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# Myocardial Infarction in Young Women

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***Abstarct:*** The low alertness of physicians and women due to the rare incidence of myocardial infarction in young women, often atypical clinical presentation, and frequent lack of obstructive coronary artery disease accounts for the issue of timely diagnosis. According to Russian researchers, the incidence of acute myocardial infarction in women aged 35–44 years in Russia in 2014 was 0.2%. Foreign studies have shown that slightly over half of young women with ST-elevation myocardial infarction experience typical chest pain. Our case reports highlight the challenges in diagnosing myocardial infarction in young women, and the impact of both gender-related and non-gender-related risk factors. Although there is no obstructive coronary atherosclerosis, myocardial infarction in young women can have a severe course and lead to complications such as cardiac aneurysms and chronic heart failure.

***Key points:*** myocardial infarction, young women, spontaneous coronary artery dissection.

Insufficient and untimely diagnosis of acute coronary syndrome (ACS) in young women and their late hospitalization in a specialized medical center are often associated with atypical manifestations of the disease, a reduced level of alertness both on the part of medical personnel and on the part of the patients themselves, with a rare incidence of this pathology at a young age [1, 2]. Thus, the incidence of acute myocardial infarction (AMI) in women aged 35–44 years in Russia, according to S.A. Shalnovoy et al. [3], in 2014 it was 0.2%. The American Heart Association reported that the prevalence of AMI in the United States in 2018 was slightly higher in women aged 20–39 years, at 0.4% [4]. In general, in the last decade there has been a tendency towards a decrease in the incidence of AMI, but when detailed by age and gender, it can be noted that in young women, on the contrary, the frequency of registration of AMI has slightly increased [2, 5].

N.S. Tretyakova et al. [1] in their study showed that 65.11% of young and middle-aged women with ST-segment elevation AMI (STEMI) and 34.89% of women with non-ST segment elevation AMI (NSTEMI) did not experience typical anginal pain in in the initial period of the disease, and the reason for seeking medical help were atypical complaints of chest discomfort, shortness of breath and severe weakness. The young age of the patients in a third of the patients was the reason for the incorrect interpretation of symptoms by doctors. The condition was regarded as a non-cardiac pathology, and the patients were left without the necessary examination, hospitalization and treatment.

In an American study [5], which included 177,602 young women with STEMI, similar results were obtained regarding the characteristics of the pain syndrome: chest pain was recorded in 56% of patients, pain radiating to the shoulder, neck or arm - in 60%, shortness of breath - in in 38%, chest tightness - in 17%, nausea - in 18%, fatigue - in 10% of patients.

A prospective study [6] of more than 300 young women with STEMI in France found no typical disease pattern. Among patients with STEMI, 90.6% had typical chest pain, and 58.9% reported associated symptoms (nausea, vomiting, asthenia, sweating, dizziness, or palpitations).

Below we present our clinical observations demonstrating the difficulties of diagnosing AMI in young women.

In addition to traditional risk factors for MI in women, there are sex-specific risk factors, including those associated with pregnancy. MI can develop during pregnancy, most often in the third trimester. In 40% of cases, this is type 1 AMI, in 27% of cases, spontaneous dissection of the coronary artery is detected, in 8% of cases, coronary artery thrombosis without atherosclerosis. Coronary artery dissection was the leading cause of MI in the postpartum period (50%) and was more often detected in the postpartum period compared to the prepartum period (34% versus 11%) [7, 8]. Spontaneous coronary artery dissection is a very rare cause of ACS in the general population. It occurs predominantly in young and middle-aged women during or after pregnancy. Its frequency, according to different authors, ranges from 3.2 to 14.6% in STEMI and up to 20.5% in NSTEMI [2, 6]. The development of this complication is associated with an increased level of progesterone, which causes biochemical and structural changes in the vascular wall. If a pregnant woman has a STEMI, percutaneous coronary intervention with balloon angioplasty is indicated if indicated, which is safe for the mother and fetus [9]. If endoprosthesis replacement is necessary, preference is given to bare stents due to the fact that the safety of drug-eluting stents in pregnant women has not been studied [7]. During pregnancy, multivessel dissection involving the trunk of the left coronary artery, the development of STEMI, and a higher percentage of complications are more often recorded [8].

