MYOCARDIAL INFARCTION AT A YOUNG AGE: ANALYSIS OF CLINICAL CASES FROM THE DUPLEX REGISTRY DATABASE

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Abstract

The objective of this study was to analyze clinical cases of myocardial infarction occurring at a young age within a sample of patients from the Duplex registry database (n=2548), to assess the prevalence of major risk factors and comorbid conditions. Specifically, patients under the age of 45 were selected (n=351).

Patients who experienced post-myocardial infarction were identified using data from clinical and anamnestic records, in accordance with the International Classification of Diseases, 10th Revision - their proportion was 0.85% (n=3) (all male patients; mean age 35 ± 1.4 years). Two out of three were smokers and had other traditional risk factors such as hypertension, dyslipidemia and overweight. In addition, patients had important comorbid diseases: morbid obesity, lymphogranulomatosis, hepatitis with transformation to liver cirrhosis. All of them had confirmed atherosclerosis of the arteries of the lower extremities. Probably one of the main precipitating factors for myocardial infarction development in them was a hereditary predisposition due to a burdened family history, although none of them met the Dutch Lipid Clinics Network criteria for familial hyperlipidemia and none of them underwent genetic testing.

A better understanding of risk factors and pathophysiological pathways in young adults may improve strategies for both preventing and treating myocardial infarction in this patient group. Raising awareness can help identify young individuals at higher risk and determine primary prevention strategies.

However, the identification of patients with premature coronary artery disease by screening for traditional risk factors does not effectively identify patients at risk prior to the diagnosis of myocardial infarction. Additional studies are needed to evaluate new risk factors and apply additional imaging techniques so that these patients can be identified before myocardial infarction occurs.

Introduction

Despite advancements in combating cardiovascular diseases, the occurrence of myocardial infarction (MI) in younger individuals has not exhibited a decrease over time [*Singh A et al, 2018; Wu W et al, 2020; Sagris M et al, 2021*] and its diagnosis in a patient under the age of 45 has ceased to surprise the medical community and is no longer considered rare. An age analysis of MI patients in

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the Lyubertsy Infarct Survival Study (LISS)-3 ACS registry LISS registry showed that the youngest age recorded was 26 years [*Martsevich S et al., 2011, 2017*]. It is likely that psychological factors along with behavioral and hereditary factors can play a large role in this [*Wiesbauer F et al., 2009; Chait R et al., 2011*]. A stressful lifestyle, irregular working hours, the economic crisis, inflation, the risk of job loss, global cataclysms, the COVID-19 pandemic [*Gaisenok O, 2020*] and other causes lead to the formation of a state of chronic stress, hypersympathicotonia and excessive production of catecholamin's. Which in turn trigger pathophysiological mechanisms that activate the young patient's early movement along the path of the cardiovascular disease continuum, initiated with an increase in heart rate and blood pressure [*Dzau V et al, 2006; Custodis F et al., 2013*].

Stress can have its negative impact on the cardiovascular system through lipid factors and not only through its effects on the nervous system and neurohumoral factors thus leading to lipid disorders [*Gaisenok O, 2015*]. Studies confirm that workplace stress is associated with an increased risk of atherosclerosis [*Liu Y et al, 2015*]. The INTERHEART study confirmed the important role of stress in the development of MI (RR 2.67) [*Rosengren A et al., 2004*].

Being in a state of chronic stress, in turn, increases the likelihood of alcohol consumption and smoking, which are included in this process as additional risk factors. The Shiga Subclinical Atherosclerosis Epidemiological Study confirmed that smokers have a significantly higher risk of developing atherosclerosis not only in the coronary arteries but also in the arteries of other vascular basins compared to never smokers [*Hisamatsu T et al., 2016*]. An analysis of data from the Cardiovascular Risk in Young Finns Study showed that alcohol consumption has proatherogenic effects in young healthy adults [*Juonala M et al., 2009*]. Irrational nutrition with an increase in the consumption of fats and easily digestible carbohydrates leads to an increase in the prevalence of diabetes mellitus, obesity and dyslipidemia among such patients [*Wu W et al., 2020*]. In addition, it should be noted that patients with cardiovascular diseases were most at risk of various complications during the COVID-19 pandemic [*Gaisenok O, 2020*].

Present study aimed to analyze clinical cases of myocardial infarction at a young age among a sample of patients under 45 years of age according to the Duplex registry database and to assess the presence of major risk factors and comorbid conditions in them.

MATERIAL AND METHODS

The Duplex registry database (n=2548) was used for this study. The detailed methodology for conducting this registry was described in previous publications [*Gaisenok O, Drapkina O, 2022*]. Patients under 45 years of age were selected based on the WHO criteria for young people (n=351). Identification of patients after MI was carried out among them based on the data of clinical and anamnestic status and international classification of diseases 10th revision - their proportion was 0.85% (n=3).

RESULTS

A detailed study of the clinical and anamnestic status of patients with myocardial infarction at a young age was carried out (all male patients; mean age 35 ± 1.4 years). We analyzed such indicators as age, features of coronary lesions, the presence of family history of cardiovascular disease, the presence of arterial hypertension, smoking, overweight, dyslipidemia, the presence of atherosclerosis of other localizations, ongoing statin therapy, the presence of major comorbidities with the calculation of the Charlson polymorbidity index. The obtained data are presented in table.

