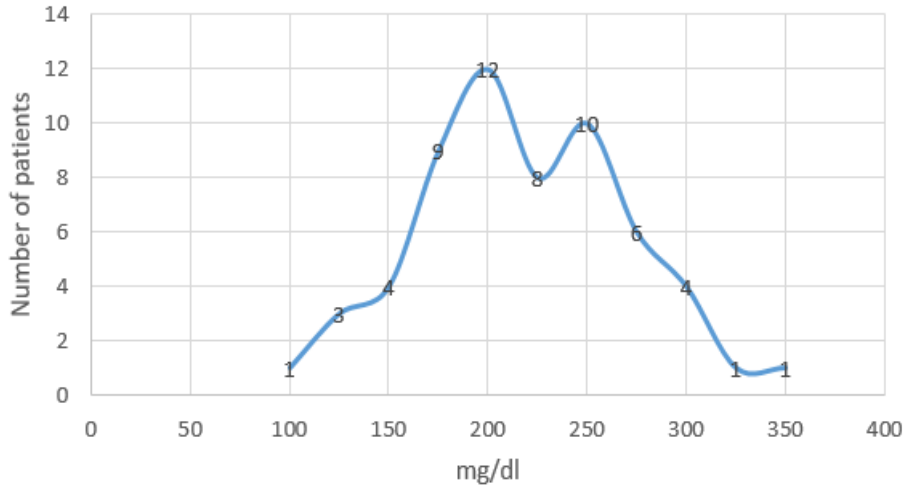

Figure 5. The distribution of total cholesterol among patients with MI.

Of all the patients observed, only 6 (10%) had LDL-C levels below 100mg/dl.

The average was 132mg/dl, with a minimum of 33mg/dl and a maximum of 252mg/dl.

Of the 60 patients, 18 (30%) had HDL-C values higher than 45mg/dl.

The average value for these patients was 43mg/dl, with the lowest value being 17mg/dl and the highest value 118mg/dl.

Of the patients studied, 60% had triglyceride levels below 150mg/dL.

The mean value was 163mg/dL, with a range of 22-1021mg/dL (Figure 6).

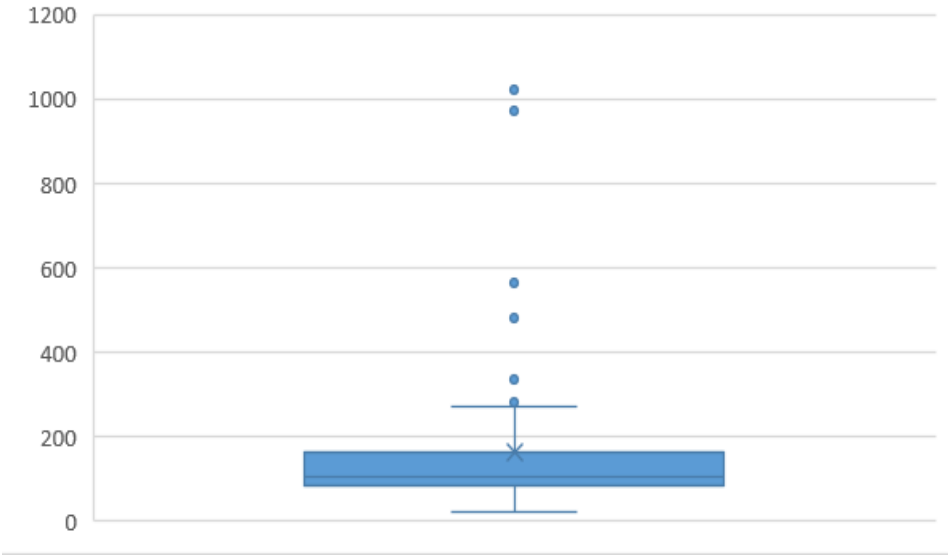

Figure 6. The distribution of triglycerides among patients with MI.