**Clinical observation 1**

Patient F., 20 years old, was admitted to the emergency hospital on the 3rd day after birth. Delivery was carried out at the Regional Clinical Center for Maternal and Child Health by cesarean section at 30 weeks. pregnancy due to the development of preeclampsia. The surgical intervention took place without complications. After birth, the child was transferred to the intensive care unit in serious condition. Against this background, the patient was in a state of severe emotional stress, she developed a typical anginal status, relieved by tramadol. On the ECG: sinus rhythm with a heart rate (HR) of 85 per minute, the electrical axis of the heart is normally located, elevation of the ST segment in leads I, aVL, V1-4 up to 2-3 mm with reciprocal changes in the form of depression of the ST segment in leads II, III, aVF up to 2 mm, regression of the R wave from V1 to V4, qr in aVL, single ventricular extrasystole .

Taking into account the diagnosis of ACS with ST segment elevation, the patient was given a loading dose of antiplatelet agents (ticagrelor 180 mg, acetylsalicylic acid 250 mg), as well as sodium heparin 5000 IU subcutaneously. The patient was delivered to the vascular center within 2 hours from the development of pain. Upon admission to the vascular center, the pain syndrome was relieved, hemodynamics were stable. Emergency coronary angiography was performed, the results of which revealed: the right type of blood circulation, in the trunk of the left coronary artery there was a spontaneous dissection of type B from the upper third, passing to the anterior interventricular artery, the diameter of the trunk of the left coronary artery was 5.5 mm, in the anterior interventricular artery there was a dissection of the type D to the distal third of the artery, turning into occlusion, the circumflex and right coronary arteries are unchanged (Fig. 2A). Recanalization of the anterior interventricular artery was performed, percutaneous transluminal coronary angioplasty was performed at the site of occlusion of the anterior interventricular artery with a balloon catheter with a diameter of 2.5 mm, with an exposure of 5 minutes. An antegrade blood flow to the apical part of the anterior interventricular artery was obtained. Next, repeated recanalization of the anterior interventricular artery was performed to the apical part, 4 stents with drug eluting with zotarolimus 2.5×22, 3.0×26, 3.5×30, 4.0×26 mm were installed from the distal third of the anterior interventricular artery to its mouth. On control coronary angiography, antegrade blood flow in the anterior interventricular artery was restored, TIMI III, there were no signs of dissection (Fig. 2B). Dissection of the trunk of the left coronary artery type B remained, which did not limit blood flow, and therefore it was decided to refrain from endoprosthesis replacement of the left coronary artery. In stable condition, the patient was transferred to the intensive care unit.

The diagnosis of AMI was confirmed by laboratory tests: an increase in the level of cardiac-specific enzymes was detected: creatine phosphokinase-MB upon admission - 17.5 U/L, over time - 158.6 U/L.

Subsequently, echocardiography was performed: the left ventricular ejection fraction (LVEF) was significantly reduced - 34% according to Teicholtz, diffuse hypokinesis of the LV walls, akinesia of the septal, anteroseptal, anterior, lateral segments of the LV, mitral regurgitation of the 2nd degree. Akinesia of the anterior wall segments indicates AMI.

Taking into account the examination results, the diagnosis was formulated as follows: spontaneous dissection of the anterior interventricular artery, complicated by acute ST segment elevation with the formation of a pathological Q wave on the ECG of MI of the anterior wall of the LV in the late postpartum period.

Taking into account the severity of the condition and the high probability of repeated surgical intervention, the patient, according to the routing, was transferred to the regional vascular center of the Regional Clinical Hospital No. 1. Upon admission, the patient's condition was stable, and therefore a conservative treatment strategy was chosen. Due to the development of cardiac arrhythmias and progression of heart failure, veno-arterial extracorporeal membrane oxygenation and artificial ventilation were performed. The patient was discharged in satisfactory condition on the 40th day of treatment. According to echocardiography, the formation of a LV aneurysm was observed over time.