DISCUSSION

Many publications have been devoted to the study of the problem of early MI in recent years. The emphasis in most studies began to be given not only to the analysis of known risk factors, but also to the search for new determinants in the development of this disease. It is also interesting to pay attention to the prevalence of this pathology. In most studies, the vast majority of patients with early MI were men [*Martsevich S et al., 2011; Wittlinger T et al., 2020*], which was also shown in our case series (all male patients; mean age 35 ± 1.4 years). Although the detection of this pathology in women was studied in a single work /or in a few works. For example, in a Malay study that

TABLE

Clinical and anamnestic status of patients with myocardial infarction at a young age

Signs	Patients with myocardial infarction at a young age		
	N1	N2	N3
Age of enrollment (years old)	36	37	44
Age at the time of MI (years old)	33	37	35
Coronary artery lesions	CA - 80%	ADA - 96%, CA - 95%, OMB - 75%	n.a.
Coronary artery stenting	CA stenting	ADA, CA and OMB stenting	n.a.
A burdened family history of cardiovascular disease	+	++	n.a.
Hypertension	+	-	+
Smoking	+	-	+
Overweight	++	-	+
Hyperlipidemia	-	+	+
Carotid atherosclerosis	-	-	+
Lower limb arteries atherosclerosis	+	+	+
Statin therapy	+	+	-
Comorbidities	Morbid obesity	Lymphogran-ulomatosis	Hepatitis with cirrhosis transformation
Charlson index	1 point	3 points	5 points
Predicted 10-year survival	96%	77%	21%

NOTES: MI – myocardial infarction; ADA - anterior descending artery; CA - circumflex artery; OMB - obtuse marginal branch; n.a. - not available

analyzed the course of MI in young women (mean age 39 ± 4.68 years). At the same time, the authors stated the prevailing role of genetic predisposition, since young Malay women have significantly higher rates of family history of premature coronary artery disease [*Venkatason P et al., 2019*].

The percentage of patients who suffered MI among all young patients was 0.85% in our study. Data analysis from the prospective Dresden Registry of Myocardial Infarction (2005-2014) showed that patients under the age of 40 years made up 2% of the entire study cohort. At the same time, young patients experienced ST-elevation myocardial infarction more often than myocardial infarction without ST segment elevation (70% vs 30%) [*Wittlinger T et al., 2020*].

It is important to analyze new risk factors for myocardial infarction at a young age, which should be paid attention to by the practitioner when collecting anamnesis. Androgenic-anabolic steroid abuse is known to increase the risk of heart disease including acute MI. Chest pain in young patients secondary to MI is not uncommon, and therefore an important consideration in assessing the history is the review of medications, including anabolic steroid use. Athletes, bodybuilders and others who use anabolic steroids should be monitored by physicians in order to promptly detect complications associated with steroid use [*Samreen F et al., 2021*]. In addition to androgenic anabolic steroids, MI in young patients may be associated with cannabis and cocaine use [*Sagris M et al., 2021*].

Although smoking is a known risk factor for MI, most physicians and patients interpret it in relation to cigarette smoking. One recent study confirmed that this also applies to waterpipe smoking [*Abed MA et al., 2018*].

None of the patients in our case series used steroids, cannabis, cocaine or waterpipe smoking. Although 2 out of 3 were smokers and had other traditional risk factors such as arterial hypertension, dyslipidemia, overweight (2/3, table). In addition, patients had important comorbid diseases: morbid obesity, lymphogranulomatosis, hepatitis with transformation into liver cirrhosis. All of them had confirmed atherosclerosis of arteries of the lower extremities in a duplex scanning. Probably one of the main precipitating factors for MI development in them was a hereditary predisposition due to a burdened family history, although none of them met the Dutch Lipid Clinics Network criteria for familial hyperlipidemia and none of them underwent genetic testing.

An Austrian study found evidence that the familial-combined hyperlipidemia phenotype appears to be a major risk factor for MI at a very young age. The familial-combined hyperlipidemia phenotype was associated with a 24-fold increase in the adjusted risk of MI in patients younger than 40 years of age in the study (95% CI 7.5-81, P<0.001). Very-low-density lipoprotein cholesterol and non- high-density lipoprotein-cholesterol of all lipid parameters were most strongly associated with MI [*Wiesbauer F et al., 2009*].

Speaking about the possibilities of laboratory

diagnostics of predisposition to early development of MI, interesting data were obtained in an Indian study [*Gupta M et al., 2020*]. In this pilot study relative telomere length was found to be significantly shorter in young MI patients (31-45 years old) compared to healthy controls (p<0.0001). Thus, in the future, telomere length analysis may be a potential screening tool for young patients who do not have the usual risk factors.

Ambroziak M. and co-authors (2018) in their study noted the role of adiponectin and its genetic variants in the risk of developing premature myocardial infarction at a young age.

The absence and/or underestimation of available standard risk factors leads to late prescription of statin therapy. At the same time, screening for traditional risk factors usually does not effectively identify young patients at risk before the diagnosis of MI [*Chait R et al., 2012*].

A group of authors noted in their study that the vast majority of adults with a history of MI at a young age did not meet the current thresholds for statin therapy prior to MI, as recommended by the American College of Cardiology/American Heart Association 2013 and the Prevention Task Force US Services 2016 [*Singh A et al., 2018*]. These results highlight the need for better risk assessment tools for young people.

CONCLUSION

It is necessary to further study the pathogenetic mechanisms underlying the development of myocardial infarction among young individuals. It is known that young patients with MI are more likely to be smokers, obese, lead a sedentary lifestyle and drink alcohol.

Younger than older MI patients are more likely to be male and have familial-combined hyperlipidemia. A better understanding of risk factors and pathophysiological pathways in young adults may improve strategies for both preventing and treating myocardial infarction in this patient group. Raising awareness can help identify young individuals at higher risk and determine primary prevention strategies.

However, evaluating patients for premature coronary artery disease by screening for traditional risk factors does not effectively identify patients at risk prior to the diagnosis of myocardial infarction. Additional studies are needed to evaluate new risk factors and apply additional imaging techniques so that these patients can be identified before myocardial infarction occurs.

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