Diabetes mellitus

Of the 60 patients, 13 had type 2 diabetes before hospitalization, five were diagnosed with it during hospitalization, and 42 did not have diabetes (Figure. 7).

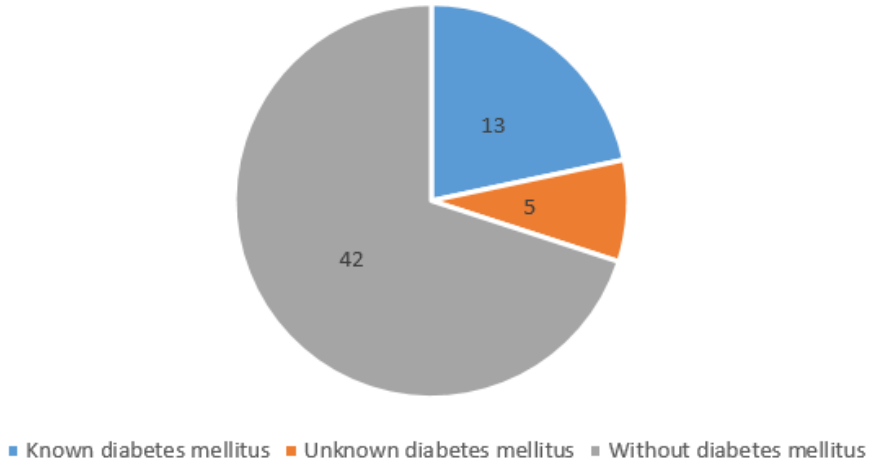

Figure 7. Diabetus mellitus distribution among patients with MI.

The mean blood glucose value on admission was 133mg/dl, with a minimum of 65mg/dl and a maximum of 393mg/dl.

The QQ chart does not show a Gaussian distribution of blood glucose values (Figure 8).

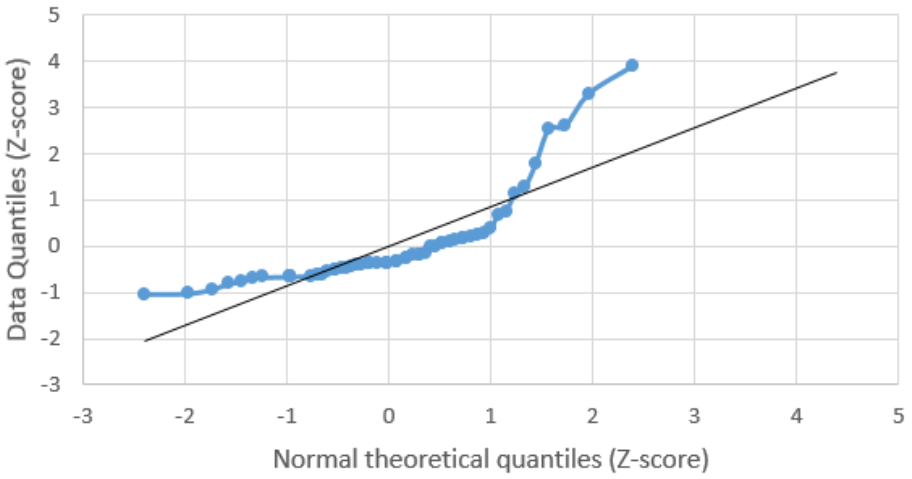

Figure 8. Blood glocose distribution at admission among patient with MI.

Discussions

The lack of representative data on cardiovascular risk factors in Romania led to the initiation of the project "Study for the Evaluation of Prevalence of Hypertension and Cardiovascular Risk in Romania" (SEPHAR). 2005, the first epidemiological survey (SEPAHR I) was carried out.

It confirmed that Romania is a country at high cardiovascular risk, with a high prevalence of arterial hypertension and other risk factors.

The SEPHAR II epidemiologic survey conducted in 2012 and SEPHAR III in 2016 showed a rise in the majority of other cardiovascular risk factors, including diabetes mellitus, obesity, and dyslipidemia [16].