Spontaneous coronary artery dissection with the development of MI in young women is not uncommon. The uniqueness of this clinical observation is that, despite the severe course of the disease, the need to connect extracorporeal membrane oxygenation, the outcome of the disease was positive, the patient was discharged for rehabilitation treatment. The prognosis of women with spontaneous coronary artery dissection associated with pregnancy is worse than that of non-pregnant women. During pregnancy, more extensive STEMI is more likely to develop, proximal dissection of the coronary arteries is recorded, lower LVEF values are observed, and life-threatening complications develop: ventricular fibrillation, cardiogenic shock [10], which was demonstrated in the above clinical observation.

Myocardial infarction in young women can also occur in the presence of traditional risk factors; in this case, the absence of obstructive lesions of the coronary arteries puts doctors in a difficult position in terms of specifying the type of MI.

**Clinical observation 2**

Patient K., 33 years old. Deterioration of the condition within 1 week, when for the first time in life short attacks of angina pectoris appeared during physical activity. Risk factors for coronary heart disease (CHD) included smoking, untreated hypertension, and obesity (body mass index 38.58 kg/m2). The patient independently applied to the district hospital with complaints of pressing pain in the chest for an hour, radiating to the neck, palpitations, a feeling of lack of air, rsevere weakness. The pain was relieved by administration of morphine. The ECG shows a rhythm of supraventricular tachycardia with a heart rate of 200 per minute. In standard lead I, negative waves of the QRST complex predominate and a negative P-wave is recorded, standard leads II and III have swapped places, in aVR there is a positive QRS (with a positive P-wave) (Fig. 3). These signs indicate that the patient has dextrocardia.

With a diagnosis of ACS without ST-segment elevation, the patient was transferred to the vascular center. Upon admission, examination confirmed dextrocardia. The patient claimed that she had not previously been diagnosed with transposition of internal organs or dextrocardia. An ECG recorded taking into account dextrocardia showed sinus rhythm with a heart rate of 66 per minute, downward depression of the ST segment with negative T waves in the precordial leads.

According to emergency indications, coronary angiography was performed, which revealed no changes in the coronary arteries. Subsequently, against the background of standard treatment, the

pain syndrome did not recur; the ECG showed positive dynamics in the form of a decrease in the depression of the ST segment and the depth of the T wave. The blood test showed changes in troponin levels that were normal for AMI (at admission - 367 ng/l (normal up to 30 ng/l). l), on the 3rd day of the disease - 1.20 ng/l). Taking into account the clinical picture, changes in the ECG, and the dynamics of troponin levels, a diagnosis was made: acute without ST segment elevation and without the formation of a pathological Q wave on the ECG, MI of anterior localization without obstruction of the coronary arteries.

However, the issue of the presence of ischemic heart disease in this patient is controversial. On the one hand, the patient has traditional risk factors for coronary artery disease and has developed AMI. On the other hand, with duplex scanning, the brachiocephalic arteries are not changed, and with coronary angiography, the coronary arteries are not changed. The lipidogram does not have a pronounced atherogenic profile: total cholesterol - 5.36 mmol/l, triglycerides - 1.67 mmol/l, high-density lipoprotein cholesterol - 1.19 mmol/l, low-density lipoprotein cholesterol - 3.48 mmol/l. Taking into account the fact that AMI in young women often develops in the absence of obstructive lesions of the coronary arteries, as well as the presence of risk factors for coronary artery disease, and the absence of an alternative cause of AMI, the patient's condition was assessed as coronary artery disease - type 2 AMI.

**Conclusion**

The clinical observations we presented demonstrate the importance and difficulty of timely diagnosis of AMI in young women. According to world literature, non-obstructive lesions of the coronary arteries are detected in women more often than in men, which, in the absence of a typical clinical picture and nonspecific changes on the ECG, complicates the diagnosis of ACS. Another feature of the course of AMI in this category of patients is its severe course and the development in a fairly large percentage of cases of serious complications, such as cardiac arrhythmias, LV aneurysm and chronic heart failure, which require additional therapeutic measures to stabilize the patients' condition. The above clinical observations once again confirm this position.

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