Despite medical advances, the prevalence of cardiovascular risk factors is high, and the

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incidence of risk factors such as obesity and diabetes are increasing [17].

Cardiovascular disease has traditionally been considered the preserve of the male sex, with women being hormonally protected from heart disease.

Until menopause, they are relatively protected by their hormones and characteristics, so degenerative diseases and atherosclerosis occur less frequently.

However, cardiovascular diseases can occur even during this period if there are significant risk factors, such as excessive smoking, high dyslipidemia, and hereditary predisposition.

After menopause, women are no longer protected and, perhaps, because they live longer than men, after 65, they have more heart disease than men, and sometimes the disease is more severe than in men [4].

This study has shown the presence of myocardial infarction in men in general, with men being affected at younger ages than women.

Smoking is one of the most important cardiovascular risk factors.

In developed countries, smokers remain high at around 20-30%.

In our country, the Figure is about 21% [18].

In the study, 38% of patients were active smokers, and 11% were former smokers.

In relative value, the risk for atherosclerosis of hypertension is lower than that of cholesterol.

If we consider that about 31% of the world's population has hypertension, that in adulthood, the percentage is 40%, and that the elderly after 65 years of age have increased blood pressure values by more than 75%, in terms of total risk hypertension is more critical for atherosclerosis than any other risk factor [19].

In the present study, 81% of patients were hypertensive.

31% of the Romanian population has hypercholesterolemia [18].

In the study, 73% had cholesterol higher than 200mg/dl.

Obesity has long been questioned as a cardiovascular risk factor.

It is tough to draw a line between overweight and obesity as cardiovascular risk factors because of a continuous increase in risk with increasing weight.

However, not all types of obesity increase cardiovascular risk to the same extent.

For example, it has been shown that when obesity is deposited mainly on the hips and lower limbs (female obesity), it is not as dangerous to heart health as when it is deposited in the abdomen (abdominal obesity), which is more common in men, but increasingly in women [18].

That is why obesity as a risk for heart disease is currently defined more by measuring abdominal circumference, meaning that when this circumference exceeds 80cm in women and 94cm in men, cardiovascular risk increases.

In the current study, 22% had a BMI>30kg/m2. From the general population in Romania, 26% is obese [18].

The prevalence of diabetic patients is about 11.6% in Romania[20]; in the given study it is about 30%.

Anabolic substances and some drugs were also mentioned as risk factors because they can intervene in the etiopathogenesis of MI, especially at young ages.

These patients mainly have features of type 2 infarction with patent epicardial coronary arteries.

Conclusions

Male sex increases predisposition to myocardial infarction; after menopause, the ratio equilibrates.

Improved cholesterol and LDL-cholesterol decreased HDL-cholesterol are higher in patients with myocardial infarction.

Among the cardiovascular risk factors in the patients studied, hypertension was the most common, followed by dyslipidemia, obesity, smoking, diabetes mellitus, and rarely used drugs and anabolic substances.

From all the cardiovascular risk factors studied for the population of Romania (hypertension was the most common, followed by dyslipidemia, obesity, smoking, diabetes mellitus and very rarely the use of drugs and anabolic substances), our research showed a concordance with the abroad studies, where the male sex increases predisposition to myocardial infarction, after menopause the ratio equilibrates; increased cholesterol and LDL-cholesterol, decreased HDL-cholesterol are found to be higher in patients with myocardial infarction.

Further research should still be conducted to establish the role of cardiovascular risk factors in MI, especially when coronary heart disease remains the leading cause of death worldwide.

Acknowledgments

Negroiu Cristina Elena is a Ph.D. student at the University of Medicine and Pharmacy of Craiova Doctoral School, and this research is part of her dissertation thesis.

This study is part of a more extensive study on obesity.

This work was supported by the grant POCU/993/6/13/153178, ”Performanță în cercetare” - "Research performance" co-financed by the European Social Fund within the Sectorial Operational Program Human Capital 2014-2020

Conflict of interests

None to declare.

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